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CENSUS OF INDIA, 1961

VOL XII—PART VII-A

SURVEY OF
TRADITIONAL CRAFTS

ORISSA

M. AHMED, I.A.S.
Superintendent of Census Operations
Orissa

With the compliments of

The Superintendent of Censuses Operations, Orissa

CENSUS OF INDIA, 1961

VOL XII—PART VII-A

SURVEY OF TRADITIONAL CRAFTS

ORISSA

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FOREWORD

ONE OF THE FIRST STEPS to be taken in the First Five-Year Plan was the establishment of six Boards for the promotion of handicrafts, village and small industries: (1) The Khadi and Village Industries Board; (2) The All-India Handicrafts Board; (3) The All-India Handloom Board; (4) The Central Silk Board; (5) The Coir Board; and (6) The Small Industries Board.

The rapid expansion of the activities of these Boards which concentrated not only on production and techniques, but also on organisation, extension, credit, marketing, and export, consolidated and enlarged the position that the household industries sector had so long enjoyed in the nation's economic life. It was this fact that forced itself upon the preparations for the 1961 Census and demanded that household industry should be separately investigated for a proper accounting of the nation's manpower, resources and its specific contribution to the national income. The 1961 Census therefore asked a special series of questions on household industry, input of family and hired labour, and the periods over which household industry is conducted. It was felt, however, that an enumeration of the total number of establishments and their industrial classification would be incomplete without a proper description of what they produce and how they produce. It was important to make an assessment of the limits of rigidity within which traditional skill operates. This could be obtained by studying the caste, occupational, social and economic stratifications, the limitations of credit and marketing facilities, the dominance of custom over contract, the persistence of traditional tools and design forms, the physical limitations of transport, communication and mobility, the inability to adopt new lines or adapt to changing circumstances. It was important also to make an assessment of the limits of flexibility that traditional skill is capable of, because the transformation of traditional skills to modern skills is easier said than done and a thorough study may well reveal that it is perhaps cheaper from the social point of view to develop industrial skills from scratch than to try to graft traditional skill on alien soil. A rather tragic case of failure to make what would on the face of it seem a minor adjustment cast its heavy shadow on the nation when it was discovered that goldsmiths used to working on 22-carat gold all their lives felt sadly helpless when asked to work on 14-carat, so narrow and unadaptable were the limits of their skill and proficiency and so rudimentary the tools and equipment with which they and their forefathers had worked. This fiscal accident revealed that tools are even more important than skills.

An early opportunity was therefore taken in February 1960 to suggest to State Census Superintendents, that the Census provided a unique opportunity for conducting and documenting a survey of this kind. As such a survey was quite outside the usual terms of reference of Census work it was thought prudent cautiously to feel one's way with the thin end of the wedge of what would, it was hoped, prove to be an exciting pursuit. It was therefore considered the wiser course to wait until the State Census Offices felt so interested that they would no longer take the inquiry as an imposition but rather want to do it on their own and ask for the necessary staff and equipment. This office, too, in its turn, could make use of the interval to organise and elaborate the design of inquiry in order to feed the appetite that work in progress would serve to whet. Because it was a labour of love, sought to be unobtrusively thrust on one's colleagues and because the inquiry itself was so vast that normally it would demand in any country as big a set-up, if separately established, as the Census organisation itself and that over a much longer period, and because it was almost a pioneer venture, nothing like it having been undertaken since the 1880's, it was decided to move towards a build-up by stages, to let the inquiry unfold itself only as fast as my colleagues chose to ask for more.

Thus, in the first circular of 18 February, 1960, it was suggested that the inquiry might be conducted through the agency of the Development Department, the State Director of Industries, the Director of

Tribal Welfare, the Registrar of Cooperative Societies, and other organisations concerned with the promotion of household industry. A draft questionnaire containing 30 questions in three parts was recommended for canvassing. It was suggested that information on this questionnaire, village by village and area by area, might either be obtained through the regular departmental channels of the State Government, or through the newly set up Census organisation, or through the hierarchy of the newly created Panchayats. Stress was laid on the need of photographic documentation and illustration of designs, shapes and forms not only by photographs but with the help of line drawings or sketches together with a full description of the materials used.

Almost the whole of 1960 and the first half of 1961 were spent in organising and taking the census count, although several States even during this period had not allowed the grass to grow under their feet but made exploratory studies and decided in their minds how the inquiry should be organised. A series of regional conferences held in Trivandrum, Darjeeling and Srinagar in May and June 1961 revealed much enthusiasm among State Superintendents to proceed with the survey, but the need of separate staff and equipment was felt at the same time as the realization dawned that this was much too serious an inquiry to be treated casually and left to be achieved through the usual administrative channels and State Census Superintendents proceeded to augment their staff with qualified research and investigating officers, technical persons, photographers, artists, draughtsmen and other trained personnel.

This was followed by rapid progress in coordination between the Central and State Census offices in the matter of exchange and processing of information, documentation and investigation, of assisting each other with trained investigators and in editing and finalizing drafts, layouts, presentations.

Mention has been made of a questionnaire in three parts and thirty questions. The idea was to make a beginning with empirical, analytical studies based on a structured questionnaire which would replace general descriptive accounts that had obtained so far. The primary aim was to obtain a picture as much of the artisan himself as of his craft, to obtain a perspective of the artisan and his craft in his social and economic setting, the extent to which tradition bound him and the winds of change ruffled him, the extent of his mobility and immobility, the conditions of market, credit, new contacts and designs in which he operated, the frame of new as well as traditional producer-customer relationships in which he still worked, and how far he was ready to pierce his own caste-tribe socio-economic cocoon and make a break through to new opportunities promised by the Five Year Plans. The aim was to hold up the mirror to hereditary skills struggling with the dialectics of tradition and change.

Thus, the first part of the questionnaire, purporting to be a village schedule, sought to take account of the size and population of the village, its remoteness from or proximity to centres of trade and commerce, in short, the degree of isolation in which the artisan worked and the relative strengths of various communities in the village which would afford clues to social interdependence and the prevalence of the *jajmani* system. The second part was devoted to artisan communities in the village : the several castes of artisans, the number of families in each, the total number of workers, males and females, the extent of cooperative activity among them, the extent of dependence upon employers and of wage or contract labour. There were questions on the raw materials used, the means of their procurement, the possible extent of dependence on others for raw materials, the extent of the material that artisans can handle within the limits of their skill. There were other questions on the exchange and flow of designs, the use of colours, the ancientness of the craft and legends associated, the colonization of the craftsman, on patrons and customers and on social and economic contact with the world inside and outside the village. There were specific questions on the workshop itself and particularly the tools and the source of supply of these tools, because it was felt that tools decide everything and are the surest index of inertness or flexibility. Separate blocks of questions were designed to bring out the ramifications of artisan castes throughout the country and the ways they sustained themselves, the type of clientele they catered for, the extent to which they operated on money or barter or service, how specialized their craft was,

how wide the market, how dependent they were on their socially preordained clientele and how restricted the latter was by the seemingly unalterable laws of social custom; the extent to which they could operate in the open market, the range of their wares and the sizes to which these were ordinarily restricted either by the limits of their own skill or the length of their customers' purse-strings. Inquiries were to be made about the operation of middlemen and of cooperative societies, the people who gave new designs and demanded new products. Finally, the several stages of production of the articles themselves were to be fully described including the final and finishing stage and a list of very skilled craftsmen of each community was to be furnished. The third part was devoted specially to tribal communities and designed to find out how self-sufficient or dependent they were on the production and supply of manufactured goods, the extent to which they produced themselves or depended on others, their contacts with other communities and the specific forms of production and commerce through which these contacts were maintained.

Particular emphasis was laid on the need of obtaining as full an account as possible of unique regional design differentiations as they reflect not only the very culture patterns of the country but the persistent inventive faculties of the craftsmen. The importance was emphasised of giving full attention to articles of domestic use as it is in their shapes, designs and forms that the culture patterns and traditional skills persist most tenaciously.

Simultaneously with the investigation of specific crafts, State Superintendents proceeded to compile a comprehensive list of all types of handicrafts obtaining in their State. As for the specific crafts to be investigated several tables were devised from the structured questionnaire in order to guide investigators toward pointed observation and analysis, to enable them to write, not just general descriptions but with their eye on the object and on facts.

Investigations conducted between September 1961 and May 1962, including a study group of all States and the Social Studies Division in December 1961 at Delhi, stimulated many of the States into going in for a much enlarged schedule. The revised village schedule itself, the counterpart of the first part of the February 1960 schedule, contained 19 large sections containing elaborate and probing questions. The Family Schedule for practising artisan families similarly contained 19 main questions each subdivided into many questions. The Family Schedule for non-practising artisan families contained 21 questions. There were schedules for the study of cooperative societies, of production-*cum*-training centres, and of consumer's preference. This enlarged schedule of investigation, in the formulation of which the States themselves actively assisted, was greatly welcomed. The surveys that will appear in this series will therefore consist of two main types : (a) those based on the original short schedule and (b) those based on the much enlarged schedule. In some cases Census Superintendents felt enthused enough to scrap the work based on the original short schedule and do it over again on the enlarged schedule. In the meantime much experience was gained on the analysis of facts and figures to clothe each observation with plenty of authentic information so that the reader could make his own judgement instead of being expected to see all the time through another pair of eyes.

This programme of survey of handicrafts and household industries has been fortified by several ancillary surveys, each one of which would deserve major attention. Along with the survey a compilation has been made of all handicraft centres in each State and an inventory prepared of skilled craftsmen. Photographic and other documentation has been built up to constitute what may now be regarded as the most considerable repository in the country. Elaborate and accurate maps of craft centres in taluks, tehsils and districts are either ready or under preparation. A full census of all fairs and festivals, weekly hats and markets, throughout India, has been taken and is being published for the first time. Andhra Pradesh has embarked upon a project of chronicling the social and religious antiquity and uniqueness of every fair and festival. A separate volume will be devoted to each district which

promises to be of the utmost value to sociologists and orientalists. A full and complete inventory, replete with sketches and measurements of every object, has been prepared of exhibits in museums of tribal crafts in India. There has been a fairly satisfactory survey of houses and buildings, indigenous architectural designs and use of local building material of the whole country. All this has been entirely a labour of love, patiently organised and executed under great strain and in disregard of health and comfort, for which I take this opportunity of expressing my appreciation and grateful thanks to my colleagues.

New Delhi,
July 30, 1964.

ASOK MITRA
Registrar General, India

PREFACE

We have great craft heritage but little material to tell about its problems and prospects. Outside the old gazetteers, an excellent and inimitable institution, few in recent years have thought it worth-while to study and elaborate on local handicrafts. When the Census Organization decided to study the variegated phenomena of Indian life, traditional crafts of different States were included as one important branch of investigation and research. Directions were received from the Registrar General to undertake study of a few important crafts and to prepare monographs which must be illuminating and instructive. Broad indications were given regarding the mode of selection of crafts which were to be grouped under three heads : (i) those which are dying out, (ii) those which are thriving, and (iii) new industries that are coming up. Emphasis was laid on the fact that the crafts must be very much indigenous, very much imbedded in our tradition. Some of these crafts may be traditionally associated with certain communities, while there may be some which may be associated with regional or extra-regional cultural complexes, being confined to no particular caste or community. Some of them, apart from being distinguished for considerable utilitarian value, should be objects of artistic excellence displaying creative imagination and depth of feeling. The Survey Wing of the office of the Registrar General, therefore, insisted on a comprehensive study not only from a techno-economic point of view but also in terms of their contribution to the upkeep of the cultural values of the localities where they flourish. The investigation was expected to embrace such aspects as the existing condition of the craft, availability of raw materials, details of working technique, improvement in quality and design, competition from foreign or factory-made products, problems of marketing and finance, reasons of decay, promotion and revival and grant of commercial protection. The physical distribution of the craft was required to be plotted within a geographical area for the purpose of tracing out the evolving pattern. Lastly, the study should include an exegesis of the continuity of the craft since the earliest times.

The terms of reference required considerable erudition and scholarship, as well as extensive research and local investigation if the indicated standard was to be maintained. The facilities offered in the shape of sanction for appointment of Research Assistants or persons versed in the technicalities of the craft remained a mere consolation, for it was at the utmost possible to come across persons with some routine notions of the publicity aspect of attractive handicrafts but none having any insight into the science, the technique and the subtle skill behind the craft. Moreover, the time that could be set apart in proportion to other multifarious assignments and the conventional responsibilities of the Census Organization was too short to attempt a survey on the comprehensive scale as contemplated. A practical relief on the face of these limitations was derived from a very kindly gesture in the official direction, " Treat the data in a flexible manner ". This served as a silver lining and induced selection of a few traditional crafts of Orissa for purpose of investigation which, however, was conducted on much humbler lines than those indicated by the Registrar General.

The volume comprises three Books, each of which is devoted to a particular craft. An attempt has been made in Book One to give a short and simple exposition of the indigenous industry of smelting of iron as practised in several districts of Orissa. The publication has no pretence to any comprehensive character of the survey of this ancient craft. The study was to a large extent focused at one particular centre with the hope of intensifying observation on certain aspects of the most common type of the clay furnace used for smelting of iron. Results of such observation have, as far as possible, been faithfully recorded so that they may serve as the basis for further measures that may be necessary for the resuscitation of the decaying craft and the rehabilitation of the men engaged in it, whose poverty and helplessness are progressively increasing. The investigation has established that it is possible to

raise the pitiable level of earning of these traditional craftsmen by introducing improvements in their tools and technique, so that smelting as a cottage or household industry may not compare unfavourably with any other economic activity followed by the rural folk. A message of hope is thus derived, for it is not too late now to bring about amelioration in the condition of this poorest community of workers who strive hard to eke out a precarious livelihood, and to restore the declining craft its due place in the aggregate economy of the country.

Book Two deals with the industry relating to yet two other metallic but non-ferrous alloys, that is, brass and bell-metal. Though the antiquity of this industry is difficult to trace, it is certain that at one time, the products of this ancient craft with the royal patronage and mass popularity had attained a stage of excellence, perfection and universality that far transcended the territorial limits of this State and won for it a good market in the bordering States. The varieties of products of this industry is truly prolific ranging from popular household utensils to costly luxury goods, decorative wares and curios. For the purpose of this book, in the analogy of the treatment adopted for Book One, a rapid survey has been undertaken of important centres of the industry in the State of which only one has been singled out for intensive investigation into the materials, methods, markets and the subtle techniques of production. The concluding paras strike a solacing note for any lover of ancient crafts. Notwithstanding heavy odds, the industry is struggling hard for survival and there is ample evidence to establish that the industry is not in a declining stage.

An equally important theme, the story of silversmithy is the subject matter of Book Three. The silver filigree works of Cuttack, one-time capital of the State continues to maintain its excellent traditions and the industry, now patronised by the State and apparently in a thriving stage, has earned a name abroad for the superb craftsmanship of some of its fine specimens. But this book is the outcome of intensive study of the industry in a more remote and insignificant village of the State where the products encompass a short utilitarian range catering to more popular taste. Here the qualities of craftsmanship are not so much emphasized as the mass demand for cheap and popular ornamentation. The ingenuity and the creative talent of the skilled artisan is sacrificed at the altar of the craze for quantity in commercial production. The industry is further characterised by the ubiquitous class of traders stepping in to intervene between the artisan and the consumers and reserving to them the monopoly of the trade through control of capital, raw materials and the market. An element of exploitation thus slowly creeps in by way of major share of the profit being appropriated by these traders and the artisans wriggling with a subsistence wage. The resultant picture is obviously one of flight of artisans from the industry in quest of 'fresh woods and pastures new' and of diversion of capital by traders into more profitable concerns. With the slumping of the trade, therefore, the state of this craft is veritably in doldrums and this booklet while depicting it all attempts in its concluding note to hope and prescribe ways for reanimation of this popular industry.

With regard to Book One, I am grateful to my erstwhile colleagues Dr. A. K. Mallik, Chief Metallurgist and Dr. A. Khan, Chief Chemist of the Hindustan Steel Ltd., Rourkela, who, in the midst of heavy preoccupations on the eve of the expansion of the Steel Plant, ungrudgingly undertook to conduct the chemical and metallurgical analysis of the samples of raw materials and manufactured articles obtained from indigenous smelters. Dr. Mallik has kindly furnished an illuminating report of analysis which appears in the Appendix. I am also thankful to the Research & Control Laboratory, Rourkela Steel Plant for furnishing six copies of Photomicrograph of the metals tested and analysed. The Public Relations Department of the State Government and Messrs. Photo Emporium of Cuttack deserve my gratitude for similar help for Book Two of this volume.

Cuttack
The 17th May, 1967

M. AHMED

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CENSUS OF INDIA, 1961

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II-A	..	General Population Tables
II-B (*i*)	..	General Economic Tables
II-B (*ii*)	..	General Economic Tables
II-C	..	Cultural and Migration Tables
III	..	Household Economic Tables
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SURVEY OF TRADITIONAL CRAFTS

BOOK ONE

INDIGENOUS SMELTING OF IRON

Acknowledgment

Local contact	...	Shri Banamali Misra, Investigator
Field Investigation and Preparation of Report	...	Shri M. Ahmed, I.A.S. Superintendent of Census Operations, Orissa
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Photomicrograph	...	Research and Central Laboratory, Rourkela Steel Plant
Chemical and Metallurgical Analysis	...	Dr. A. K. Mallik, Chief Metallurgist, Rourkela Steel Plant

Year of Investigation

1 9 6 2

PREVIEW

TRAVELLING through Orissa, one is struck by the great number of primitive iron smelting kilns that are still active, especially in the northern and western districts of the State. Few things make a more forceful impression than to find these kilns flourishing within a few miles of Rourkela—in some respects, the last word in modern steel-making. The prevalence of the antiquated smelting kilns not only serves to remind us of the technological gap, it gently tells us that Rourkela notwithstanding, the crude village kiln still serves a useful purpose: it produces the type of iron which is just right for the type of agricultural implements in local use, which again are just right for the type of agriculture prevailing in the country so that it is impossible to say which is responsible for which. Above all, the iron produced suits the local peasant's pocket. The process of smelting, which has been so methodically and elaborately described in the monograph, shows how a skill has been preserved which, in its turn, serves to employ some amount of surplus human labour and makes use of local raw material, thus directly transforming human labour into wealth. The entire, almost continuous, smelting range from Koraput in the west along the northern districts of Orissa, up to Mayurbhanj and over again from Mayurbhanj through Singhbhum, Bankura, western Burdwan up to the southern bank of the Dwarka river in Birbhum district has now been practically broken off further east beyond Sundargarh, but serves, nevertheless, to remind us that much of India's requirements of iron used to be supplied by this girdle. But that the country still has use for this low-grade iron is proved by the survival of these smelting kilns and I was very delighted when Shri Ahmed accepted my suggestion to produce a monograph on this subject.

The process of smelting here described is of the crudest, being even less elaborate than what was described by Dr. Francis Buchanan Hamilton in his book on Mysore in 1807. The monograph has very successfully related the technology with the communities who smelt the ore and produce the iron implements and then again with the agricultural communities who use those implements. It thus succeeds in reproducing the fabric in which the industry still thrives and has also succeeded in relating this process with the past and present techniques of steel production.

New Delhi
The 7th January, 1963

A. MITRA
Registrar General, India

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SECTION 1

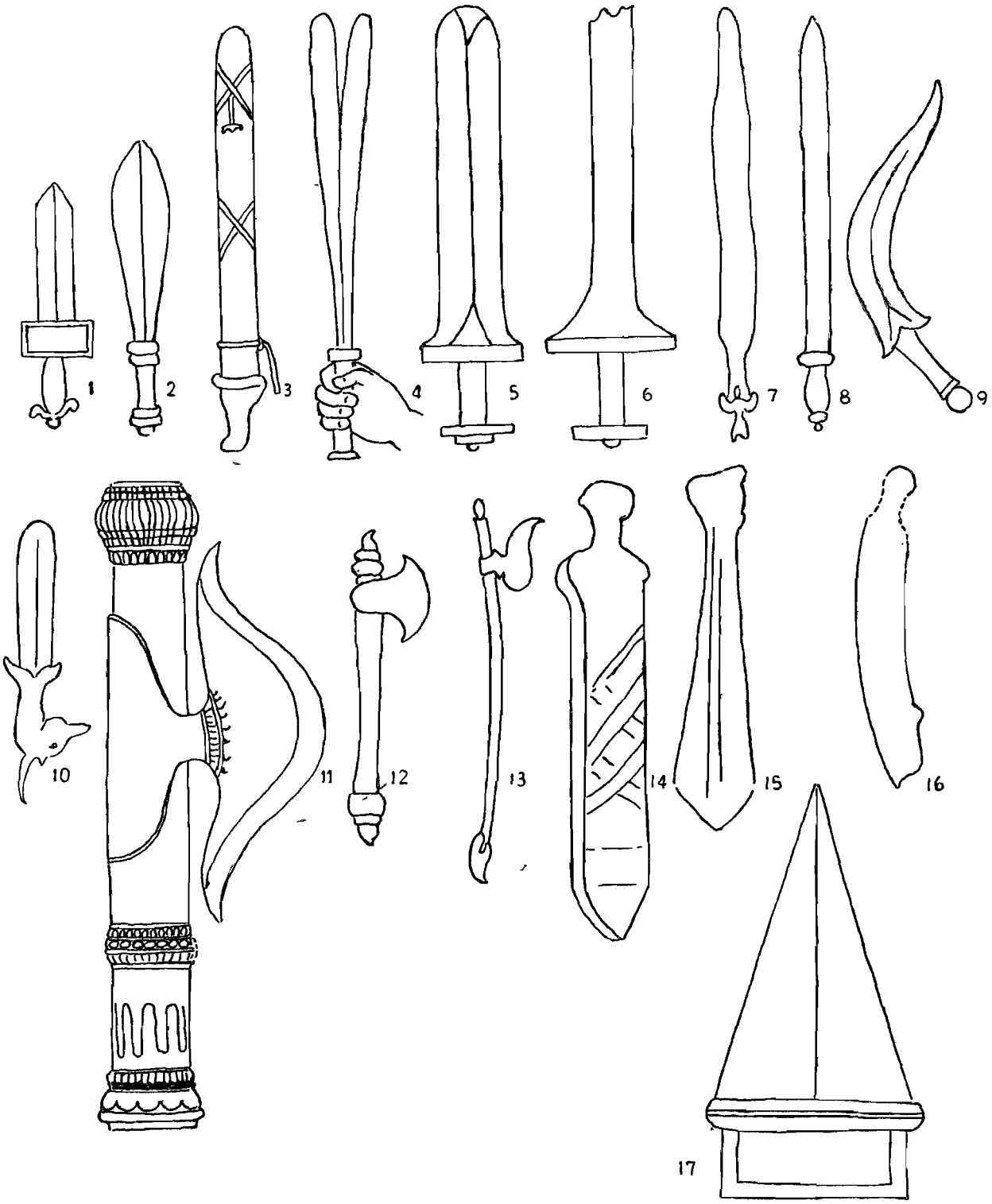
INTRODUCTION

Antiquity of Iron

The story of man's first use of iron is lost in the remote past. Iron is rapidly rusted and attacked by elements so that few samples of early manufacture remain now to give evidence of their use, unless they happened to be in localities where the atmosphere was relatively non-corrosive. It is, therefore, not possible to say how the knowledge of use of iron was acquired in India, or when was iron first discovered and produced, but its great antiquity is attested by references in the earliest Indian religious literature. Elsewhere in the world it was also in use, perhaps from an earlier age. The fragmentary writings or inscriptions on tombs and monuments which survived the fall of great Empires or ancient civilizations as those of Babylonia, Assyria, Egypt, Greece, Rome and China bear testimony to the antiquity of use of iron in the dim pre-historic past. Archæological research has established that iron has been in use through a period of about 5,000 years. Some of the oldest known iron objects found in various localities of the world include a large piece found in the great Pyramid built about 2,900 B.C. in Egypt. It may be that these pieces of iron were not man-made, but were obtained from fragments of meteorites which inference is based on the composition of the metal which contains a liberal proportion of nickel. Whatever be the source of their first acquaintance with the metal, the ancient peoples ultimately came to know that iron is a substance with very great possibilities than either copper or stone for the making of tools and weapons. Such knowledge heralded the dawn of Iron Age, when man-made iron began to be produced. The arts and crafts of the Greeks involved little use of iron, but the Romans appear to have been more resourceful in the extraction of iron, for the success of their extensive conquests was facilitated by use of iron in making weapons of war. Other peoples in the Continent also got acquainted with the use of iron by this period, for when Caesar crossed the English Channel, he found iron already in use among the native Britons. In India and China, the metal is believed to be in use at least as early as 2,000 B.C. Some of the authorities ascribe the discovery of the original process of smelting of iron to the people of India at a much early date.

Historical Background

2. Out of a multitude of references in the ancient literature of India relating to the use of iron, a few may be mentioned, such as, the use of razors referred to in the Rig Veda, of warrior's coat-of-mail made of iron in the Yajurveda and of iron-made arrows in the Dhanurveda. There is an interesting account of tempering of swords in Brihat Samhita, the famous Treatise on Astronomy, which shows that the ancient people had the practical knowledge of various processes of making iron and steel and knew how to temper a blade with varying technicalities so that it will cut off an elephant's trunk or so that it will be fit for piercing stones or so that it will not yield to whetting on a piece of stone or cannot be blunted by other iron instruments. Variations in the tempering process seem to have been effected by using a variety of liquids for 'quenching' the heated metal, a principle which is recognized even at the present time. The selection of the liquid depended upon the quality of the steel required to be produced for a specific purpose, and extended over a wide range of objects, namely, from



WEAPONS USED IN ANCIENT ORISSA

(From *Antiquities of Orissa* by Rajendralal Mitra)

1. Lancet-headed dagger 2. Dao or bill-hook 3. Straight sword in scabbard 4. Double-bladed sword 5. Another type of double-bladed sword 6. Broad straight sword 7. Jagged sword 8. Lancet-headed straight sword 9. Kukri 10. Dagger with deer-headed handle 11. Ganesa's battle-axe 12. Battle-axe 13. Curved-bladed battle-axe 14. Doorkeeper's sword in sheath (Udayagiri hills) 15. Warrior's sword (Udayagiri hills) 16. Another type of warriors' sword 17. Conical dagger.

water to organic matters, such as, blood, ghee, milk from a mare or a camel or an elephant, a mixture of fish-bile with milk from deer, goat and horse blended with toddy, and many other queer liquid preparations.

Ancient Indian Steel

3. On attainment of a high degree of metallurgical skill, India started producing the most celebrated variety of steel known as the Wootz, produced from regions near about modern Hyderabad. It was extensively admired as a quality material for weapons of war. There are indications of the Imperial Romans importing the finest grade of steel then known to the world from some eastern source, which in all likelihood points towards India rather than distant China. A king in India was enjoined, by way of keeping away from ill omens, not to look at his own face in the reflections from the blade of his war sword, an idea which could not have been conceived if the excellence in imparting dazzling brightness to the finished product of steel had not been achieved. When Alexander the Great invaded India in the 4th Century B.C., King Porus is reported to have presented to him a 30-pound piece of Indian steel. The fact that a mere piece of iron was considered worthy of presentation to the conqueror of the world, leaves no doubt about the unparalleled excellence of the quality of the Indian steel.

4. Among the weapons of iron and steel used by the warriors of ancient times, some were massive and some sharp and slender. A study of the sculptures at Udayagiri, Bhubaneswar and Konarak reveals the use of a number of such weapons, namely, battle-axe, dagger, spear, javelin and swords of many varieties including double-bladed sword and conical sword. The world-famous Sun temple of Konarak liberally used iron as a structural material, particularly in the shape of huge beams one of which is over 25 feet long, 11 inches broad as well as deep and weighs about 4 tons. These beams are rust-proof and have remained unaffected in spite of atmospheric and climatic conditions resulting from the salinity and humidity of the seacoast. Outside Orissa may be seen the wonderful famous iron column at the Kutub Minar near Delhi, which is believed to have been made about 3,000 years ago. It is the largest and heaviest single piece of iron, coming down to posterity from old times, and weighs about 7 to 8 tons. The forging and manipulation of massive objects, such as, this iron column or the iron beams of Konarak remain a mystery down to the present age.

Inexhaustible Reserves

5. The principal factor contributing to the production of iron in India from ancient times seems to be the extensive occurrence of iron-bearing rocks in the country, sometimes abundantly lying as surface layer in hills and forests. It is now known that there are inexhaustible deposits of high-grade iron-ores in several regions, namely, Orissa, Madhya Pradesh, Bombay, Bihar and Mysore. The iron-ore reserves in India are estimated at 21,000 million tons* which are approximately one-fourth of the total reserves of the world. Orissa alone has about 8,000 million tons** of iron-ores, which will be sufficient to feed a modern steel plant like the one at Rourkela for 4,000 years consuming at the rate of 2 million tons per year. The frequency and vastness of discovery of mineral resources resulting from progressive Geological Surveys justify the expectation that the total iron wealth of the country may be much more than what is known at present. An outline map is given here to indicate the approximate location of deposits of iron-ore in Orissa.

**Mineral Production in India, 1958*, Ministry of Steel, Mines and Fuel, page 97

***Techno-Economic Survey of Orissa* by National Council of Economic Research, page 55

6. *Iron-bearing Minerals*—There are a vast number of mineral species which contain iron but only a few are of any commercial importance, because in most cases the iron content is too low to justify extraction of the metal. Iron-bearing minerals of chief importance may be grouped into four classes, namely, iron oxide, iron carbonate, iron silicate and iron sulphide, out of which the first variety of mineral is important for purpose of smelting. The mineralogical name of the rocks containing iron oxide are magnetite, hematite and limonite. Among these rocks, magnetite has the highest percentage of iron content, the others in order being hematite and limonite. Magnetite is difficult to tackle in usual type of smelting furnaces. The choice of smelters is, therefore, confined to the other two varieties of iron-bearing ores.

Scope of Present Study

7. The scope of the present monograph is limited. It relates to the study of the indigenous process of smelting of iron in small clay furnaces by a particular section of the village community of Orissa. The process conducted in different localities of the State is broadly the same, and the description of one of them would, *mutatis mutandis*, suffice for all except in respect of the underground furnace of the Koraput type. Thus, for the facility of close examination of the subject, the study has been confined to the smelters of one particular village, named Penthabahal in district Sambalpur. Incidentally, a quick survey was also made of the underground furnace existing in village Singelbecha in police station Mathili, district Koraput and a brief report is included here, mainly to bring out the aspects of difference from the Penthabahal type. The location of these two villages is roughly shown in the Map of Orissa appearing at page 13.

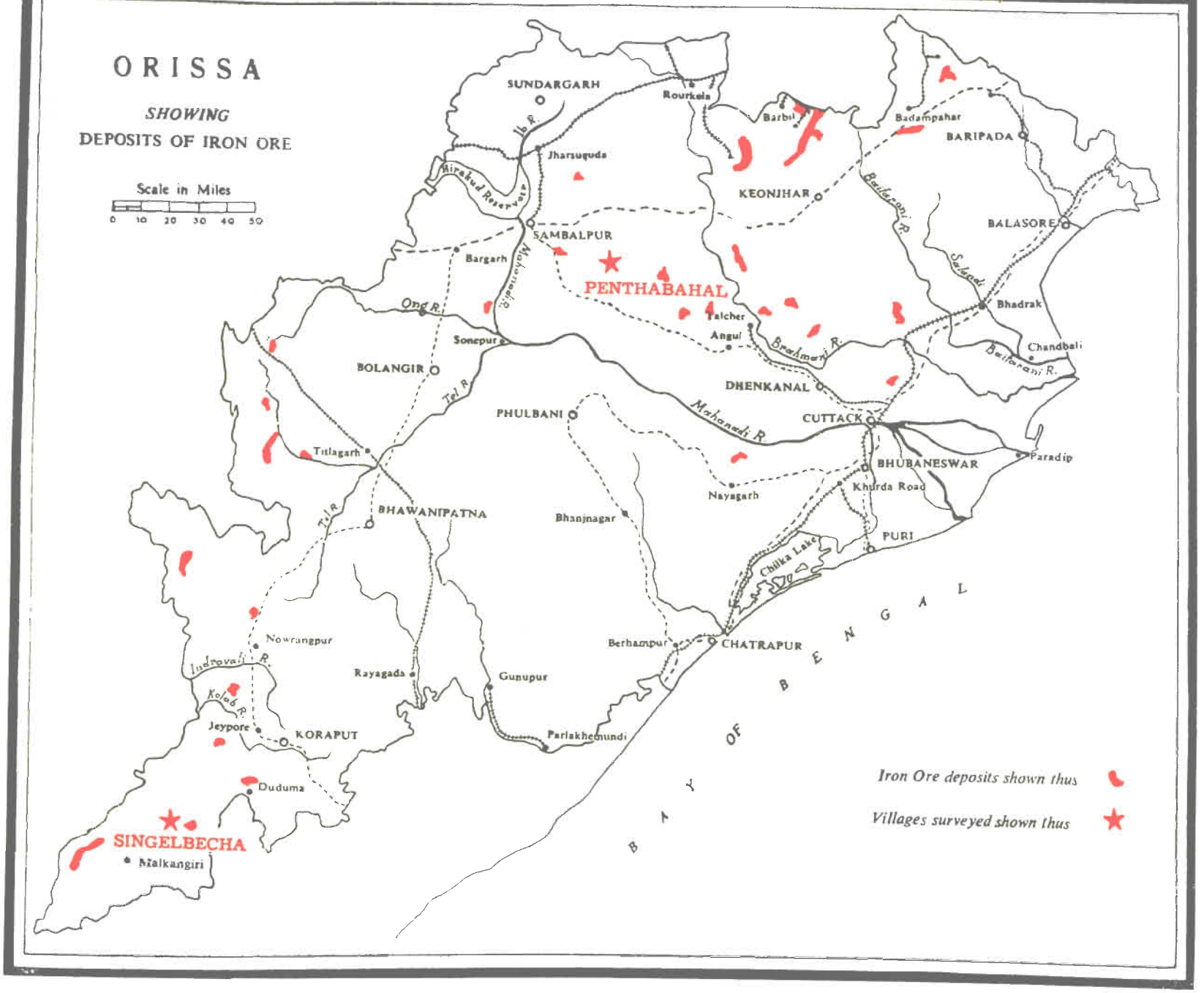
Smelters of Penthabahal

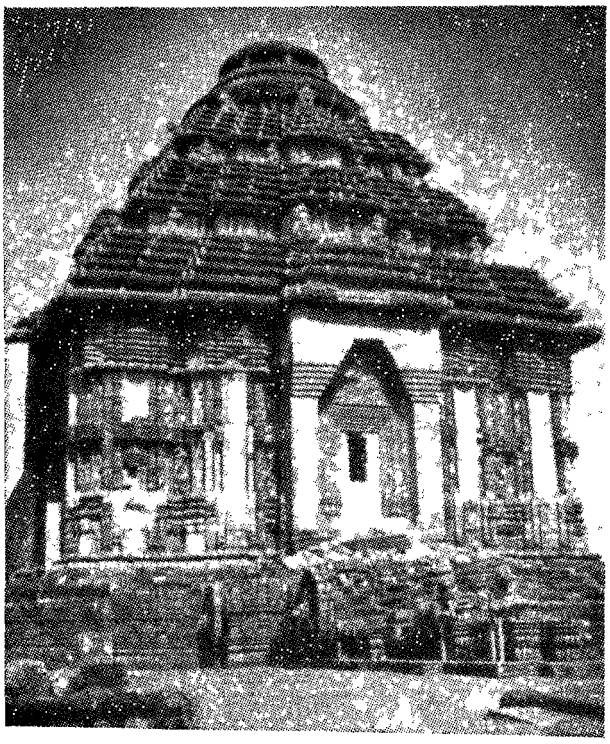
8. Penthabahal is a small village far in the interior of the undeveloped tract of country in Rairakhol sub-division of district Sambalpur. It is over 17 miles from the sub-divisional headquarters and is connected by a fair-weather road which passes through dense forests and crosses a number of hill-streams which are not bridged. It is surrounded by isolated rocky ridges, and has to the South-East a prominent hill with an elevation of 1,351 ft. called the Kalapat hills. This hill is the source of supply of iron-ores for the smelters of the village. The extent of deposit does not seem to have been surveyed ever, but taken as an independent unit, it does not appear to be considerable in view of huge and inexhaustible occurrences elsewhere in Orissa.

9. About the beginning of the 17th Century some roving Konds first came across the iron-bearing rocks lying exposed on the surface of the Kalapat hills, and decided to settle down. They took to smelting of iron, and reclaimed lands for cultivation, but later migrated elsewhere in search of better prospects. It was left to a more adventurous group of cultivators at a later date to take advantage of the natural facilities available in the locality and to settle down permanently. They broke down conditions of wilderness and isolation and thus encouraged other communities to come and acquire habitation. Among these communities were the Kamars, whose sole means of livelihood was derived from the hereditary profession of smithy and smelting of iron. The Kamars have dark complexion, round face, flat nose and muscular physique and are well-suited for the profession they follow. Women are hard-working.

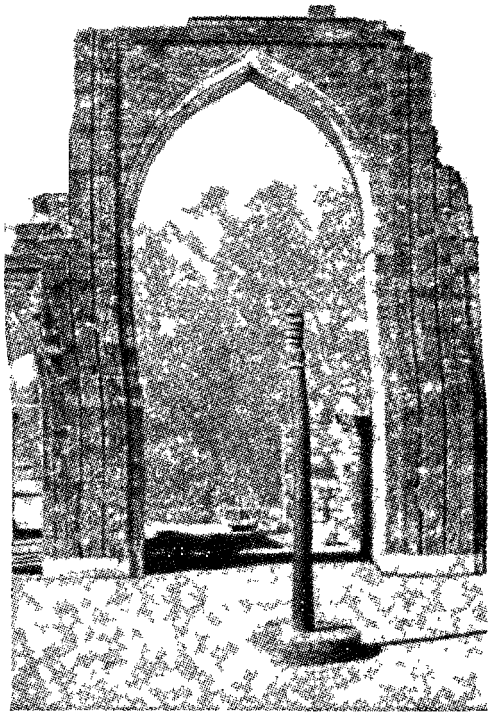
Other Centres of Production

10. The ancient technique of iron smelting is in vogue in many localities in Orissa. It appears that in bygone days wherever deposits of soft iron-ore were found on the surface and close to forest areas where production of charcoal was possible, the smelting industry sprang up.

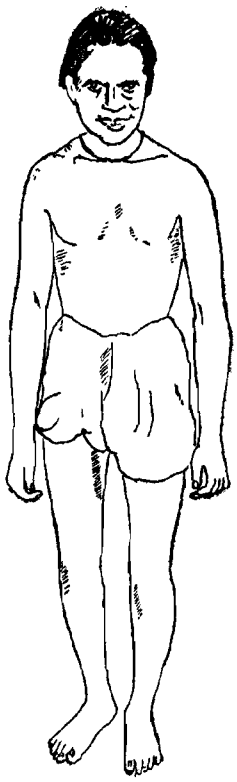

ORISSA
SHOWING
DEPOSITS OF IRON ORE
Scale in Miles
0 10 20 30 40 50
SUNDARGARH
Rourkela
Barbil
Badampahar
BARIPADA
Ib R.
Jharsuguda
Hirakud Reservoir
KEONJHAR
Baitarani R.
BALASORE
SAMBALPUR
Bargarh
Mahanadi R.
PENTHABAHAL
Ong R.
Talcher
Angul
Sonepur
Brahmani R.
Bhadrak
Chandbali
Baitarani R.
BOLANGIR
Tel R.
DHENKANAL
PHULBANI
Mahanadi R.
CUTTACK
Titlagarh
BHUBANESWAR
Paradip
Khurda Road
Nayagarh
BHAWANIPATNA
Tel R.
Bhanjnagar
PURI
Chilka Lake
B A Y O F B E N G A L
Nowrangpur
Berhampur
CHATRAPUR
Indravati R.
Rayagada
Gunupur
Kolab R.
Jeypore
KORAPUT
Parlakhemundi
Duduma
SINGELBECHA
Malkangiri
Iron Ore deposits shown thus
Villages surveyed shown thus



SUN TEMPLE OF KONARAK
...iron used as structural material



IRON COLUMN AT KUTUB MINAR
(Courtesy—Demag Aktiengesellschaft)



A Kamar



A Kamar woman

Down to this day, the industry is carried on in many out-of-the-way villages in the districts of Koraput, Kalahandi, Bolangir, Sambalpur, Sundargarh, Keonjhar and Dhenkanal. Koraput alone may have about 50 villages where the indigenous furnace is working. In Malkangiri subdivision, furnaces of underground type are extensively found in many villages, namely, Mendkuli, Sindabada, Daudaguda, Mathili, Sirlaguda, Dangarkali, Ratabata, Chalanguda, Pakuaguda, Singelbecha, etc. In Nowrangapur subdivision, the villages situated round about the Hirapur hills and the Podagarh hills have thriving smelting industry. In Bonai and Deogarh subdivisions of Sundargarh district, in Athmallik, Angul and Talcher subdivisions of Dhenkanal district and in Rairakhol and Deogarh subdivisions of Sambalpur district, there are many villages where the industry is doing well. The village Penthabahal in Rairakhol subdivision and some villages around it, namely, Kadopada, Tinkibiri and Brahmanpali are noted for production of indigenous iron and for manufacture of tools and implements.

11. ***Centres closed down***—In course of the present survey, however, one deplorable fact came to notice. The indigenous smelting industry was found thriving in several villages of Umarkot police station in district Koraput during the period of the Census enumeration in February 1961, but by the time the present survey was undertaken in the latter half of the year 1962, the industry had no trace of existence in many

of these villages. A comprehensive list has not been drawn but a few of the villages where the industry has completely died out during the year 1961-62 are Semla, Sunabeda. Naikguda, Gorama, Ekma, Dhanpur, Achala, Malaguda (Janiguda), Murtuma, Buruja and Sirliguda, all located in Umarkot police station. The smelters while deploring the loss of their traditional livelihood blamed some subordinate officials who stopped removal of ores from the nearby reserved forest areas. The region round about Umarkot is now within the ambit of the Dandakaranya Project, where resettlement and rehabilitation of refugees is in progress, and a large number of officials have been stationed. Some overzealous subordinate officials seem, probably without the knowledge of superior authorities, to have brought about this total destruction of an indigenous industry which kept generations of innocent craftsmen happy and prosperous in that hitherto wild, inaccessible yet self-subsisting tract.

Quantity of Production

12. Although there are so many production centres in Orissa even at the present time, the total output does not appear to be considerable. The village Penthabahal, which has two furnaces working regularly, produces barely 12 to 15 seers of iron per week. The total production from clay furnaces existing throughout Orissa may not exceed 50 tons a year. This compares unfavourably with the quantity of pig iron produced by indigenous process in China, which in the form of a decentralized cottage industry is believed to have yielded several million tons per annum during the Second World War, though of late there is a sharp decline, as observed by the Indian Technical Delegation which visited China in 1959.

SECTION II

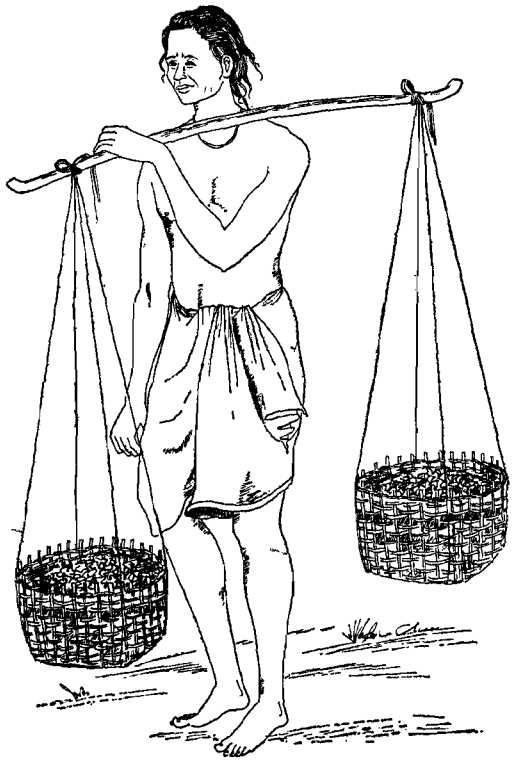
RAW MATERIALS AND EQUIPMENTS

Iron-ore

13. The ores used by the smelters of Penthabahal are obtained from the Kalapat hills and are reddish-brown in colour and slightly porous. On examination they are found to be partly hematite and partly limonite. These two varieties of iron-bearing rocks are extensively distributed over many regions in India. Hematite is reddish in colour and has higher iron content. Limonite is comparatively lighter and is porous and looks brown. The ores of the Kalapat hills may be classified as 'sub-native', being available on or near the surface of the ground in an impure condition. They occur intermixed with reddish brown soil spread in patches here and there over an area of 4 to 5 square miles, giving little promise or outward indication of their valuable content.

14. ***Chemical Analysis***—Pieces of ore collected from the hill, which the Kamars of Penthabahal use for extraction of iron, were put to chemical analysis. The report of analysis conducted by an eminent Metallurgist is given in the Appendix. It appears that the iron content in the ore is not high, namely, 45 per cent, but the proportion of silica and alumina is satisfactory, namely, 13 and 7 per cent respectively. It may be interesting to compare side by side the relative data of the ores used in the Rourkela Steel Plant. This modern factory uniformly uses high-grade ores standardized by processes of blending and beneficiation of the raw materials received from two different iron-ore mines located at Barsua and Badjamda. The minimum iron content of the ores thus made ready for the blast furnace is 60 per cent. Silica and alumina constitute about 2 and 3 per cent respectively. It is useful to note that the ore which contains more of silica and less of alumina is more easily fusible, requiring less temperature for the process of reduction. The Kalapat ore has a silica-alumina ratio of 2 : 1, while Rourkela has an adverse ratio of 1 : 1·5. This great redeeming feature of the Kalapat ores makes up for the deficiency in iron content, which is 45 per cent as against 60 per cent of Rourkela. The Kamars of Penthabahal, in fact, do not mind a low-grade ore, if it is soft and can be easily smelted.

15. ***Collection and Transport***—The Konds, who happened to be the earliest batch of people to utilize the ores of Kalapat hills are supposed to have previous knowledge of identification of ores suitable for smelting process. When the Kamars came later, they possibly got indications of the previous smelting industry by the Konds and settled down to the work in a business-like manner. The Kamars usually collect pieces of ore-stones lying on the surface of the hill and then dig, say, up to six feet deep, wherefrom an abundant quantity of stone-pieces varying in size from one-fourth inch to five inches are found. They do not go below a depth of six feet even if the bed of ores continues, in order to save labour in lifting the heavy material. A woman worker of the family generally assists the Kamar in collection of ores in split-bamboo baskets. But the transport is done by the Kamar himself as it is a strenuous job to carry the heavy stone-pieces from the hill site to the workshop. For such transport, he uses a *bhar*, i.e., a springing split-bamboo pole put across the shoulder with two basket-loads slinging down from two ends. The Kamars should have done better by using a bullock-cart



A Kamar carrying ore-stones by *bhar*

for such transport, owning it either jointly or separately so that some amount of unnecessary labour could have been saved and diverted towards handling of larger quantity of smelting materials. But they are poor, and cannot afford to possess a pair of bullocks and a cart even on joint basis. They have not even thought of hiring a cart from a neighbour-cultivator as it involves payment in some form.

Charcoal

16. Besides iron-ore, the other raw material used for smelting of iron is charcoal from wood. The Kamars are expert charcoal burners. They make it usually from *sal* or *jaman* tree, which yields charcoal suitable for conditions of combustion and blast as obtaining inside the smelting furnace. They move about in the forest trying to locate dead and dried up trees which are approximately a foot and a half in circumference. Trees which are thinner, and twigs and small branches of trees are not used for production of charcoal, because they may either get completely burnt into ashes or get reduced into too small a size of charcoal-pieces, which are uneconomical for use in the furnace or the forge. The dried up trees of suitable girth are cut into logs 4 to 5 feet long. Half a dozen of such logs are piled up and a quantity of dried leaves or twigs are inserted in the openings to take fire



A Kamar woman with a head-load of charcoal

from a straw torch which is carried from the village for setting fire to the pile of logs. It takes about 2½ to 3 hours for these logs to burn into charcoal. The well-burnt portion of the charcoal is collected into baskets, leaving the unburnt or half-burnt portion at the site as useless for their purpose. At times, this discarded material

is used up in the next burning process but generally the inclination is to try fresh pieces of logs. After charcoal is collected in baskets, it is transported either by women in head-loads or by men in *bhars*.

Two days in the week, namely, Wednesday and Thursday, are set apart for burning charcoal and transporting ore and charcoal to the site of the furnace.

Furnace

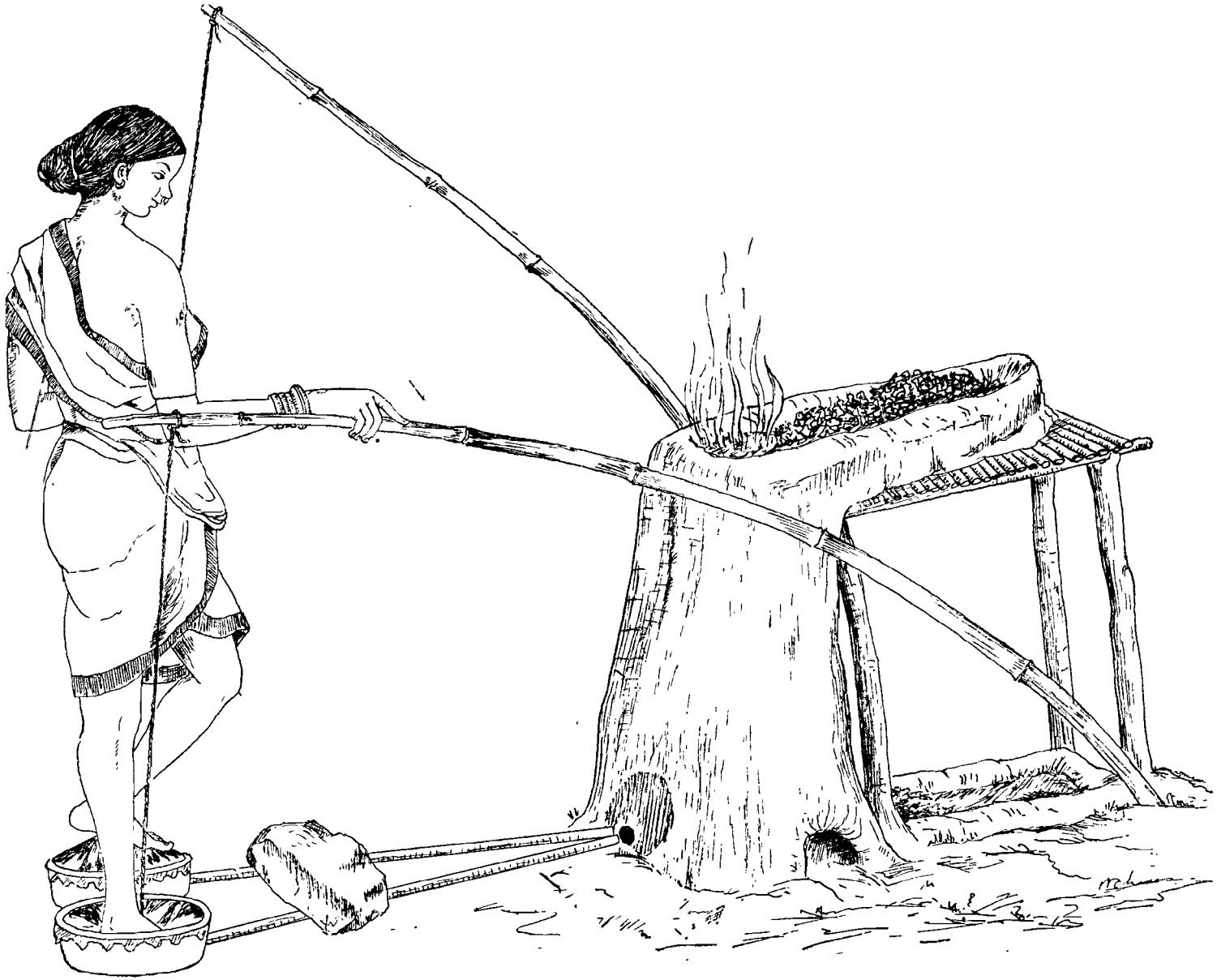
17. The first object that engages a visitor's attention on entering the smelting shop is the furnace. It is a cylindrical kiln called *bhati* in local language and is made of clay. The *bhati* has an overall height of 36 inches with an outside circumference of 58 inches. The diameter of the opening at the top of the furnace is 12 inches. There is another opening at the base of the furnace on the front side which is 12 inches high and 10 inches broad in the centre narrowing down to 7 inches both at the bottom and top of the opening. It is meant for fixing the blast nozzle and for allowing the smelt product to be removed. In this opening the nozzle is fitted which consists of a baked clay tube 7 inches in length, about 1½ inches across at the wider end and slightly tapering. The nozzle is fixed by packing moist clay or wet sand so that heat may not escape but blast may pass through the nozzle. On the right side at a little lower level is an aperture for draining out useless molten matter from the furnace. It is appropriately called the *hagani-gada* or an aperture for excretion. This opening is 7 inches broad at the bottom and 4 inches at the top and is 7 inches high. On the side opposite to the nozzle, there runs backwards a wooden platform 28 inches long and 18 inches wide. It is 43 inches high at the rearmost portion inclining 5 inches downwards till it reaches the top of the furnace. This serves as a slide-down platform for charging charcoal or ore into the furnace conveniently. It is called *machan*. It is plastered with mud and is provided with small ridges on three sides about 3 inches high. Below the *machan* is a shallow pit which is utilized for storage of the slag for the time being until removed to a distant heap.

The Bellows

18. The bellows used in the smelting shop are distinctive and very much different from the hand-bellows of country smiths or rotary blowers of modernized shops. The bellows are made of a section of trunk of *gambhari* tree shaped so as to be 11 inches in diameter on the upper side and 10 inches on the bottom side, with a height of 5 inches in all. The inside of this piece of wood is dug out so as to make a cavity 7½ inches in diameter on the upper side, leaving the bottom intact and a hole is made on one side to take the bamboo pipe which is meant to carry the blast to the furnace. A piece of hide of *sambar*, deer or goat is stretched across the top in the fashion of a drum* and tied down strongly with seven rounds of *siali* rope so as to make it air-tight. In the centre of this cover a hole is punctured and a rope is passed through and is held in place by a twig or a nail. The other end of the rope is tied to a springing bamboo called *dang*, one end of which is buried in the ground.

19. In this manner a pair of bellows lie side by side in front of the furnace, fitted air-tight with bamboo pipes 2½ feet long leading from the drum to the nozzle of the furnace. Before the bellows are worked, the hide-cover is soaked in water to make it sufficiently pliable. When the pair of bellows are ready for operation, a Kamar woman, generally the wife or the daughter-in-law, rides over them with one foot on each of the bellows and starts depressing

*In Koraput district (village Singelbecha) the smelters use a piece of discarded thick rubber tube of the wheel of a bus or truck, which is available in Jeypore town for Re. 1 only. It is more flexible and is reported to be more durable than the hide of a wild animal used in Northern Orissa.



CLAY FURNACE

. . . . blast is steadily maintained and red and blue flames keep on fluttering above top of the furnace . . . . (*See* para 25)

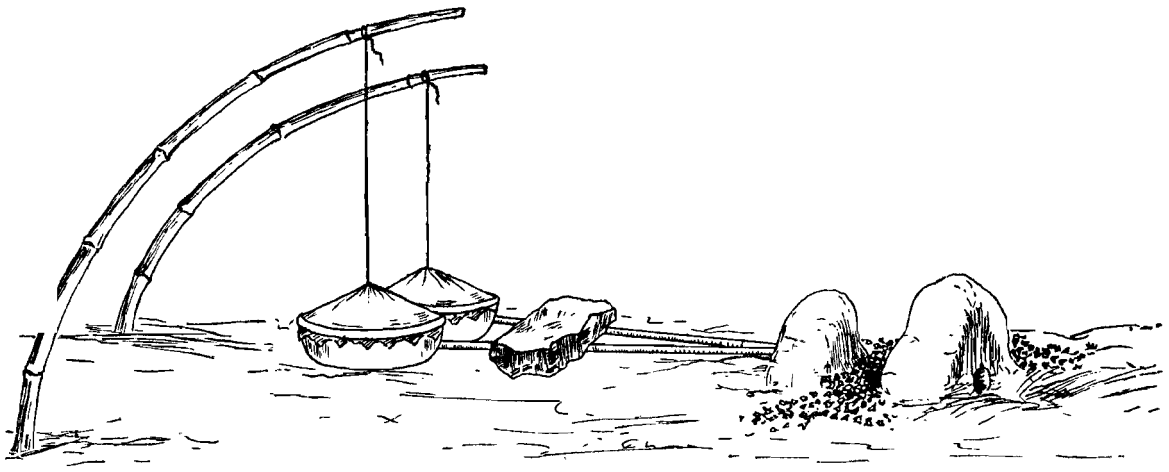
and releasing them alternately. The holes in the centre of the covering hide act as valves. As the foot of the bellows-worker depresses, her heel serves as a stopper to the valve and forces the air through the bamboo pipe into the nozzle of the furnace. When the foot is taken off, the bellows get released and the bamboo stick springs lifting the hide-cover. At this stage the hole in the cover is open and the bellows are filled with air by such action. She holds the springing bamboo for support but occasionally holds a stick in her hand. The two bamboo pipes are kept under a piece of heavy stone to remain stable during the bellowing operation. Otherwise the pipes are liable to be thrown out with the pressure of air coming from the drum.

The Forge

20. A little away from the clay furnace, there is the forge which is used for heating and reheating the sponge iron for refinement and for manufacture of various articles. It is a simple structure. There is a small nozzle fixed by mud in the ground and inclined slightly downwards to a small pit filled with charcoal. There is a small earthen wall about 12 inches high and 18 inches long built at right angles to the line of the nozzle which has a hole leading to a still deeper pit in the ground. This pit serves as a flue and an escape for useless materials which might be still forced from the iron in course of its refinement. The bellows which were in work in the furnace are shifted and placed so that the bamboo pipes converge into the nozzle. The forge is ignited by charcoal. The bellows start sending blast and raising temperature of the fire. The fire is then utilized for heating and reheating either the sponge ball for expulsion of last traces of impurities, or the wrought iron billet for further improving the quality of the metal and shaping it into particular tools or implements which are in demand in the local market.

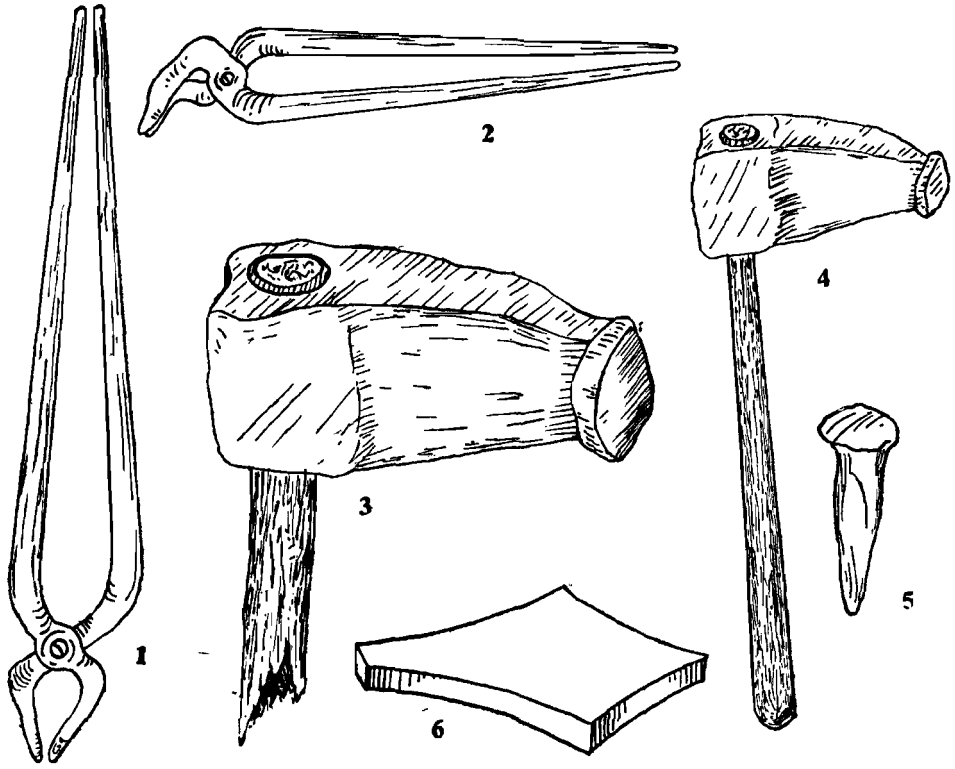
Forging Tools

21. Among the tools and implements necessary for forging and allied work, the most important ones are the hammer and the anvil. For heavy work there is a piece of large granite boulder which serves as an anvil. It has no specific name, but is simply called *muguni pathar* or granite



Foot-bellows and Forge

stone. Hammers are of two types. The heavier one is called '*ghana*' which is a solid heavy block of iron tapering towards the working end and having a hole through the opposite end in order to hold the wooden shaft. Both ends are blunt and are square in cross-section but of different dimensions. It measures nearly 10 inches in length and weighs without the shaft about 10 pounds. The wooden shaft is 28 inches long and 2 inches in diameter. The other hammer is smaller in size and is known as '*hathudi*'. It is meant for lighter work and is used in shaping tools and implements. The '*sanduasi*' or tongs are of two different types, one with straight lips and the other with curved lips. Both the types have long arms for effective grip with the lips which are pointed. It is generally 18 to 24 inches long. There are several other tools small but quite necessary. Important among them are a small steel anvil called '*nehi*', flat in shape and with concave sides and the punch called '*atila*' meant for cutting or piercing hard substances.



TOOLS FOR FORGING

1. Sanduasi (tongs) with straight lips 2. Sanduasi (tongs) with curved lips 3. Ghana (ten-pounder hammer) 4. Hathudi (light hammer) 5. Atila (punch) 6. Nehi (small steel anvil)

SECTION III

TECHNOLOGY

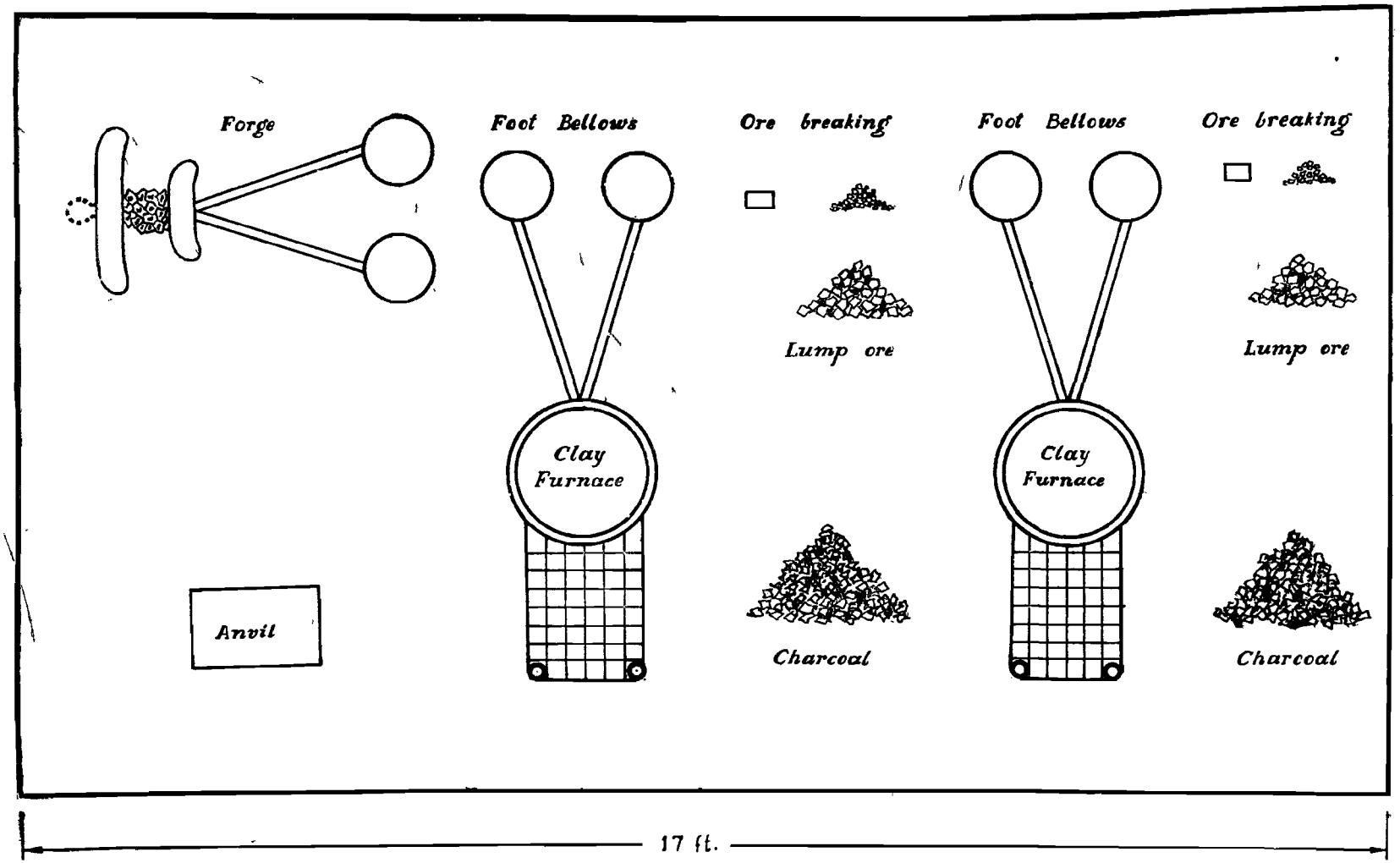
Process of Smelting

22. The origin of the process used by the Kamars of Penthabahal of extracting iron from ore is unknown. As however, the industry has continued to thrive from century to century, it is not likely that these Kamars developed the technique independently. Moreover, the same process with little or negligible variation is in vogue in many other centres of production. Whatever be the origin, it is certain that the Kamars possess adequate practical knowledge of the conditions under which extraction of iron becomes possible. These conditions are that the iron-bearing ores should be heated strongly in contact with hot carbon out of contact with air. Small lumps of ore placed in a hearth surrounded completely by burning charcoal meet these conditions to a considerable extent. The ores available from the Kalapat hills are a combination of iron with oxygen and other matters. The process mentioned above drives away oxygen from the ores ultimately to combine with the hot carbon, leaving iron in a metallic state. In more appropriate language, the iron is said to have been reduced from its oxide. The process by which such reduction is effected is called smelting. Charcoal plays a multiple role in this process. It generates heat required for the melting of ores. It is an excellent fuel. It also acts as a chemical reducing agent by inducing carbon from the charcoal fuel to combine with oxygen from the iron oxide contained in the ore. The process of heating, melting and of chemical transformation inside the furnace is a metallurgical operation by which the metal is separated by fusion from the impurities with which it may be chemically combined or physically mixed.

The Experiment

23. A full-scale smelting operation was watched in order to study the process. The results are given below indicating the time taken, the quantity of raw materials charged and the number of charges made during one single operation. To begin with, the interior of the furnace was filled with charcoal which has a capacity for taking 20 standard seers of charcoal of average size. Thereafter, a quantity of lump ore weighing 2½ seers was placed above the column of charcoal. Fire was introduced at the nozzle and air blown. At first a few short and sharp blasts from the bellows were given to ignite the charcoal. Thereafter the bellowing operation took a regular rhythmic form. Within a quarter of an hour the column of charcoal began to settle down due to loss in combustion resulting from continuous blast. A small quantity of charcoal was then added. A few minutes later the second skip of lump ore was put in. In this manner charcoal was added in quantities differing from half a seer to more than 3 seers and lump ore at the rate of 2½ seers each time every 10 or 15 minutes. Within a couple of hours from the start, charcoal had been added 9 times and lump ore 12 times, the total weight of each of the materials being 30 seers. The operation of adding lump ore each time is called in Kamar's language a *bhadi*. One smelting operation is completed in 12 *bhadis*.

24. For the first half an hour or so, the furnace is charged with coal and lump



SKETCH OF SMELTING SHOP OF SRIDHAR PENTHOI OF PENTHABAHAL

ore alternately 4 times. At the end of the fourth *bhadi*, the escape hole which is locally called *hagani gada* is opened just for a few seconds to allow the *gangue* (waste material) to escape into a pit adjacent to the furnace. The escape hole is sealed at once with wet sand after the *gangue* is allowed to run out. The smelters do not allow a considerable quantity of this matter to remain within the furnace as it will adversely affect the smelting operation. If allowed to accumulate, this molten material may ultimately drown the burning charcoal and reduce the thermal efficiency of the furnace. At the time of each *bhadi* subsequent to the fourth, the escape hole is opened for letting out the waste material. Thus out of 12 *bhadis*, the last 9 are immediately followed by the draining out of the molten matter.

25. During the entire operation the blast is steadily maintained, and red and blue flames keep on fluttering above top of the furnace with occasional burning cinder bits flying out. Within half an hour from the start or by the time of the fourth *bhadi*, the lump ores start descending to the lower portion of the furnace, emitting a lot of useless softened material. At this stage the ore begins to get reduced to a semi-metallic state and move further down to the lower region of the furnace where the temperature is highest. The earthy waste material and other useless substances have now been melted into a fluid. This molten fluid is called *gangue*. As it comes out of the furnace it solidifies in contact with air in the pit outside the furnace. The *gangue* also contains some unreduced portion of the lump ore due to inadequate fusion resulting from defective operation.

26. In the above manner when the twelfth *bhadi* is over and the *gangue* has been let out from the furnace 9 times, the smelting operation stops because the Kamar judges the iron to be ready at this stage. The bellows stop working and the clay fittings at the nozzle are demolished and removed, when a blazing body is visible inside. This is pulled out with a pair of tongs and is taken direct to the granite anvil *(muguni pathar)*. Meanwhile the woman who was working the bellows pulls out the burning charcoal from inside the furnace and throws water over it. The extinguished charcoal is kept aside for being thrown away as it has become unfit for further use in the furnace or the forge.

27. *Time-table*—The time-table of operation described above was noted as given at page 26.

Product of Furnace

28. Thus in about two hours, the furnace yields its product. What happens inside the furnace resulting in its transformation is a simple story of metallurgy. When charcoal is ignited in the furnace, carbon monoxide is formed by combustion. The blast of air which comes from the bellows helps carbon monoxide to pass through lump ores, which are now in contact with fire. Under conditions of heat, the iron oxide of the ore gives out its oxygen which combines with carbon monoxide from hot charcoal to form carbon dioxide. This gas along with some waste gases escapes from the top of the furnace. In this process of disintegration when oxygen and other gases leave the parent body, the ore starts undergoing reduction and descends lower down in the furnace where the temperature is higher and the process of reduction is faster. By the time the ore has reached the hottest part a little above the level of the blast nozzle, it is largely reduced to metallic iron and takes the shape of a sponge ball.

29. This metallic sponge is the final product of the smelting furnace. It is removed and placed over a granite boulder

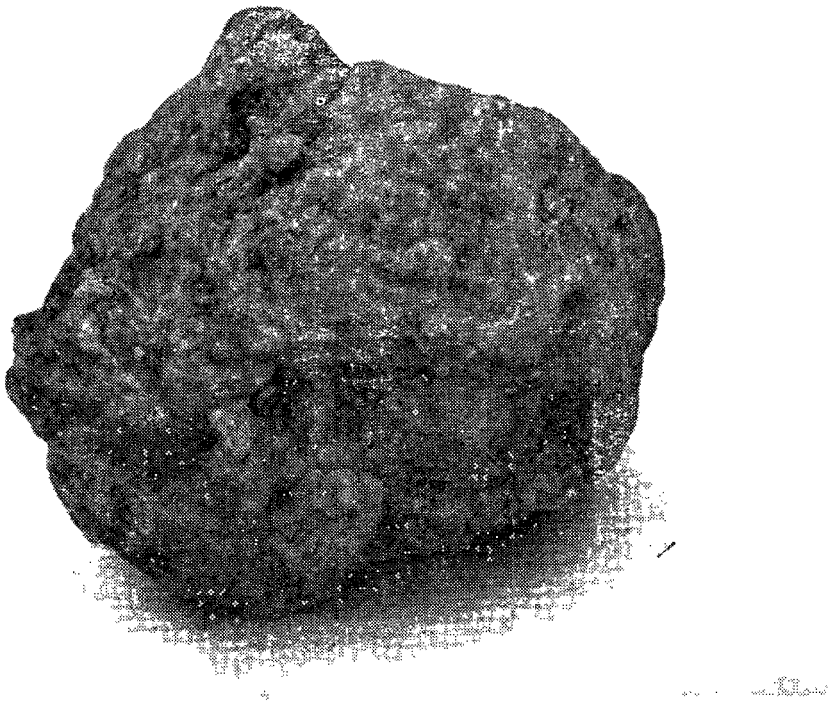
and is held firmly by a pair of tongs by one of the Kamars, while the other starts hammering it with a *ghana* or heavy hammer. The hammering continues for a short while of less than a minute till the body becomes cold. It receives about 25 to 30 strokes of hammer. During the process of hammering, the body is turned from side to side, so that all the sides are subjected to hammer strokes. It is given

TIME-TABLE OF OPERATION

(*See* para 27)

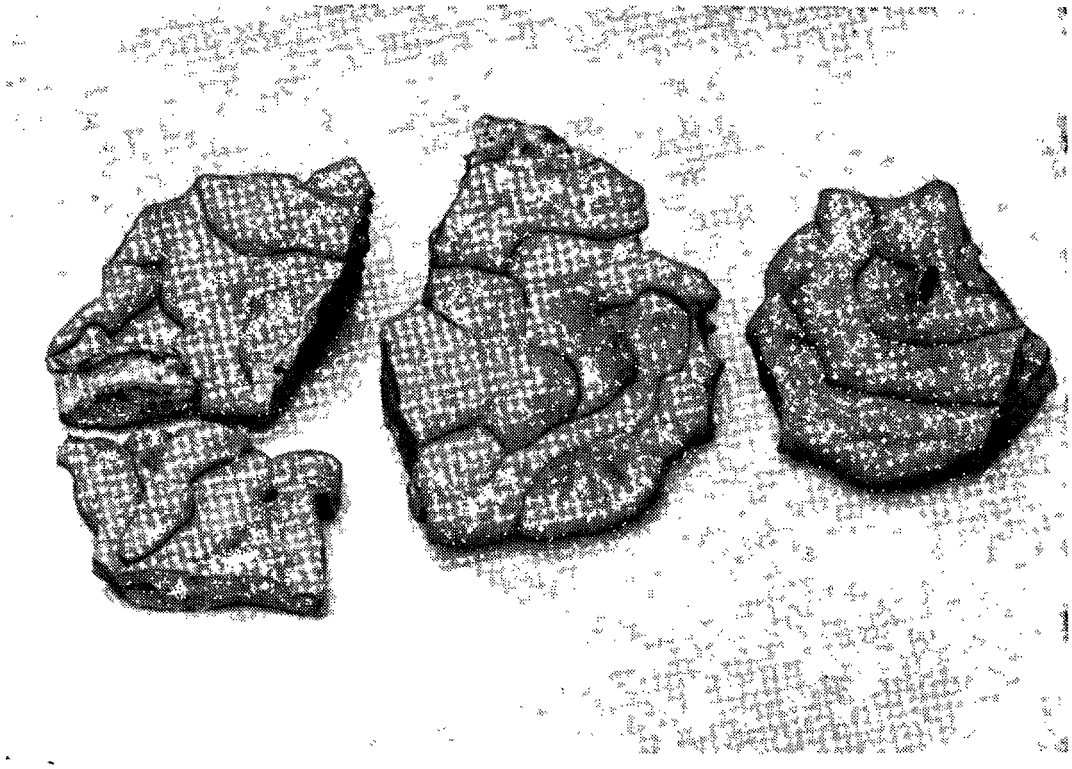
Time		Charcoal		Lump ore		Discharge of *gangue*
		Sl. No. of charge	Quantity charged	Sl. No. of charge	Quantity charged	
(1)		(2)	(3)	(4)	(5)	(6)
			Seers		Seers	
3-30 P.M.	...	1	20	1	2½	...
3-45 P.M.	...	2	½	...	...	...
3-50 P.M.	...	...	...	2	2½	...
3-57 P.M.	...	...	...	3	2½	...
4-00 P.M.	...	3	½	...	...	...
4-10 P.M.	...	4	2	4	2½	I Discharge
4-20 P.M.	...	...	...	5	2½	II Discharge
4-30 P.M.	...	5	½	6	2½	III Discharge
4-40 P.M.	...	6	3½	7	2½	IV Discharge
4-50 P.M.	...	...	...	8	2½	V Discharge
4-55 P.M.	...	...	...	9	2½	VI Discharge
5-00 P.M.	...	7	½	...	...	...
5-05 P.M.	...	...	...	10	2½	VII Discharge
5-10 P.M.	...	8	½	11	2½	VIII Discharge
5-20 P.M.	...	...	...	12	2½	IX Discharge
5-30 P.M.	...	9	2	...	...	...
5-40 P.M.	...	Bellows stop. Nozzle fittings removed. Sponge iron pulled out. Furnace closed down.				
Total	...	9 times	30	12 times	30	9 times

the shape of a small block of brick which is more compact than when it was brought out from the furnace. It is a heavy mass of coalesced granules and looks dirty. There is nothing in its appearance now to indicate the potential good wrought iron which it contains. At this stage, however, it is intermixed with considerable slag lodged in the pores. In the above manner, each furnace produces three blocks of metal in



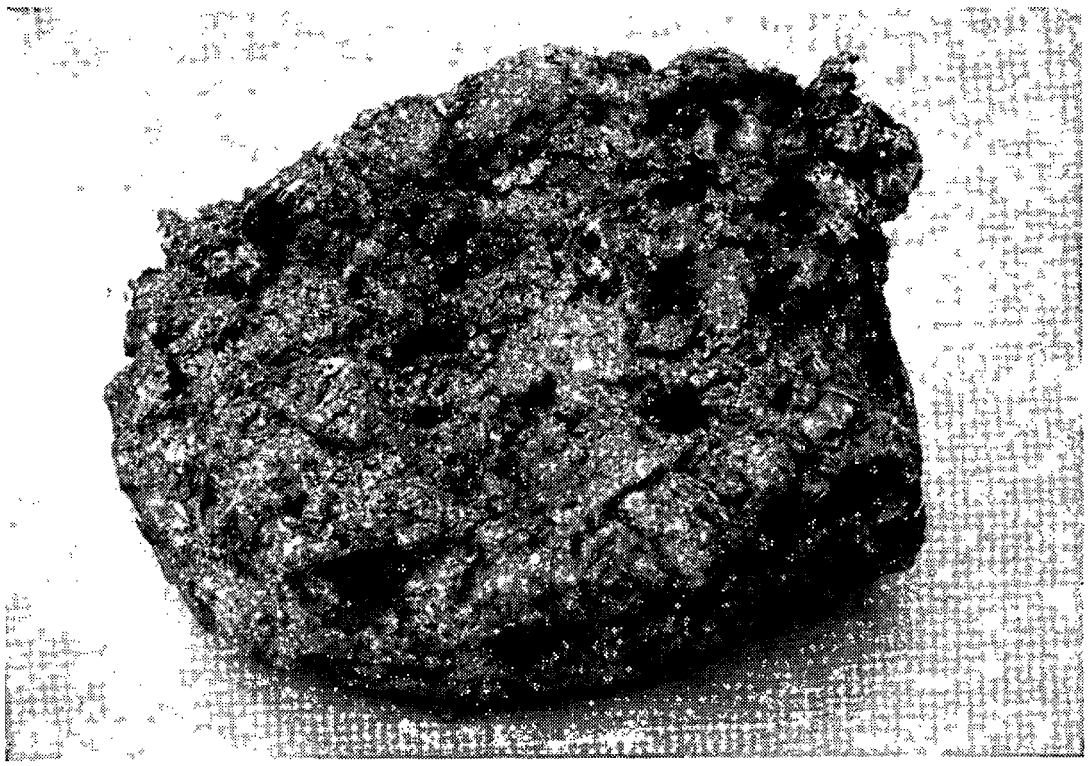
A PIECE OF ORE FROM KALAPAT HILLS

. . . . reddish-brown in colour and slightly porous. . . . (*See* para 13)



GANGUE

. . . . molten fluid solidifies . . . . (*See* para 25)



SPONGE IRON

. . . . nothing in its appearance now to indicate the potential good wrought iron which it contains . . . . (*See* para 29)

course of three shifts of smelting operation in one single day. All these blocks are kept aside for the day, to be taken up on the following day for further treatment with a view to improve the quality of the iron.

Refinement

30. The process of refinement and forging is taken up a day after the smelting operation is over. All the blocks of iron prepared on the previous day are brought to the forge. The foot-bellows are placed in position, the fireplace is ignited, the bellows are worked and the block of iron placed in the fire well covered with burning charcoal. When the block is red-hot, it is brought out and placed on the anvil for hammering. In the first instance it is just given a few light strokes and is then sent back to the forge fire for reheating. It is subjected to heating and hammering process a number of times. The time-table of an operation which was watched is given below:

6-50 a.m. ... The block of iron is placed in the fire-place for heating.

6-57 a.m. ... It was brought out and hammered 5 times and immediately sent back to the fire.

7-02 a.m. ... Hammered 30 times and sent back for reheating.

7-07 a.m. ... Hammered 20 times and then reheated.

7-12 a.m. ... This time heavy hammering starts. While one Kamar holds the block of iron with a pair of tongs, two Kamars of strong physique take the 10-pounder hammer one each and start striking alternately while the iron is hot. In course of a minute about 50 heavy strokes are delivered while the block of iron is turned from side to side by the man holding it with the pair of tongs.

7-15 a.m. ... Reheating and hammering by two men

7-20 a.m. ... Reheating and hammering by two men

7-25 a.m. ... Reheating and hammering by two men

7-30 a.m. ... Reheating and hammering by two men

7-35 a.m. ... Reheating and hammering by two men

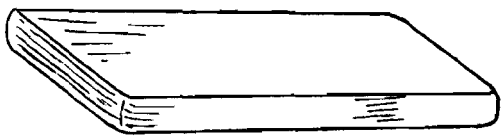
7-38 a.m. ... Reheating followed by light hammering by one man. By this time the piece of iron has become a compact body and the slags have been forced out.

7-42 a.m. ... Reheating and hammering into a particular shape

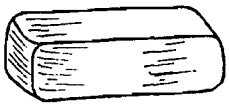
Billets

31. At this stage the hammered material is a solid mass of metal, and has taken the shape of what may be called a billet. The Kamars seldom produce blooms of iron. The distinction between a bloom and a billet is one of size. A billet is smaller than a bloom in cross-sectional area, both having length much greater than the maximum cross-sectional dimension. The cross-section of a bloom may be 5 or 6 inches square or a little oblong or at times

round and its length may be 10 to 12 inches. A billet has a cross-section of 2 or 3 inches round or square or slightly oblong and has a length of 5 to 7 inches. The Kamars of Penthabahal generally make billets which are suitable for making small tools and



Slab



Bloom



Billet

implements. Whenever heavier and larger pieces of articles are required to be manufactured, they make blooms as they claim but it is difficult to do with a small furnace as they have. They do not make slabs for any of their requirements. A slab is much wide and is comparatively thin and of short length.

Wrought Iron

32. ***Composition***—By its quality and chemical composition, the metallic substance now taking the shape of a billet is known as wrought iron. It is highly suitable for being forged into household wares and agricultural implements of various types. There are many chemical elements which remain alloyed with iron in the usual course of manufacture, but each kind of iron has its own composition different from other kinds according to manufacturer's choice or to conditions of smelting. The composition of wrought iron commonly includes a specific percentage of carbon, silicon, sulphur, phosphorus and manganese which, however, should be limited to small quantities if the metal is of high quality. The limit of admixture in wrought iron of good quality has been indicated by authorities* as follows:

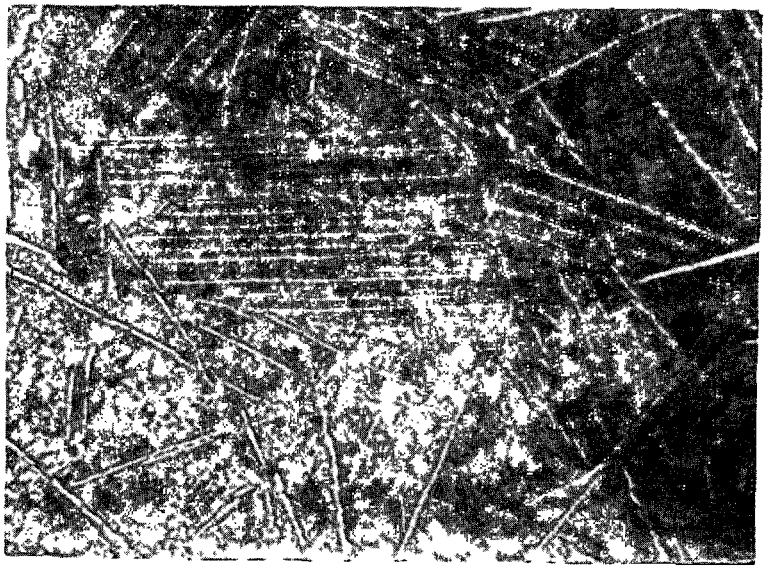
Carbon	...	0·02 to 0·08 per cent
Silicon	...	0·10 to 0·20 per cent
Sulphur	...	An undesirable element, should not exceed 0·03 per cent.
Phosphorus	...	Should be higher in wrought iron than in steel, say, between 0·10 and 0·25 per cent or even more.
Manganese	...	Low percentage is an earmark of quality and should be 0·05 per cent or less.

33. The wrought iron produced at Penthabahal is not pure enough to be classed as the ideal metal according to the above formula. The chemical composition of this indigenous iron was analyzed by the Research and Control Laboratory of the Hindustan Steel Plant at Rourkela, a full Report of which is given in the Appendix. According to this Report, the sample of sponge iron sent for examination contained:

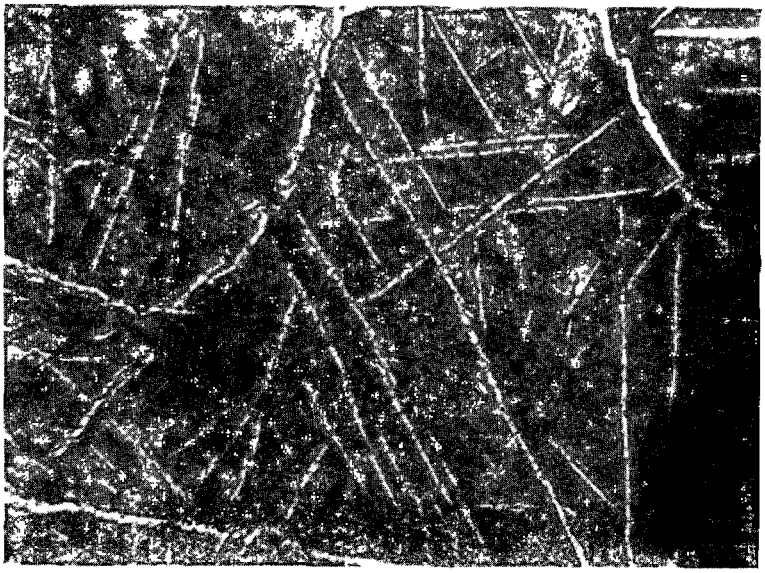
Carbon	...	0·30 per cent but at certain points rising up to 0·45 or even 0·60 per cent
Manganese	...	trace
Sulphur	...	trace
Phosphorus	...	0·02 to 0·03 per cent
Silica	...	0·18 to 0·20 per cent

34. ***Quality***—The primary fault lies in the excess of carbon which ranges from 0·3 per cent upwards. This is due to the fact that there are considerable quantities of slag and charcoal pieces imbedded in the pores of the sponge iron as the Metallurgist's Report shows. The carbon content is not uniform in all positions of the

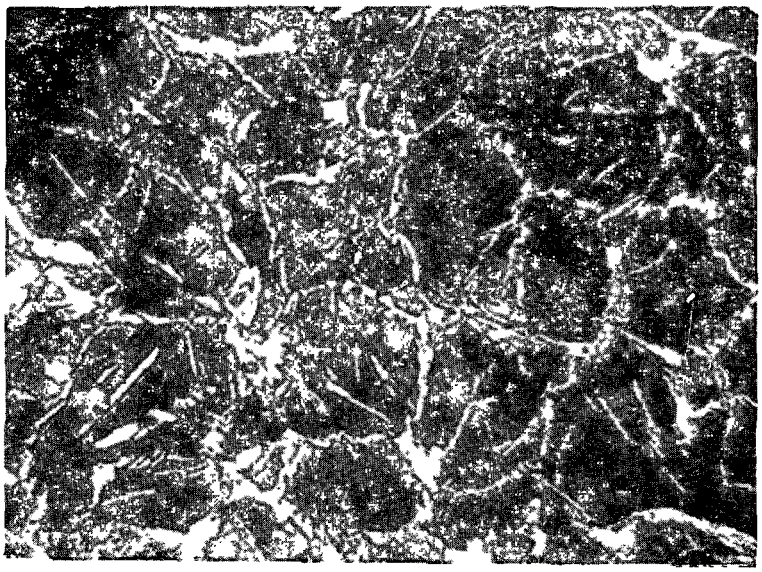
**The Making, Shaping and Treatment of Steel* by U. S. Steel Corporation, U. S. A., 1957, P. 218



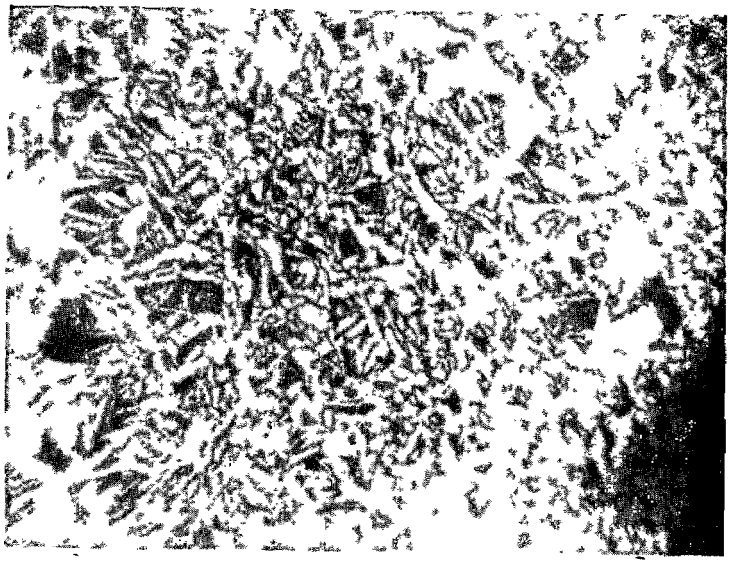
Photomicrograph I (X 145)
SPONGE IRON WITH LOW CARBON FILAMENT



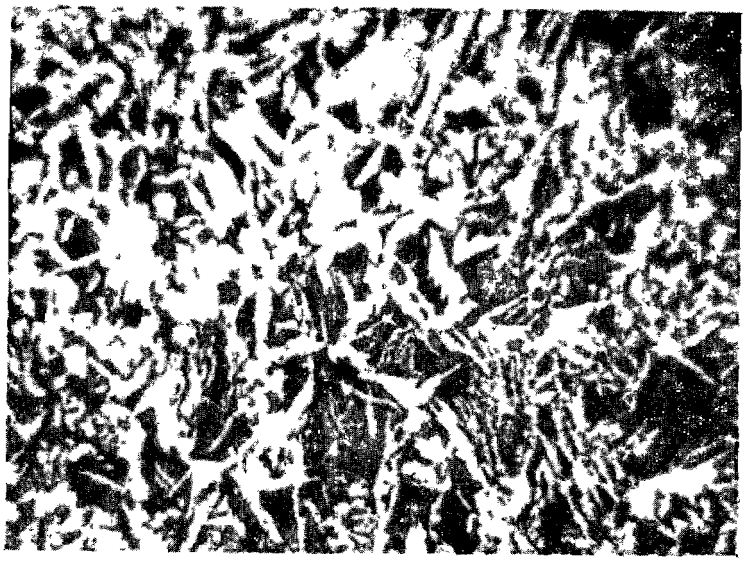
Photomicrograph II (X 145)
SPONGE IRON WITH MEDIUM CARBON FILAMENT



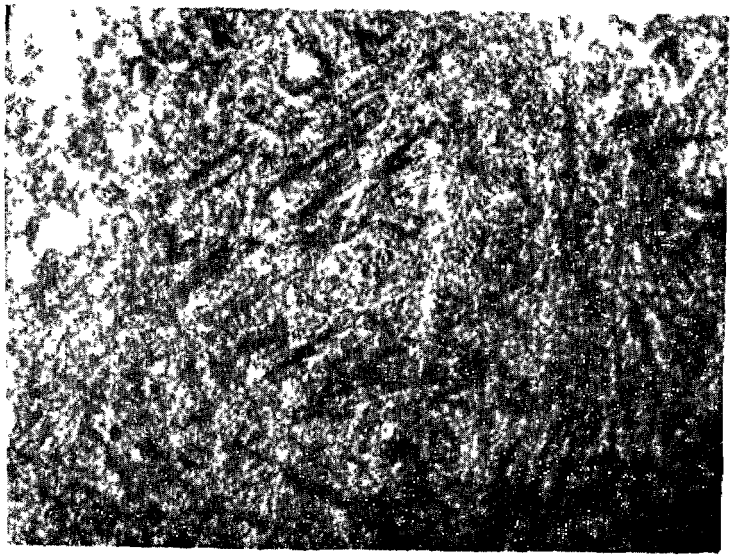
Photomicrograph III (X 145)
SPONGE IRON WITH HIGH CARBON INTRUSION



Photomicrograph IV (X 145)
MICROSTRUCTURE OF A KNIFE



Photomicrograph V (X 145)
MICROSTRUCTURE AT THE
EYE OF AN AXE



Photomicrograph VI (X 145)
MICROSTRUCTURE AT THE CUTTING
EDGE OF AN AXE

sample. Some areas were good and had fairly low carbon deposited in the form of long needles *(vide* Photomicrograph II), in other areas still less carbon *(vide* Photomicrograph I), while in some areas high carbon was noticed in cellular pattern *(vide* Photomicrograph III). This inconsistency of carbon in the sponge iron is, however, greatly normalized in the later process of forging when pieces of charcoal and slag imbedded in the pores are hammered out, and still further in course of refinement at the time of manufacture of tools and implements *(vide* Photomicrographs IV, V and VI). A commendable feature of the indigenous iron is its low proportion of phosphorus, an element which is not always good for the metal. Moreover, silica, sulphur and manganese are found in correct proportions, ensuring good mechanical properties of the metal. The excess of carbon as mentioned above tends to promote a bit of the qualities of medium carbon steel in the metal, which then becomes very good for tool-making. Thus the slight departure from the standard quality of wrought iron has made the metal a good commercial material for manufacture of iron and steel articles which are in demand in the local market. The metal as actually manufactured has some amount of hardness which is good for tool-making, without effectively reducing its other desired qualities of malleability and ductility.

35. ***Malleability and Ductility***—Malleability is a quality which makes the metal fit to be rolled or hammered into desired shapes without rupturing. If the metal lacks in adequate malleability, production of thin or flat tools like knife, sickle, chopper, etc., will not be possible. Wrought iron, unlike steel, is malleable because of its low carbon content. The iron produced in Penthabahal has sufficient malleability for the purpose of making tools and implements. The other notable virtue in good wrought iron is its ductility. Ductility enables the metal, when pulled, twisted or stressed beyond a certain point, to alter its shape permanently without breaking or fracturing. The remarkably low proportion of phosphorus in the indigenous iron, helped by still lower proportion of manganese in the composition, gives it high ductility which, combined with the quality of malleability, makes the product a really good metal for the purpose intended.

Steel-making

36. The local demand is not confined to products of wrought iron. Sharp cutting weapons, such as, knife, or hard and tough implements, such as, ploughshare are wanted by the villagers. The metal suitable for manufacture of these articles must have some properties of steel. It, therefore, becomes necessary that the wrought iron produced by the Kamars should be converted, at least partially, to steel. They have obviously no theoretical knowledge of the principles of metallurgy, but their skill is based on the experience born of watching forefathers doing the job. They have the practical idea how to impart qualities of steel to the indigenous iron they produce, which may be put in simple language as follows.

37. ***Quenching***—If a piece of wrought iron is allowed to remain under high temperature in the fire of a forge, in contact with burning charcoal in a manner so that it is completely surrounded by such charcoal and is protected from oxidation by exclusion of air, a quantity of carbon will be absorbed by the surface layers of the wrought iron. If this condition continues long enough for sufficient carbon to be absorbed, and if in this state the piece of iron in its high temperature is rapidly cooled by dipping it in a quenching liquid, it will acquire the properties of hard steel. This phenomenon, however, is limited to the surface which has just absorbed

adequate carbon. The interior of the metal had no opportunity to come in contact with burning charcoal for absorption of carbon and so the process of quenching will convert the outer layer into hard steel but will leave the interior relatively soft as it was before the processing.

38. *Case-hardening*—The steel produced by the Kamars is thus merely a quality of wrought iron with its outer layer or 'Case' hardened into steel. This is good enough to satisfy the local demand, for the object produced serves as a good steel product so long as the case remains intact. The points or edges of cutting or piercing instruments, such as, axe, chopper, chisel, sickle, spade, ploughshare, knife, arrow-head, shovel and hunting spear are all good steel and prove excellent in service.

Tempering

39. The Kamars by sheer experience coming down through generations know well that the metal must be subjected to necessary processes which will make tools and implements useful and durable. As mentioned above the outer case of soft wrought iron is converted into steel by increasing the carbon content of the surface layer and then by rapidly dipping the hot metal in a suitable liquid, so as to enable it to cool down suddenly from high temperature. But the metal undergoing such quenching process is very hard and somewhat brittle. Brittleness is no good quality for a household article or an agricultural implement. So the Kamars follow up the next process by reheating the manufactured article to a relatively low temperature and then allow it to cool down slowly in contact with open air. This process makes the iron less brittle without too drastically lessening the hardness obtained by quenching. In other words, the manufactured article is 'tempered' to the quality required for a sharp tool of durable nature.

Quantity produced per Shift

40. In a smelting experiment which was personally watched, the quantity of raw materials used, the waste materials and the final product available after the conclusion of the process, were carefully weighed The relevant data are given below:

		Seers
Charcoal from sal wood	...	30
Iron-ore + ¾ inch size	...	30
Gangue (waste matter)	...	9¾
Sponge iron produced	...	3½
Slag	...	1½
Wrought iron billet	...	2

41. The recovery of wrought iron, therefore, was 2 seers out of 30 seers of ore, or 6·6 per cent, which indeed is a poor result. As the ore contains 45 per cent of iron, the quantity of 30 seers of ores should have yielded 13½ seers of iron under theoretical conditions. But the process involves wastage and loss in many forms as the Chemical and Metallurgical Report at the Appendix indicates. Iron oxide escaping with the gangue is of the order of 40 to 60 per cent and with the slag, it is naturally higher, viz., 60 to 75 per cent. The proportion of gangue is quite high, namely, 32 per cent. The sponge iron itself is quite impure as it contains 1½ seers of slag in 3½ seers of sponge, that is to say, 43 per cent. Some quantity of unreduced metal escapes with the gangue and the slag and the rate of recovery is thus lowered considerably. Unsatisfactory temperature conditions are responsible mostly for this loss and wastage.

Comparison with Old Samples

42. Iron and steel which were made in India in olden days were smelt in charcoal fire. It may, therefore, be interesting to compare the chemical composition of the

old Indian iron with that of the iron made at Penthabahal with the same kind of fuel. It has been mentioned earlier that the iron column at Kutub Minar nearby Delhi and the iron beams of Konarak temple offer outstanding proof of the smelting and forging ability of ancient Indian metallurgists. These two specimens may now be selected for comparison of their chemical composition with that of the indigenous iron manufactured at present in the furnace at Penthabahal. It is fortunate that such comparison is possible because of the availability of the results of chemical analysis of these two old iron objects. The analysis of the metal of the Delhi pillar was made by Sir Robert Hadfield and that of the Konarak beams by Messrs. Newton Friend and Thorneycroft.* The relevant figures are given below:

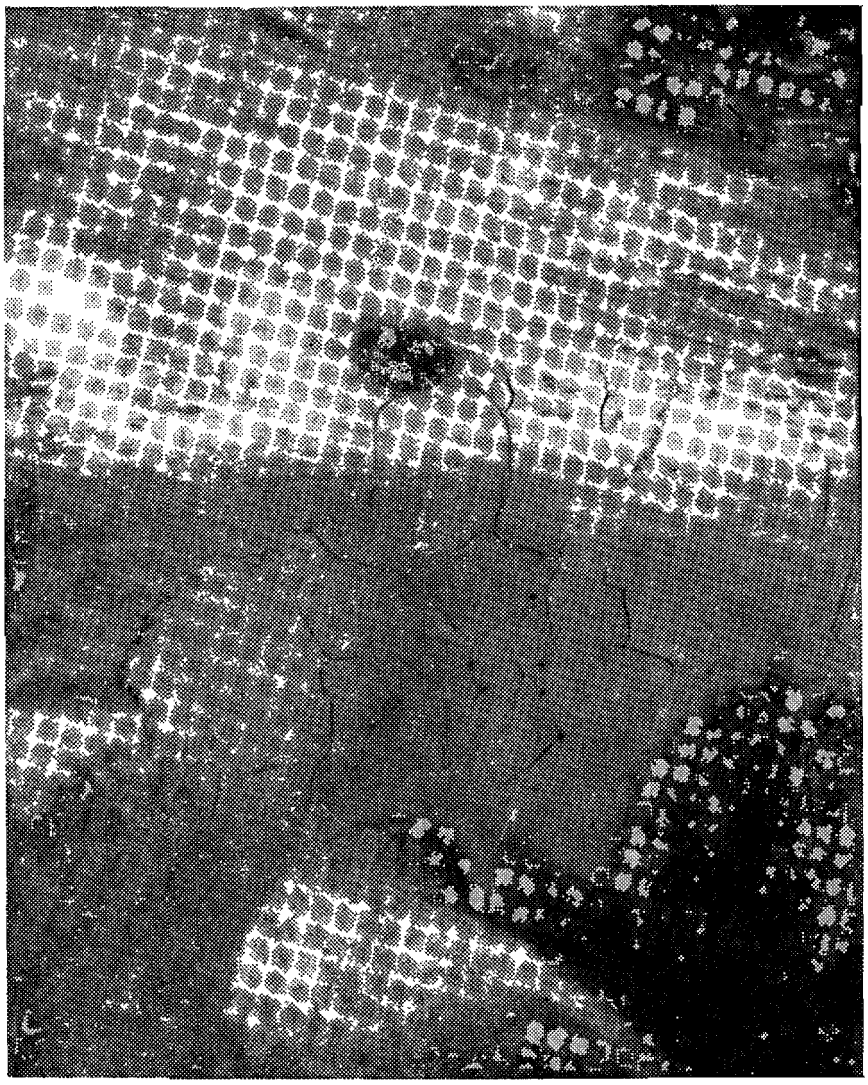
Chemical element		Delhi pillar	Konarak beam	Penthabahal iron (before refinement)	Factory-made ordinary mild steel (approx.)
Carbon	...	·080	·110	·30	·30
Manganese	...	*nil*	*nil*	traces	·50
Silicon	...	·046	·100	·20	·17
Phosphorus	...	·114	·115	·03	·04
Sulphur	...	·006	·024	traces	·03
Copper	...	·034	*nil*	*nil*	*nil*

43. The above analysis shows that the ancient Indian iron as well as the present country-made iron are characterized by low manganese, sulphur and silicon content. Low manganese is good for certain purposes, because the metal does not crack when dipped in the quenching liquid for purpose of tempering. On the other hand, it appears that the local country-made iron has a much higher carbon content than either the Delhi or the Konarak metal, although the proportion of ·30 carbon as shown above is considerably lowered when the sponge iron is refined by further heating and hammering out the imbedded slag and charcoal. The great redeeming feature of the Penthabahal metal is that it has remarkably low phosphorus. The quality of iron contained in Delhi and Konarak samples are good for huge-sized castings like the pillar and the beam, while the country-made sample is excellent for purpose of manufacture of tools and implements as are used by agriculturists and artisans of the country-side. Each one, therefore, is well-suited for the specific purpose for which it was manufactured.

Underground Furnace

44. ***Furnace at Singelbecha***—In the south-western part of the district of Koraput there are a number of smelting furnaces built underground. They are quite different in structure and in the mode of working from the type existing in Penthabahal, as described in foregoing pages. The description of one underground furnace which was observed in village Singelbecha about 4 miles distant from Mathili police station in Koraput district is given below. First of all an open place is selected close to the village site and a pit is dug about 30 inches deep and 4 feet square. About six inches away from the margin of the pit on one side, a circular hole is bored vertically to a depth of 30 inches or up to the level of the floor of the pit. This vertical hole is 4 inches in diameter from the top down to a depth of 5 inches and it then gradually widens in

*The Journal of Iron and Steel Institute, 1924



UNDERGROUND FURNACE OF SUNADHAR LOHAR OF VILLAGE SINGELBECHA
P. S. MATHILI, DISTRICT KORAPUT

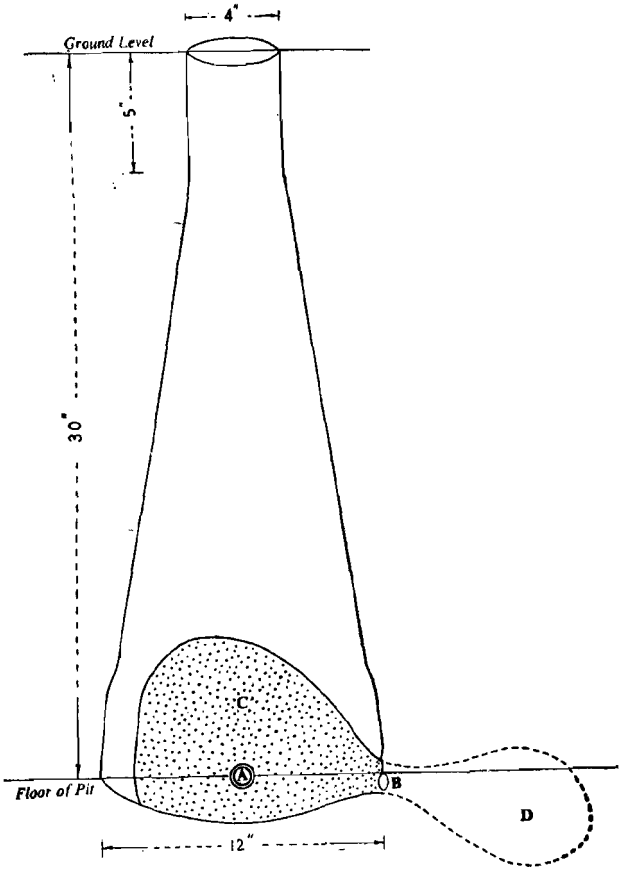
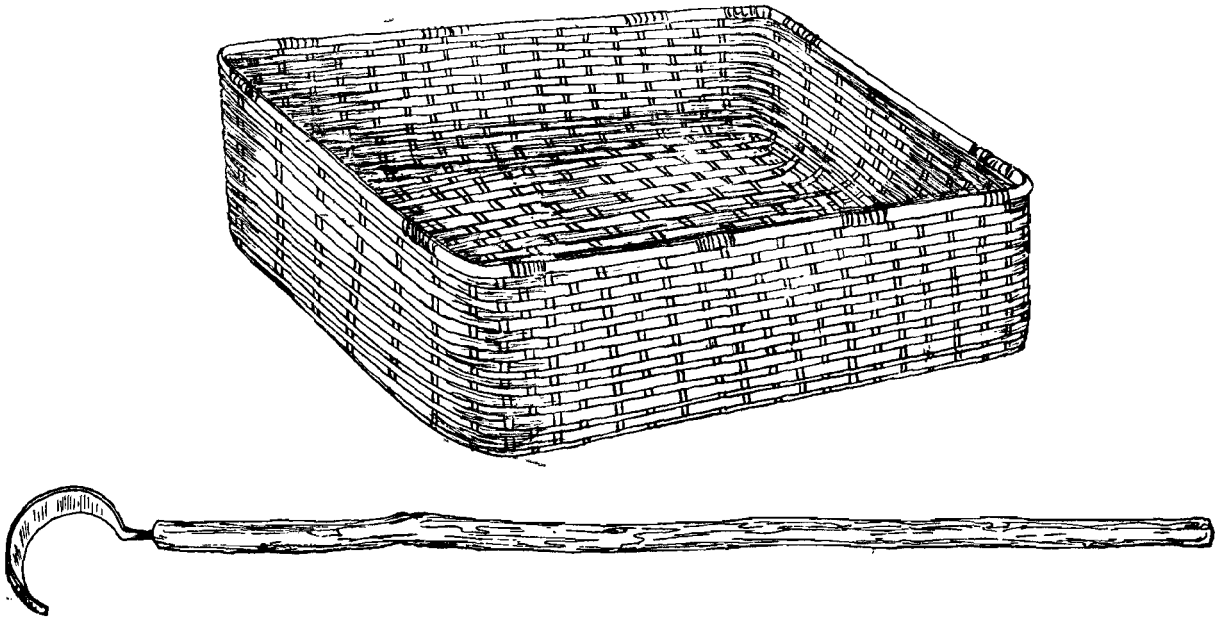


DIAGRAM OF AN UNDERGROUND FURNACE

diameter so as to measure 8 inches half way down and 12 inches at the bottom. The lowest part of the wall towards the pit is then broken open to a height of 8 to 10 inches on one side, gradually tapering towards the other side. This completes the preliminary construction of the underground furnace. Its top is flush with ground level and its bottom has the same depth as the floor of the pit dug in front of the furnace. Finishing touches are given by plastering the periphery of the top of the hole with a paste of soft mud and charcoal dust. Similar treatment is given to the opening at the bottom. As soon as the plaster dries up, the furnace is ready for working.

45. Some further preparation is necessary before the smelting operation begins. A quantity of wet sand and charcoal dust is mixed and kept ready at hand. The foot-bellows are kept in position inside the pit. Some quantity of burning charcoal is introduced into the bottom of the furnace through the opening, and the opening is at once sealed with the black sand (mixture of wet sand and charcoal dust) after fixing a burnt clay nozzle tightly a little above the bottom level. To assist imagination, a rough sketch is given to show the longitudinal cross-section of the structure. The shaded portion marked 'C' is the opening at the bottom which has been sealed with the black sand. A little below the centre of the sealed portion is the burnt clay nozzle marked 'A', meant for blowing air from the bellows to the furnace. Mark 'B' is a small hole which is punctured at a later stage for tapping the molten slag out of the furnace. The slag pit is marked 'D'.

46. ***Equipments***—The work-site and its equipments are simple. The site is divided into three parts, namely, one uncovered spot for construction of the underground furnace, one uncovered spot for location of the open hearth for pre-heating of ores and one small shed for location of the forging shop. The equipments of the forging shop are almost the same as described in respect of Penthabahal. The pre-heating open hearth requires no tools or equipments, except the hearth itself, made of stone boulders arranged in the



Chaalni, a measuring basket and *Kaarni*, a hooked rod

fashion of an arc. The underground furnace, apart from the furnace itself, has a pair of foot-bellows and two simple and cheap accessories, namely, a *chaalni* and a *kaarni*. A *chaalni* is a wicker-work basket for measurement of raw materials before being charged into the furnace. It is 16 inches square and 5½ inches high. In one single smelting operation, the quantity of raw materials used is one *chaalni* of lump ore and four *chaalnis* of charcoal. The *kaarni* is a hooked rod for pulling ore and charcoal in small doses into the mouth of the furnace. It is 33 inches long and is made of a long wooden handle with an iron-made hook fixed at one head.

47. ***Pre-heating of Ore***—Before the lump ore is considered fit to be charged into the furnace, it is subjected to prolonged heat treatment in the following manner. Pieces of stone boulders are kept arranged in a circle with an opening on one side. Small bits of dry twigs are placed in the enclosure, and it is covered with a layer of charcoal. Thereafter a layer of ore stones is spread over and finally another layer of charcoal covers the whole stack, all of which are within the enclosure of stone boulders. The twigs below are ignited and within minutes the charcoal burns and heats the ore stones. The process continues for the night without requiring any further attention. The next morning, the ore stones are ready to be broken into small pieces of plus half inch size for use in the furnace.

48. There are distinct advantages in processing the ore stones before use in furnace as described above. Pre-heating of ores results in their dehydration. The duration of reduction inside the furnace is greatly minimised when dehydrated ore is used. Secondly, the flow of molten slag is considerably facilitated, and the recovery of metal is rendered satisfactory.

49. ***The Process***—When the smelting operation starts, a quantity of burning charcoal is deposited at the bottom of the furnace. Then the opening at the bottom is closed with the nozzle properly fitted in the black sand packing and air blast is supplied from the bellows to keep ablaze the burning charcoal inside. In the meanwhile the smelter has kept two heaps of charcoal on the left and the right of the hole at the top and one pile of lump ore just behind the hole. The *kaarni* is kept ready at hand. Some quantity of charcoal is poured into the furnace with the help of the *kaarni* through the mouth of the hole at the top of the furnace. The charcoal reaches the bottom where it gets ignited in contact with the already burning charcoal. A small quantity of lump ore is then pulled into the furnace followed by small doses of charcoal and lump ore alternately at short intervals. The air blast is kept steady all the while. The temperature inside the furnace gradually rises resulting in reduction of the ore with the expulsion of molten slag. After a while when the smelter believes that a reasonable quantity of such molten matter has collected at the bottom, he punctures a small hole with a piece of wooden stick at one end of the bottom of the furnace (Mark B). As the wooden stick is pushed in and out a few times, the molten matter flows out and gets deposited in the slag pit marked 'D' in the diagram. The process of charging small quantities of charcoal and lump ore continues for over an hour while the molten slag is let out a number of times. When the smelter has finished the entire heap of ore and the charcoal he continues operating the bellows for a few minutes more and finally stops.

50. The black sand packing at the bottom of the furnace is then demolished, when a piece of red-hot sponge iron in the shape of a cabbage is visible. It is pulled out and is forged into a billet of wrought iron.

51. ***Advantages***—The underground furnace is ingenious in concept and appears

to be more advantageous than the usual type of furnace seen overground in other parts of the country, particularly in respect of certain types of ores which are refractory in character. An experiment carried out by the Akhil Bharat Sarva Seva Sangh in the district of Koraput revealed that the underground furnace is more efficient than other types in respect of thermal efficiency as the loss of heat by conduction and radiation is practically eliminated due to its underground location. Moreover, this particular type of furnace ensures higher metallic recovery. This experiment unfortunately did not record the weight of the ores charged nor the iron recovered nor was a Chemical Analysis Report obtained. But as the underground furnace uses preheated and dehydrated ores, the recovery of metal is quite high. The Lohars of village Singelbecha claim that one *chaalni* of ore weighing approximately eight seers yields a little more than one seer of iron. So the recovery is of the order of 15 per cent. Enquiries at another centre, namely, Boipariguda, reveal that the recovery is likely to rise up to 18 per cent in the best of conditions. This compares very favourably with the recovery recorded in the Penthabahal experiment which is 6 to 7 per cent only. At Penthabahal, however, dehydrated ore is not used as at Singelbecha and the two results are not strictly comparable.

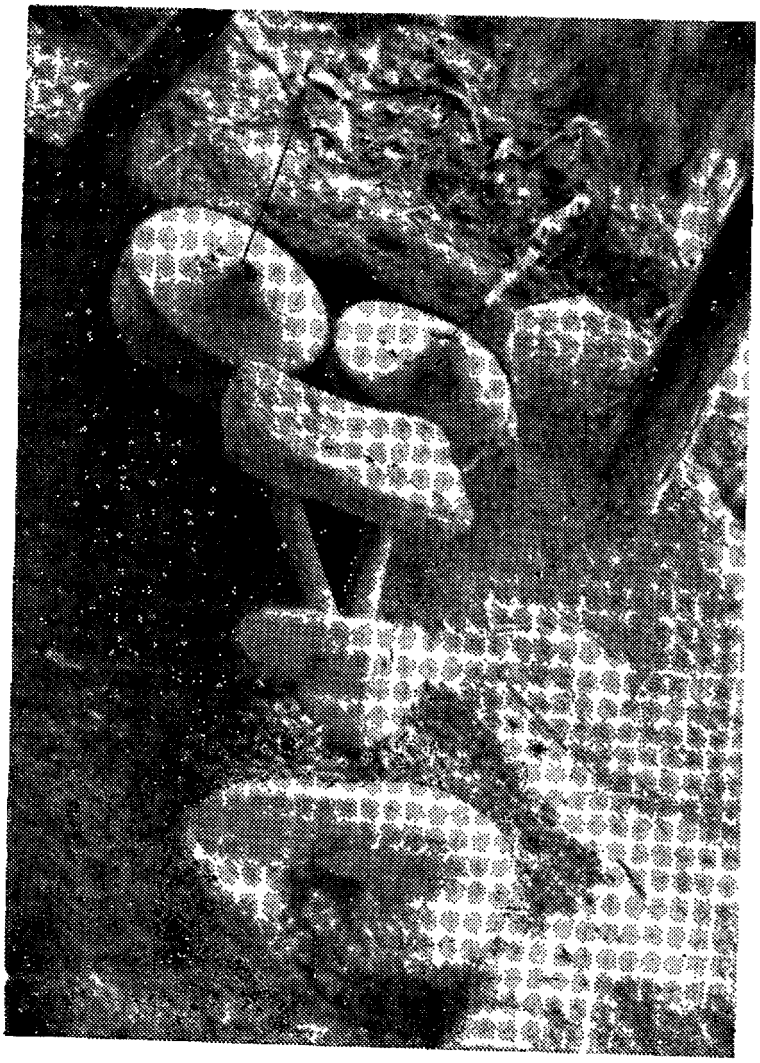
52. ***Drawbacks***—The one notable drawback about the underground furnace is that it cannot be operated during four months of the rainy season as the pit and the furnace which exist on bare open ground are full of water. So the Lohars of Singelbecha, unlike their brother-artisans of Penthabahal, must have a secondary occupation to fall back upon during rainy days. They generally get engaged in cultivation work, either as tillers of own lands or as agricultural labourers employed by neighbouring cultivators. They, however, appear to be somewhat more prosperous than the Kamars of Penthabahal and enjoy better living and housing conditions.

Use of Flux not favoured

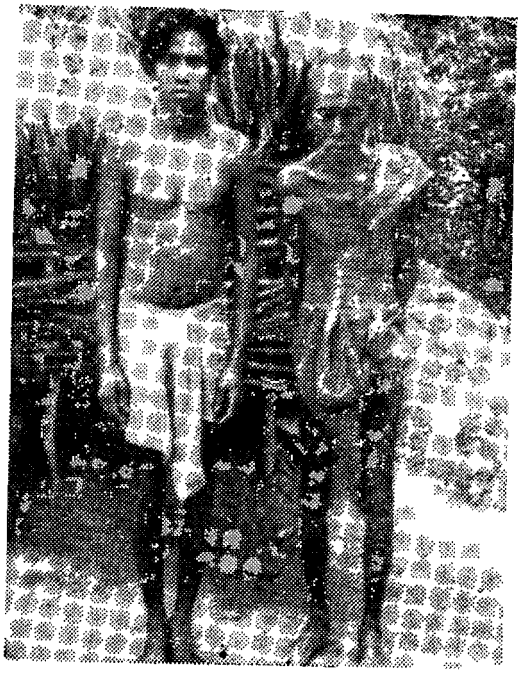
53. One striking feature of the indigenous process of smelting is the absence of fluxing. There are certainly many advantages in using a flux in the modern process of smelting. Some of the impurities contained in the iron-ore are of highly refractory nature, that is to say, they are very difficult to melt. If they remain unfused, the smelting operation is retarded. In order to fuse more easily these refractory substances, a third element, namely, the flux, is used. Secondly, the ore may contain some matters which may get mixed with iron in course of melting process by reason of chemical affinity. A flux prevents such combination by offering a better chemical field for combination with the flux itself in preference to the metal. Limestone is commonly used as a flux in modern furnaces.

54. The benefits, however, are not unmixed. Fluxing increases the risk of contamination of iron by carbon from coke used as fuel. A higher percentage of carbon, say about 4 per cent, gets mixed up with iron, resulting in the production of pig iron* rather than wrought iron. The fluxing has protected the molten iron from its undesirable combination with other substances but has failed to offer any protection against contamination by carbon. In the clay furnace the chances of admixture of carbon is nominal and results in easy reduction of the ore into wrought iron. The clay furnace does not allow any unnecessary contamination. As wrought

*Pig Iron—If carbon is absorbed to the extent of 4 per cent by the iron, it is high carbon iron. In its molten state it is poured or cast into blocks called pigs. The Iron is, therefore, called cast iron or pig iron. All high carbon iron have low melting point. The cast iron billet can be remelted and cast into desired shapes of household articles, etc.



FORGING SHOP



LOHARS OF SINGELBECHA



LOHARINS OF SINGELBECHA

iron is produced directly, it saves so much of labour which would have been otherwise necessary for removal of the unwanted carbon.

55. The Kalapat hills have no limestone but in other centres of indigenous smelting where limestone is abundantly available on the surface, no smelter has ever thought of utilizing it as a flux. It is surmised that the use of limestone in the clay furnace will complicate the production of the desired quality of iron which must not be too hard to forge into tools and household articles.

Merits and Demerits

56. ***Non-tarnishability***—Among facts deserving special notice about the country-made iron, one is that it does not tarnish in air so soon as factory-made iron. Tarnishing is prevented by the presence of such elements as nickel or copper, none of which are, however, present in the specimen of iron chemically examined. It is supposed that non-tarnishability is acquired in course of the particular process of metallurgy which has remained somewhat inexplicable even at the present time.

57. ***Purity in Quality***—Iron produced by charcoal fire is distinguished for its purity and quality. It will not be possible to maintain such a quality if there are chances of contamination by phosphorus, which has considerable injurious effect on the metal. Such contamination may result from contact of the ore inside the furnace with any substance containing phosphorus. The usual fuel of the modern furnace, namely, coke, contains a fair proportion of phosphorus, as a result of which the product of modern factories is rendered impure, but charcoal contains very low phosphorus and as a fuel it is less harmful to the metal. Among the modern steel factories, the one which uses charcoal as fuel is located at Bhadravati in Mysore. This is why the Mysore steel has a reputation and attracts foreign buyers like Japan. The indigenous iron of Orissa has more or less the same merit. Its quality is good.

58. ***Simplicity of Direct Process***—The indigenous process of smelting iron is called the direct process, because wrought iron is directly produced from the ore in one single operation. Direct process is still in use at places and, indeed, has never been wholly abandoned even in some advanced countries. The case with which iron-ores are reduced makes the direct process simple and attractive. The reduction takes place at low temperature which is an advantage where the blasting operations are comparatively feeble, or where the fuel is such as cannot stand high blast.

59. ***Commercial Inferiority of Direct Process***—In a modern furnace the process is indirect. The blast furnace, for example, produces high carbon iron called pig iron or the cast iron in the first instance, which is subjected to refinement by two or more steps in order to reduce it to wrought iron. From a theoretical consideration, the indigenous process is a better commercial proposition, but in fact there are a number of inherent shortcomings whereby the direct process fails in competition with the indirect process. The direct process, in order to be successful, requires a few specific conditions, such as:

(i) the ore must be rich,

(ii) the ore must be broken into fine pieces and intimately mixed and carefully placed over the reducing agent, and

(iii) there should be a practical method of mixing ore with the reducing agent in correct proportion so as to leave no excess of either. In case of excess of the one or the other, either the ore is wasted or the metal is too hard to handle.

60. It is difficult to ensure all the above conditions so as to enable the indigenous process to be competitive and successful.

Though, therefore, it is superior theoretically, it cannot stand commercially against the method followed by modern factories.

61. ***Inadequate Recovery***—The clay furnace does not ensure either uniform recovery or adequate recovery of the metal in the process of smelting. The quantity of recovery is liable to differ, if the quality of the ore has accidentally changed due to collection from different sites or if the quantity of ore charged into the furnace has inadvertently exceeded the correct proportion. The quantity of recovery may, therefore, vary from operation to operation though it does not frequently happen. The greatest fault, however, is that a good proportion of the metal is left unreduced in the gangue and the slag, because of inefficient air blowing or inability to maintain temperature at the required level. In the Penthabahal experiment 30 seers of ore having 45 per cent of iron content were reduced to 2 seers of wrought iron. In fact, it should have yielded 13½ seers if 100 per cent recovery was ensured. The recovery of 2 seers works out to 15 per cent approximately on this basis. It is utterly inadequate. It has been observed earlier how 40 to 60 per cent of iron oxide escapes with gangue and 60 to 75 per cent with slag. Little wonder that final recovery is limited to 15 per cent. In the underground furnace of Singelbecha type the recovery is higher although the exact percentage is not known.

62. ***Heterogeneity***—The iron produced by indigenous process is heterogenous in composition and has plentiful of inclusion. There are many surface gaps and they do not close up during the forging operation. This difficulty restricts the utility of the iron produced. Indeed, homogeneity cannot be expected from the very nature of the formation of sponge iron in shreds progressively from pieces of ore heated inadequately by charcoal. Slag inclusions could be eliminated by prolonged forging but heterogeneity in composition cannot be overcome even in the best of the products as at Konarak or at Kutub Minar. The photomicrographs I to VI show the typical structure of the sponge iron and wrought iron manufactured at Penthabahal. The homogeneity has considerably suffered due to carbon and slag filaments.

SECTION IV

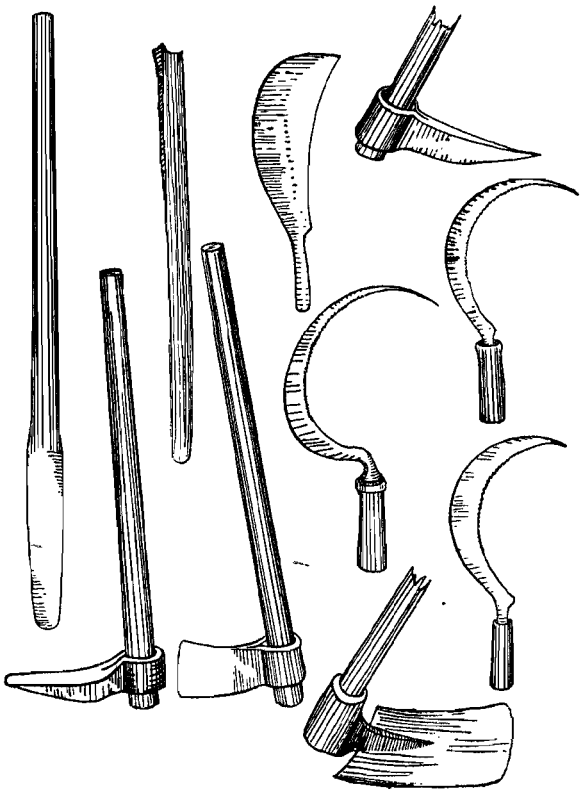
ECONOMIC ASPECT

Articles Manufactured

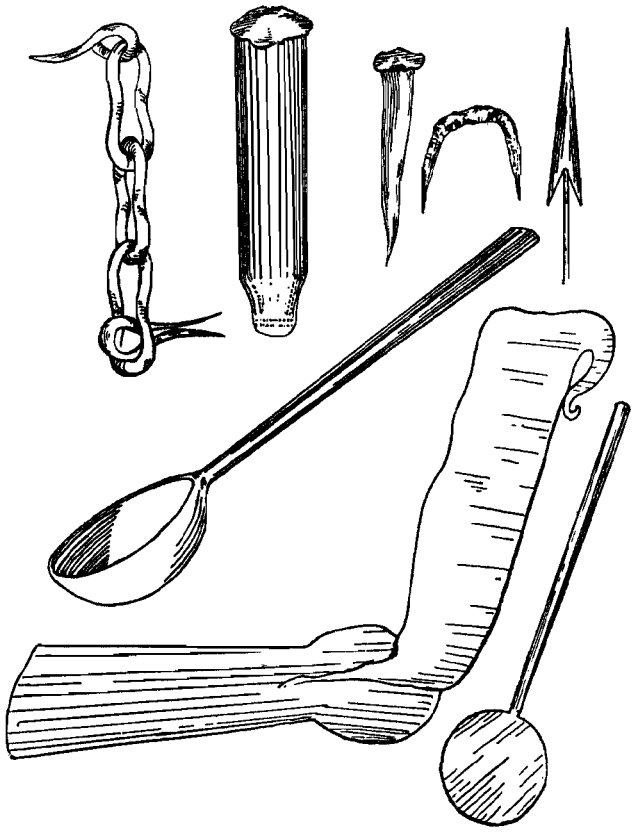
63. The wrought iron billets manufactured by the smelters are utilized by themselves for making household articles and tools and implements of agriculturists and artisans. The billets are not directly sold to other blacksmiths, because the quantity produced is small, and the smelters like to appropriate for themselves the profits that may accrue from the allied profession of smithy. Thus, immediately after the process of refinement is over and the billet is still hot, the Kamars start reheating and hammering it skilfully to an approximate shape of the article intended to be manufactured. It is flattened, rounded or made elongated, or curved or bent according to what shape may be necessary for the intended article. The process is rather slow. The manufacture of an axe, for example, which was watched with a view to ascertain the amount of labour involved and the income derived, started at 7-42 a.m., when the billet was first put in the forge fire for heating. The heating and hammering, which required the labour of one woman and one man, continued till 8-36 a.m. when the axe was ready. It took another 4 minutes for tempering the edge of the weapon, and the weapon was finally laid aside ready for the market at 8-40 a.m. It took approximately one hour for a man and a woman to manufacture an axe weighing 2 seers which was likely to fetch Rs. 2.75 P. in the market. Manufacture of a ploughshare, which is another article in heavy demand, takes much less time, as it involves no complication of providing a hole for the wooden shaft as required in the case of an axe. A ploughshare weighs approximately 3 seers and sells for Rs. 4 in the market, and its making is more profitable than an axe in consideration of the amount of labour involved.

64. ***Variety and Quality***—The items of manufacture depend on the market from season to season. But there are certain household articles which are in demand in all seasons, such as, *paniki* (meat-cutter), *karachhuli* (large cooking spoon), kitchen knife, door nails, chain and staple, etc. Agricultural implements and hunting weapons are also made for sale in the weekly market at Naktideul, or on special order. Among these articles the important ones, besides the ploughshare and the axe, are spade, sickle, shovel, *Kanka, Katari,* arrowhead, bullock-cart fittings, etc. The customers are satisfied with the quality of the metal and make no complaint about it. The Report of the metallurgical examination (Appendix) shows that the manufactured articles are medium carbon steel in quality, and the edges of sharp instruments have developed adequate hardness, sometimes to the extent of 300 V.P.N. and can serve well as general purpose tools. Whenever a cutting instrument loses its sharpness due to long use, the Kamar is ready to recondition it in his forge, sometimes free of charge and sometimes just for a nominal payment either on annual or on piece-rate basis.

65. ***Marketing***—These and other agricultural implements as well as many varieties of household articles are taken to the weekly market at Naktideul every Monday for sale. This market is visited by men from long distances of 10 to 15 miles around. The manufactured articles thus reach a large number of villages in the locality. During the season from *Asar*



AGRICULTURAL TOOLS AND IMPLEMENTS



HOUSEHOLD ARTICLES MADE OF IRON

to *Bhadra* which is a slack season, there appear many middlemen who purchase from the Kamar ploughshares and other articles produced. They get them at low rates, because there is no extensive demand from the general public at this part of the year. But when the season for actual field work starts, these middlemen sell the articles at a much higher rate, because the Kamars cannot meet the day-to-day demand during the heavy season. One ploughshare, for example, is sold at Rs. 5.50 P., while the usual price is about Rs. 4. This is a margin of profit which the Kamars themselves do not get at any time.

Labour and Earning

66. It may be of interest to note the extent of labour involved and the amount of earning derived from the industry, which is the sole means of subsistence of the Kamars. One round of economic activities connected with the procurement and transport of raw materials from hills and forests nearby, the smelting of the ores and the manufacture of ironwares and implements, and finally taking them to the weekly market for sale is completed in course of one whole week. The time-table followed by a family of Kamars in a normal working week from Wednesday to Tuesday is given below:

(i) ***Wednesday and Thursday***—These two days of the week are utilized by a party of two Kamars proceeding to the forests nearby, cutting dried-up trees of suitable girth, sizing them into logs of required length and burning them to make adequate quantity of charcoal. When the logs are still burning, they utilize the time by digging out ore-stones from the deposits nearby. After these two raw materials are collected into heaps, they are transported generally by *bhars* by the men. Occasionally a woman of the family, if conveniently available, assists in transporting the ores and the charcoal by head-load in a basket.

(ii) ***Friday and part of Saturday***—The smelting furnace is worked in three shifts of two hours each either on Friday or partly on Friday and partly on Saturday. Each shift consumes 30 seers of charcoal and an equal weight of iron-ore. The final product of wrought iron is two seers in weight per shift or six seers in course of three shifts during the day. This process employs two men and one woman. At times a grown-up child is a substitute for the second man.

(iii) ***Saturday and Sunday***—These two days are utilized for refinement of wrought iron and for manufacture of saleable articles of iron or steel. A man and a woman worker, both whole-time, are necessary. But during the heavy hammering another man joins the party.

(iv) ***Monday and Tuesday***—The principal worker, either alone or at times accompanied by a boy or another male member of the family, goes to the market at Naktideul for sale of the manufactured articles. After the sale is over, they utilize the sale-proceeds partly in the purchase of bare necessities, such as, food and cloth from the market. They are quite frugal and do not spend away the whole amount of the small money earned after a week's sweat of the brow. On Tuesday they return home from the market with a few commodities purchased and a part of the sale-proceeds in hand.

67. Thus a whole week covers a round of programme beginning from collection of raw materials and ending with sale of articles manufactured and purchase of necessities of life. During this period of seven days the total amount of earning is limited to the market-price of the products made from the quantity of wrought iron obtained in three shifts of smelting operation. In other words, six seers of ironwares

and implements are the net product of labour for one whole week by one whole-time man, one part-time man and one part-time woman. The products sell at the rate of Rs. 1.25 P. to Rs. 1.37 P. per seer, bringing a total income of about Rs. 7.50 P. Roughly speaking, two whole-time persons employed for seven days make an earning of Rs. 7.50 P. during the period which works out to approximately fifty paise per day per worker.

68. This is indeed a poor level of income at the present-day rates, considering that the Forest Department or the Public Works Department engaging the villagers as day-labourers pay at the rate of Rs. 1.50 P. per head. For all their labour, the iron-smelters remain excessively poor. Their earnings are so small that if they must have a stomachful of rice diet to enable them to work hard at the furnace and the forge, they have to be thrifty in clothing themsevles, and can hardly think of providing against a rainy day. The question of luxury in any form does not arise. Their small huts are almost bare of possessions and their women are content at best with a few pieces of brass ornaments. Children usually move about naked.

69. The Kamar remains content with whatever small earning he makes from his traditional profession, because he believes he can depend upon it for all time. He has unfailing attachment for his furnace and forge.

SECTION V

DECAY AND RESUSCITATION

DECAY

Causes of Decay

70. No information is available regarding the number of clay furnaces either in the past or at present, but there can be no doubt that their number has considerably declined. The causes of such decline are diverse and include a number of factors, internal and external.

71. ***Old Facilities denied***—An enquiry made with a view to find out the specific reasons responsible for the decay of the industry reveals that during the Durbar administration by feudatory chiefs, the local smelter of Penthabahal like any other *bona fide* villager used to pay a nominal forest permit-fee either annually or on the basis of head-loads or cart-loads for appropriation of the products of the reserved forest. A smelter, for example, prior to the year 1948 was free to remove any quantity of iron-ores for the whole year for purpose of smelting in his own furnace on payment of a small permit-fee of one rupee and eight annas. Similarly he was permitted to burn charcoal out of dead trees in the reserved forest on payment of an equal amount of permit-fee for the whole year. The amount of payment by him was small but it gave him the otherwise unrestricted legal right to remove any quantity of these raw materials required for his industry. After the end of the Durbar government in some areas and the abolition of zamindaris in others, when the normal rules of a regular district were brought into force, they were not applied in a systematic or uniform manner under changing conditions. The result was that the smelter did not have the legal right as he had before for removal of the materials required by him. Quite frequently he was taken to task or intimidated by subordinate officials charging him with theft from the Government forest. The smelter began to lose interest in his work on account of these uncertain factors. At some places furnaces are reported to have been closed down due to the undue interference by subordinate forest or revenue officials, or due to the gradual disappearance of forests and consequent difficulty in obtaining charcoal.

72. ***Social Abhorrence***—The iron-smelter has been conventionally subjected to a sort of social reproach as the industry is considered to be much less respectable than many others. Even a blacksmith who simply forges tools and implements enjoys better social status than one who has taken to smelting as the means of livelihood. Under such psychological background an industry is not expected to flourish.

73. ***Competition by Factory Products***—Another significant reason why the industry is facing hard days may be found in the ever-increasing competition from factory-made iron either imported from foreign countries or produced in mass scale in modern Indian factories. India's contact with the industrial world first resulted in disaster to cottage industries of many a variety. One among the industries which heavily suffered in this manner and began to decline is the smelting of iron by indigenous process, although at one time it was responsible for making generations of workers happy and prosperous. Factory-made iron became increasingly available in markets not only in the form of billets but also as finished goods for agricultural, industrial and household use. All localities close to lines of communication were flooded with such products. Wherever such products could not reach either because of inaccessibility or due to higher cost of transport of this heavy material, the indigenous smelting industry, if there existed any, remained unaffected and was carried on as in the days of old

It is difficult for indigenous iron to stand competition in places served by main lines of communication.

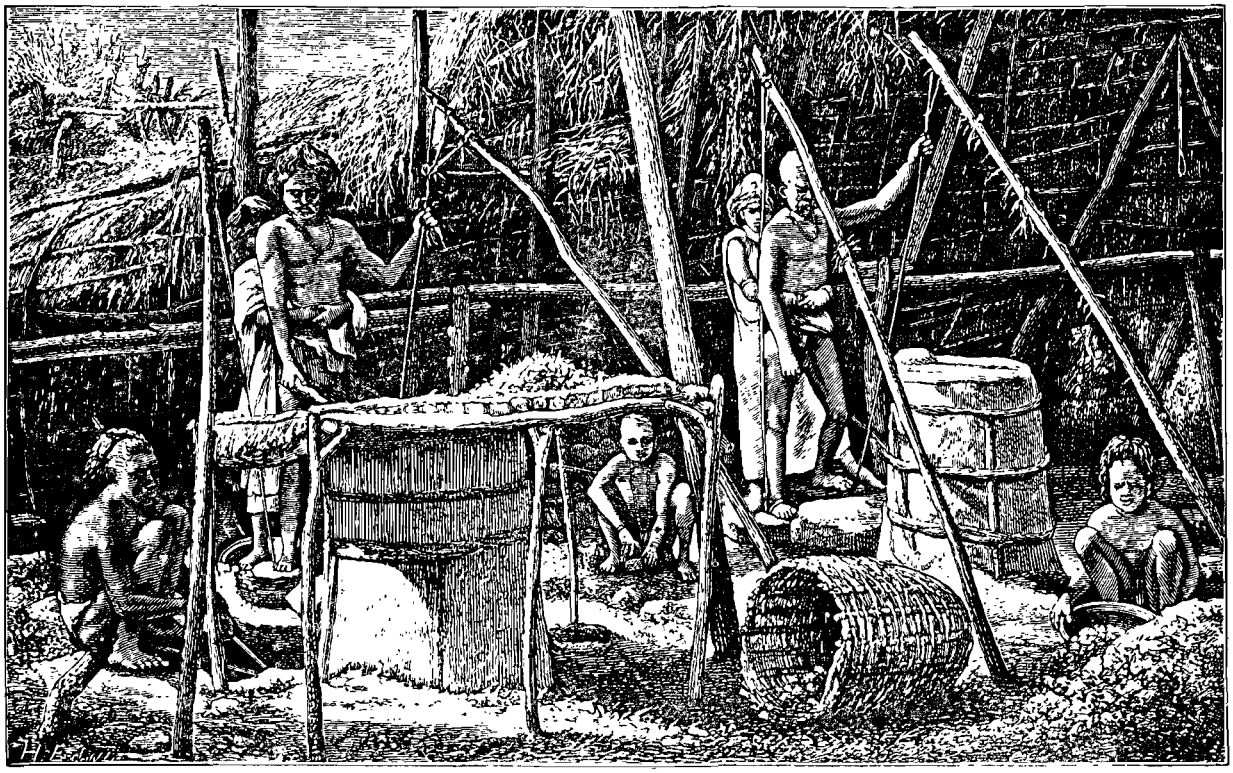
74. ***Inattention of Administration***— This industry never had any political or religious significance and no one attempted to revive it once it started declining. In the present-day welfare State when many of the traditional crafts and industries have been saved from total extinction by financial subsidies and other forms of State patronage, this particular industry has unfortunately not been able to attract the attention of the Administration for whatever help and support it deserves. The inattention of the Administration, arising not so much from a deliberate policy of neglect, but born out of sheer lack of information relating to the conditions of the industry and of the workers attached to it, has made the industry further lose its ground in comparison with other cottage industries that had the good luck of being nursed from a sickly state with adequate doses of financial assistance, technical guidance and commercial protection.

RESUSCITATION

Hard Work necessary

75. Can the lot of the proverbially poor Kamars be improved ?— The Kamars are poor because the circumstances under which they work are unfavourable. They are poor also because the technique is antiquated, and lastly because they do not sufficiently exert themselves in hard work. The quantity of production and consequently the amount of income could be raised by about 50 per cent by the Kamars themselves if they are determined to work harder. The time-table of their work as mentioned earlier is leisurely and does not indicate an inclination for continuous hard work except during a few hours on the day of smelting and on the day of refinement of iron. The average duration of work on other days is quite small. Were they hard-working they could easily collect a good deal more of the raw materials and produce correspondingly a larger quantity of iron, resulting in considerable increase in their income. But since they lead a simple life with wants limited to bare subsistence, they take things easy and produce just as much as is necessary to keep themselves going on.

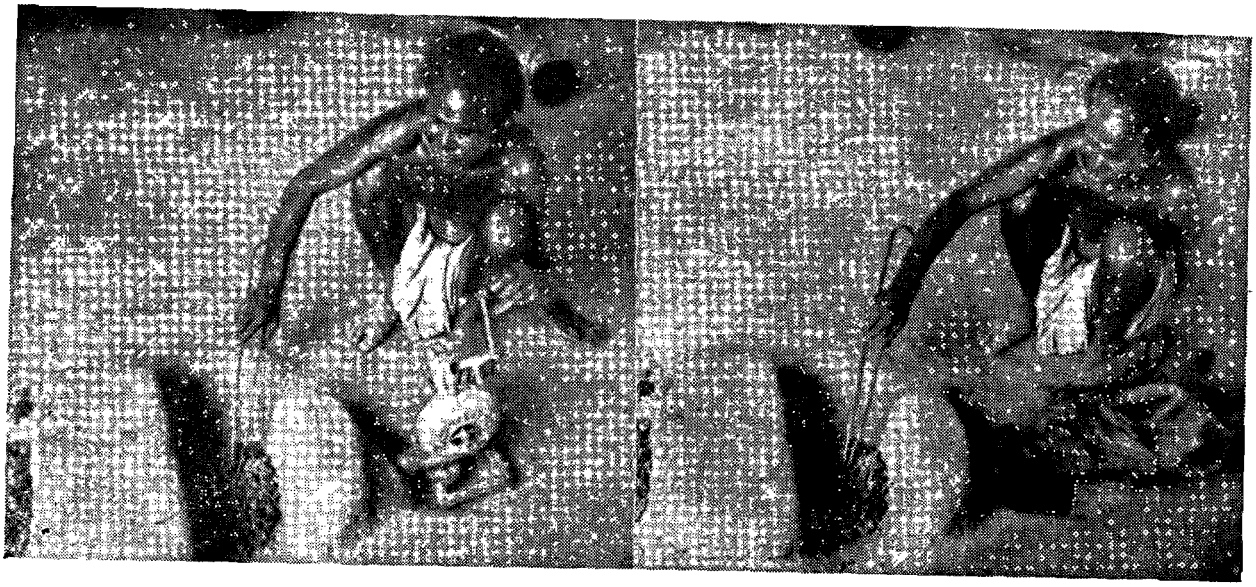
76. There are many localities in the neighbouring States of Madhya Pradesh and Bihar where the smelters tackle large-sized furnaces, heavier bellows and considerable quantity of raw materials in each shift. Such furnaces are worked not for a single day in the week as in the case of the village under investigation, but for three or four days. An illustration is given showing a typical workshed of iron-smelters of Palamau district in Bihar. It is at once noticeable that two persons, a man and a woman, are working the bellows for each furnace, thereby delivering a much stronger blast than what is supplied in the furnaces of Penthabahal. Another illustration which is given below shows that in ancient Egypt a single furnace used to be served by two pairs of bellows worked by two sturdy men. The Penthabahal furnace has one pair of bellows and one worker only. It may be that the size of the family of a local smelter is smaller than in Palamau or elsewhere. The local furnace has, therefore, been designed in a smaller scale suitable for the working capacity of a small family. But there can be no doubt that the working hours for the smelters of Penthabahal are not enough for purpose of sufficient income. The visit to the market for sale of manufactured products takes two whole days, although the market is only three miles from the village. One full day could have been saved here. The visit to the forest for collection of charcoal or ore-stones also takes two days in the week, during which time raw materials just sufficient for production of six seers of iron are collected. It should have been possible to collect a much larger quantity of



IRON-SMELTERS OF PALAMAU
(From *Jungle Life in India* by U. Ball)

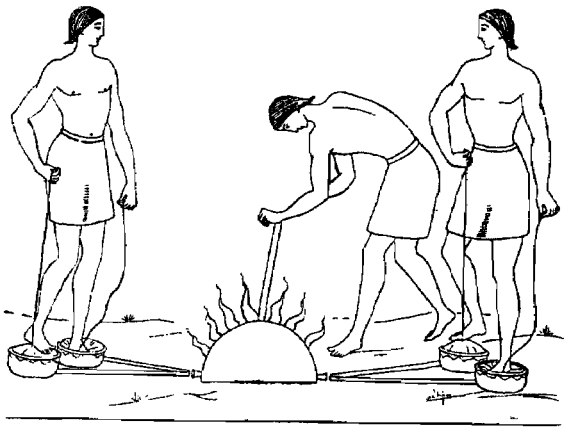


NAKED KAMAR CHILDREN
... poverty inducing nudity



ROTARY BLOWER AND HAND-BELLOWS
.... good for light job

ore-stone and charcoal during these two days. Similarly they could have worked the furnace for 10 to 12 hours instead of six hours as they do now in course of two



EGYPTIAN SMELTING YARD

(Imitated from a Reproduction)*

Original: From Wall Painting in the Tomb of Rekhmara at Thebes (1535—1450 B. C.)

days. Thus in each successive stage, the Kamars fail to do a full complement of work and cannot, therefore, complain if their earnings are low.

Inefficient Equipments to be discarded

77. Apart from reasons connected with the habit and temperament of the Kamars, there are matters of technique and equipments which contribute to the scantiness of their earning. The foot-bellows are inefficient and are incapable of producing adequate temperature inside the furnace. The clay furnace itself has many technical shortcomings one of which, for example, is that there is no practical means of keeping the nozzle cool. The nozzle is at a region where the furnace has the highest temperature. Two pieces of bamboo pipes are placed close to the nozzle for leading air from the bellows to the furnace. The bamboo pipes terminate about an inch or two from the mouth of the nozzle so that they might not get burnt. This disconnected arrangement is responsible for considerable loss of blast and the fire does not achieve the temperature that might have been otherwise possible. This results in wastage in several ways. Firstly, the expenditure of charcoal is proportionately great. Nearly 15 seers of charcoal to one seer of finished iron becomes necessary under such conditions. Sometimes the proportion is higher. Secondly, some metal is left unrecovered in the slag. The method, therefore, is wasteful.

78. ***Foot-Bellows***—An equipment which is not quite efficient is the set of foot-bellows. It is small in capacity and is worked by a single worker, unlike the type in vogue in Palamau district which is worked more forcefully each by two persons. Even the Palamau type is not the ideal one for although air delivery is much greater than in the Penthabahal type, the overall advantage gained is unequal for the labour of two. Moreover, there is the inherent limitation of human power. The furnace obviously requires still greater blast input than what two persons can deliver by physcial exertion.

79. ***Hand-Bellows and Rotary Blower***—The use of the conventional type of hand-bellows is out of question because of its very limited capacity and the intermittent break in the flow of air. A much better device than this is the hand-operated rotary blower. This ensures continuity of air-flow but its size cannot be sufficiently large if human hand-power is required to operate it for a certain length of time. Devices which are more powerful than these two types are necessary. The suitability of a mechanically-propelled rotary blower or an electric blower should, therefore, be considered.

80. ***Mechanical Blower***—In the district of Koraput, the Akhil Bharat Sarva Seva

*Another version may be seen in the *Metallurgy of Iron and Steel* by Bradley Stoughton, page 2

Sangh has made some useful experiments with a view to study the comparative usefulness and suitability of the traditional foot-bellows, a mechanically driven blower and a small electric power blower. The results are quite interesting. A rotary blower containing 16 vanes 12½ inches long, tapering from 6 inches to 2½ inches in width and enclosed in a wooden casing was installed. A speed drive was improvised with 1 : 6 ratio by means of a bicycle wheel and V belt drive. An operator seated above the wooden casing was required to pedal the bicycle wheel. A maximum of 50 r.p.m. was achieved but the air output was hardly satisfactory. Attempt at increasing the speed ratio proved fruitless because pedalling could not be maintained at the original rate with the result that there was no improvement in the flow of air. A mechanical device of this type is hardly as useful as the traditional foot-bellows.

Installation of Electric Blower

81. Experiments made with a ½ H.P. electrically-operated blower consuming 2 amps. at 220 volts gave satisfactory result. The displacement of air was calculated at 60 c.ft. per minute. It was noticed as a result of the experiment that the output of the furnace could be raised to about 25 seers of iron in course of eight hours of work, or 6¼ seers in two hours. The Penthabahal experiment produced 3½ seers of sponge iron in course of two hours with the help of the traditional foot-bellows. It may be concluded that the substitution of the foot-bellows by an electric blower of the type used in Koraput experiment will at once double the output.

82. ***Prerequisites***—The introduction of electric blower in place of the traditional foot-bellows appears to be indispensable if the level of earning of the smelters has to be raised. The use of electric blower, however, envisages various developments which must be ensured beforehand. It cannot be introduced in villages until the scheme of rural electrification has extended there, and the Administration is agreeable to arrange for supply of energy at concessional rate. The smelter must be able to pay for the blower and the cost of its installation. Otherwise the Administration should again come to his help by granting aid, subsidy or loan. Lastly the smelter himself must have some amount of minimum practical knowledge of running a simple electric machine and about its maintenance. The smelters are poor but not unintelligent and seem capable of benefiting from any arrangement that may be made to give them some amount of technical training. Finally there should be some public arrangements to attend to cases of mechanical breakdowns and failures. Once these arrangements are ready, there should be no difficulty to discard the antiquated foot-bellows and adopt its modern version, the electric blower.

The Fuel Problem

83. *Growing Scarcity of Charcoal*—Charcoal has been regarded as an indispensable raw material for use in the clay furnace since the beginning of smelting process by the ancient people. It plays a triple role in the process by serving as a fuel for production of heat, by acting as a chemical reducing agent and finally by keeping the hot reduced metal covered all round so as to protect it from the oxidizing action of air. Charcoal, however, must be available in large quantity and at close range so that transport does not become time-taking or costly. In recent years forests which contained certain particular varieties of trees, namely, *Sal*. *Jaman* and *Mahul*, are fast disappearing due to indiscriminate exploitation by the growing population as well as due to the necessity of clearance of extensive tracts of reserved forest for establishment of large-scale industries or modern townships. If, therefore, the indigenous process of smelting is to be kept alive or expanded

further, it cannot be done on the basis of the dwindling source of this important raw material, namely, charcoal made in the conventional manner from forest trees. A good alternative will have to be devised.

84. ***Production of Charcoal by Wood Distillation***—It is possible to produce charcoal in large scale by a process known as destructive distillation of wood. The process has been adopted by one of the modern steel factories, namely, the Mysore Iron and Steel Works at Bhadravati, which uses charcoal and not coke as the fuel required for smelting of iron-ore. Forest trees are cut and allowed to lie over for sometime till they are partially dried up and seasoned. When the moisture content in the timbers is reduced to the level of 20 to 22 per cent, they are cut into sized logs 3 to 3½ feet long and 5 to 6 inches in diameter. About 4 or 5 tons of such logs are loaded into a bogie and 4 loaded bogies are charged into a retort which is then sealed air-tight and passed through heat chambers. The heat drives away the moisture still present in the logs. The temperature is raised to the level of 300 to 350°C. when exothermic reaction takes place, resulting in still higher temperature and inducing distillation of a liquid called pyroligeneous liquor. The firing is reduced 18 to 20 hours after initial charging but carbonization of the wood takes about 36 hours. The hot charcoal is then passed into primary coolers where it remains for another 24 hours, and lastly to secondary coolers for a further period, by which time the charcoal is cool enough to be used in the furnace. The charcoal which is thus produced is low in ash content which is limited to 4 or 4½ per cent. Carbon constitutes 70 to 80 per cent and the rest happens to be some volatile matter. A bogie charged with 4 to 5 tons of log yields about one ton of charcoal. In Bhadravati, the plant produces about 30 to 35 tons of charcoal per day, which, not being adequate for the requirement of the furnace, is supplemented by local purchase of charcoal from indigenous producers.

85. The distilled liquid, pyroliquor contains 5 to 6 per cent of wood tar, 4 to 5 per cent of acetic acid and 2 to 2·5 per cent of methyl alcohol. The liquid is separately treated for separation of these three valuable by-products.

86. Since it is becoming more and more difficult for village smelters to obtain necessary quantity of charcoal, the local administration, namely, the Panchayat Samiti or some other equivalent administrative body may undertake to instal a wood distillation plant in an area where there are adequate number of indigenous furnaces working and where there are suitable forests nearby. There is the practical feasibility in venturing such a project because the smelters' villages are generally localized within a certain zone and reserved forests are to be found within the ambit of such zones, so that one charcoal-making plant can economically function and serve all the smelters of the surrounding villages. Besides, the body owning the plant will be creating an additional source of income for itself from the manufacture of tar, acetic acid and methyl alcohol, and will, at the same time, be able to provide employment to a section of the rural population.

87. ***Coke or Wood-waste as alternative Fuel***—If adequate production of charcoal may not be possible on account of any reason, the alternative may be confined to the use of coke or woodchips or wood-waste. Raw coal is not suitable, as it lacks the mechanical strength and the chemical qualities required in the process of smelting. It is usually converted into another form of coke, which is physically and chemically fit to do the job. All modern iron-smelting furnaces use coke as fuel. Its action in a clay furnace where the temperature is not intended to reach the

maximum level and where no lime-stone is used as flux has to be studied. Its properties as a chemical reducing agent in place of charcoal has also to be found out. Another alternative, namely, the use of wood-waste will radically change the *modus operandi,* and requires careful experiments. It may, thereafter, be possible to judge if coke or wood-waste can be introduced as a tolerable substitute for charcoal for use in country furnaces. It, however, seems certain that the structure of the furnace will require redesigning if the type of fuel is to be changed. This itself is a difficult task, and calls for patience, study and research.

Improvement of Clay Furnace

88. The most common type of clay furnace, namely, the Penthabahal type, is not the most efficient one. There are furnaces, for example, of Palamau or Madhya Pradesh type, which are larger in capacity and more profitable. There are underground furnaces of Singelbecha type, which are considered much better not only from the point of view of thermal efficiency but also in respect of quantity of recovery of metal. It is, therefore, possible to study different types of the furnaces and to design an improved type. In doing so extreme care is necessry in introducing any innovation, because the result of the present survey shows that the type of furnace which is in vogue in a particular locality has been evolved on the basis of generations of experience and is almost the best suited for the particular type of ore available in the locality. Any hasty change on the basis of theoretical knowledge is likely to introduce fresh complications rather than solve existing problems. It is known, for example, that the height of a furnace is very material to the attainment of temperature. But this should not lead one to raise the height indiscriminately, for a furnace higher than the optimum consumes more fuel and brings about complications in the production of the desired quality of iron. The height must be appropriate to the type of the ore used so as to yield maximum output of iron with minimum consumption of fuel. In this manner utmost care is necessary with regard to the girth and inner dimensions of the furnace, the size of the apertures, the volume of air-flow and finally the ore-charcoal ratio.

Reduction of Mesh of Ore

89. The smelters usually charge in the furnace lump ore of the size of ½ to 1 inch, which is really too large for effective reduction expected during the 30-inch travel down the furnace. The optimum mesh of ore as found during the Koraput experiment, is minus ¼ inch. The fines should be screened off, for, though they have no deleterious effect on the yield of steel, the spongy mass of metal which is finally recovered from the bottom of the furnace stands the risk of getting composed of metallic particles too fine to be forged to a homogeneous mass. If the mesh of ore is thus reduced, the achievement will be not only in the direction of higher metallic recovery but also in lower charcoal consumption. It is estimated that reduction in ore-mesh from plus ¾ inch size to minus ¼ inch size will nearly double the quantity of yield of iron. Simultaneously the consumption of charcoal is expected to be reduced by about 25 per cent.

Use of Flux

90. Village smelters are averse to the use of flux of any kind. The technical wisdom of their ancestors does not favour such a measure. They have themselves never tried the results of fluxing and cannot explain the reason behind their choice. It is not known if the traditional prejudice resulted from unavailability of fluxing material at close range, or if the principle was discarded after reasonable trials in old times. The present investigation, however, broadly indicates that there may be some advantage in using lime-stone as

flux in the clay furnace (paragraph 5 of the Chemical and Metallurgical Report *vide* Appendix). It may perhaps prevent to some extent the escape of the unreduced ore along with the gangue or slag and thus contribute to higher recovery of metal. The Steel Plant at Bhadravati, which uses charcoal as fuel, uses lime-stone as flux. There is, however, the danger of greater contamination of iron by carbon in a small-sized clay furnace, which should be carefully studied in an experiment. A haphazard conclusion drawn from the behaviour of a modern furnace is unsafe, for it must be remembered that a village smelter wants to produce wrought iron directly and not pig iron as in the case of a blast furnace.

Provision of Tools and Equipments

91. All the tools and equipments in the workshop are of indigenous make. A Kamar manufactures his own tools, which are good for his work, except the heavy anvil. He uses a large piece of granite stone boulder for an anvil as he cannot afford to purchase a piece of steel anvil of large size. Similarly he is too poor to provide for himself a bullock-cart for transport of ore-stones and charcoal from the forest, though this will save much of his time and labour in bringing raw materials by *bhar* or head-load. In such a case, some amount of financial aid or loan should be granted to him for purchase of a steel anvil, a vice, a bullock-cart and any other equipment which cannot be made in his workshop.

Many-sided Improvements needed

92. The review made above indicates that it is possible to raise the level of earning of indigenous smelters to a substantial extent, but it is also clear that unless many-sided improvements are made in the technique and equipments that have remained unchanged since pre-historic times, the industry may not be able to stand on its own legs in the highly competitive field of the present day. The substitution of traditional foot bellows by electric blower of the type described will alone double the present output. Other measures, such as, reduction of ore-mesh, provision of suitable tools, redesigning of clay furnace, and lastly hard work by the Kamars themselves will make the industry adequately lucrative so as to compare not unfavourably with any other economic activity followed by the rural folk. Apart from what experiments and observations have been made in course of this survey, it may be necessary to examine further what may be the actual increase in the income of the smelter, and how far smelting of iron in the form of a decentralized cottage industry can expand, when necessary improvements are introduced.

SECTION VI

CONCLUDING REMARKS

93. The extent of the ancient smelting industry has greatly declined. It stood as a self-subsisting industry for many a long century. Ultimately there was the gradual spread of mechanized modern industries in India, though this development itself was preceded by what may be called an era of 'deindustrialization'. During this infamous era, India's traditional handicrafts declined sadly from their original height of prosperity. The phenomenon became widespread as the new change gathered momentum from decade to decade, finally to sweep over the length and breadth of the country. The ruin, sooner or later, of the old traditional crafts was an inescapable consequence of the new revolution ushering in with all the vigour and characteristics of a freshborn movement.

94. Yet neither foreign imports nor competition from mass-scale production of iron by modern Indian factories, deadly famines nor increasing cost of living, the poor unprogressive technique nor the most pitiable level of earning have succeeded in altogether defacing the little clay furnace. The reason for this heroic persistence is the Kamar's genuine love of his ancestral craft, combined with the peasant's preference for tools and implements made from the soft and malleable metal produced by these good old workers. The peasants believe that tools made from the village iron are easier to mend when broken, and that they do not rust quickly as does the factory-made iron. This aspect alone should suffice to dispel the prejudices of those who feel that revival of the industry is a far cry, and to justify attention of the Government for providing conditions conducive to the development of the industry on correct commercial lines.

APPENDIX

Report on Chemical and Metallurgical Examination of Samples of Indigenous Iron-ore and Slag, Finished Tools, etc.

Sample pieces comprising iron-ore, sponge iron, gangue material, squeezed out slag and also 'finished' tools (chopper axe, knifelike cutter) were received for examination. These were stated to be collected from Kalapat Hill areas where tools and implements are believed to be made from the indigenous raw materials.

2. Investigation comprising chemical analysis, micro examination and some hardness determinations was made to assess the quality of the raw materials and finished items. The findings are given in the next page and, for convenience, are summarised below.

3. The analysis shows iron-ore containing about 45 per cent iron against normal 60 per cent and above, having silica and alumina contents of 13 and 7 per cent respectively, sulphur being practically nil and phosphorus very low. The silica/alumina ratio, unlike the Steel Plant ore, is 2: 1 (against 1 : 1 or 1 : 1·5). No presence of magnetite was observed and the high ignition loss indicates some proportion of limonitic variety.

3-A. The gangue and slag show high but variable iron oxide content (40 to 60 per cent and 60 to 75 per cent respectively) in different places, with about 8 to 9 per cent alumina and about 1 to 2½ per cent lime. The gangue shows 24 per cent silica whereas the squeezed out slag about 13 per cent SiO_2 with some amount of unburnt 'carbon'.

3-B. The interesting features observed, it will be seen, are high ignition loss (about 12 per cent) and silica/alumina ratio, though favourable, in the ore, and very low lime in the slag and the gangue.

3-C. The sponge iron is found to be a highly porous mass, with large amount of embedded slag and charcoal pieces. It is, therefore, not surprising that the piece has given variable analysis from different positions outlined below:

		Position I	Position II	Position III
Carbon	...	·30 per cent	·45 per cent	·60 per cent
Manganese	...	trace	trace	...
Sulphur	...	trace	trace	...
Phosphorus	...	·03 per cent	·02 per cent	...
Silicon	...	·20 per cent	·18 per cent	...

4. It will be noted that excepting carbon, other items are reasonably consistent and very low, and the material resembles more 'Puddle' iron than 'Wrought' iron, which is characterised by very low carbon. Sponge iron piece was also found difficult to cut when pieces were needed for microscopic examination. However, cut pieces show varying amount of embedded slag in different positions and the hardness determinations vary considerably (from 160 to 190 V. P. N. in softer areas and 250 to 300 V. P. N. in harder areas).

As expected, the samples show different characters in different areas, some areas with fairly low carbon, deposited in the form of long needles (*vide* photomicrograph II), in other areas still less carbon (*vide* photomicrograph I), but in some areas high carbon in a different form (cellular pattern, *vide* photomicrograph III). The 'finished tools' show considerable resemblance to 'normalized' medium carbon steel (*vide*

photomicrograph IV). Some areas are similar to 'overheated' type (***vide*** photomicrograph V). The cutting edge reveals Sorbitic-Martensitic Structure. The chemical analysis and hardness determinations came as follows:

		Knife-tip	Axe-tip	Away from Axe-tip
Carbon	...	·40 per cent	·60/·68 per cent	·50 per cent
Manganese		trace	trace	trace
Phosphorus	...	·05 per cent	...	...
Sulphur	...	trace	...	...

Hardness (V. P. N.): Knife: 156, 167, 176, 182

Axe: 200/205 (Eye portion)
170/215 (Middle portion)
290/300 (Cutting edge)

The axe appears to be much more well finished product both from the point of view of appearance and utility.

N. B.—Hardness figures vary considerably in the finished material. This is to be expected from the nature of sponge iron. Further determinations indicate similar hardness variations, ***viz.***, from about 225 to 160 V. P. N. and about 120 to 200 V. P. N. in the smaller piece in the main body, ***i.e.***, 'away from the cutting edge'.

5. It appears that low grade iron-ore, containing high silica and alumina contents, but low in sulphur and phosphorus, is used for indigenous manufacture of tools and implements. The ore is basically similar to hematite type with a portion of limonite. The presence of unburnt carbon indicates unsatisfactory temperature condition. While some lime in the slag is expected from charcoal, it is not clear how about 2 per cent lime comes in the slag when no limestone is used for manufacture. Deliberate addition of lime, even in small quantity, will be advantageous. The varying character of the sponge-iron is reflected in the quality of the finished tool. Addition of lime in the charge and full burning of charcoal during smelting will tend to make better quality sponge. The highly carburized layer at the tip arises from repeated heating and forging to shape out the implement and also to squeeze out the slag prior to water-quenching and operation appears quite satisfactory. The fairly deep edge hardness developed in the tools should suffice for general purpose tools.

FINDINGS

SUBJECT—Analysis of samples received on the 21st October 1962 relating to Sponge Iron and allied materials

Received from Superintendent of Census, Government of India, Orissa Circle.

1. Iron-ore sample collected from Kalapat Hills:

Loss on Ignition	...	11·91 per cent
Fe.	...	44·80 per cent
SiO_2	...	13·20 per cent
Al_2O_3	...	7·05 per cent

2. Broken piece of Lump Ore that are charged to the Furnace:

Loss on Ignition	...	11·20 per cent
Fe.	...	45·10 per cent
SiO_2	...	12·85 per cent
Al_2O_3	...	7·20 per cent

3. Gangue Material tapped out of the Furnace at interval:

SiO_2	...	23·82 per cent
Total Iron as FeO	...	61·50 per cent
Al_2O_3	...	9·20 per cent
CaO	...	2·60 per cent
MgO	...	0·75 per cent

(Contains small amounts of Ferric Iron)

4. Sponge Iron:

Si.	...	0·18 per cent to 0·24 per cent	Drillings are not uniform and contain small amounts of slag.
Mn.	...	traces	
Phosphorus	...	0·20 per cent to 0·03 per cent	
Sulphur	...	Less than 0·005 per cent	
Carbon	...	0·30 per cent to 0·60 per cent	

5. Slag forced out of Sponge Iron in the process of Forging:

SiO_2	...	13·10 per cent	Contains small amounts of free iron as well as carbon.
Total Iron as FeO	...	75·60 per cent	
Al_2O_3	...	7·95 per cent	
CaO	...	1·48 per cent	
MgO	...	0·45 per cent	

6. Analysis of Finished Tools:

(*a*) Smaller piece: Knife—

Carbon	...	0·42 per cent
Mn.	...	traces
Phosphorus	...	0·06 per cent
Sulphur	...	Less than ·005 per cent
Si.	...	0·05 per cent
Hardness	...	212 (average) at the edge 120 to 160 in the centre

(*b*) Bigger piece: Chopper Axe—

Carbon	...	0·49 to ·51 per cent
Manganese	...	*nil*
Sulphur	...	As in (*a*)
Phosphorus	...	As in (*a*)
Hardness	...	150 to 220 at the edge 160 to 170 in the centre 300 in the tip, *i.e.*, cutting edge

ROURKELA

The 6th November 1962

A. K. MALLIK

Chief Metallurgist,
Hindustan Steel Ltd.
Rourkela Steel Plant

TERMINOLOGY

Words		Local terms at Penthabahal	Local terms at Singelbecha
Smelter	...	Kamar	Lohar
Furnace	...	Bhati	Gaana
Forge	...	Sala	Chuli
Basket	...	Kantara	Chaalni
Ore	...	Luha-pathar	Paakna
Charcoal	...	Koila	Angra
Slag	...	Khaado	Gu
Slag pit	...	Hagani-gada	Gu-kadha
Bellows	...	Janta	Jatri
Hammer	...	Ghana	Hatudı
Tongs	...	Sanduasi	Sandasi
Punch	...	Atila	Tussa
Iron anvil	...	Nehi	...
Nozzle	...	...	Nala
Charging platform	...	Machan	...

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SURVEY OF TRADITIONAL CRAFTS

BOOK TWO

BRASS AND BELL-METAL INDUSTRY

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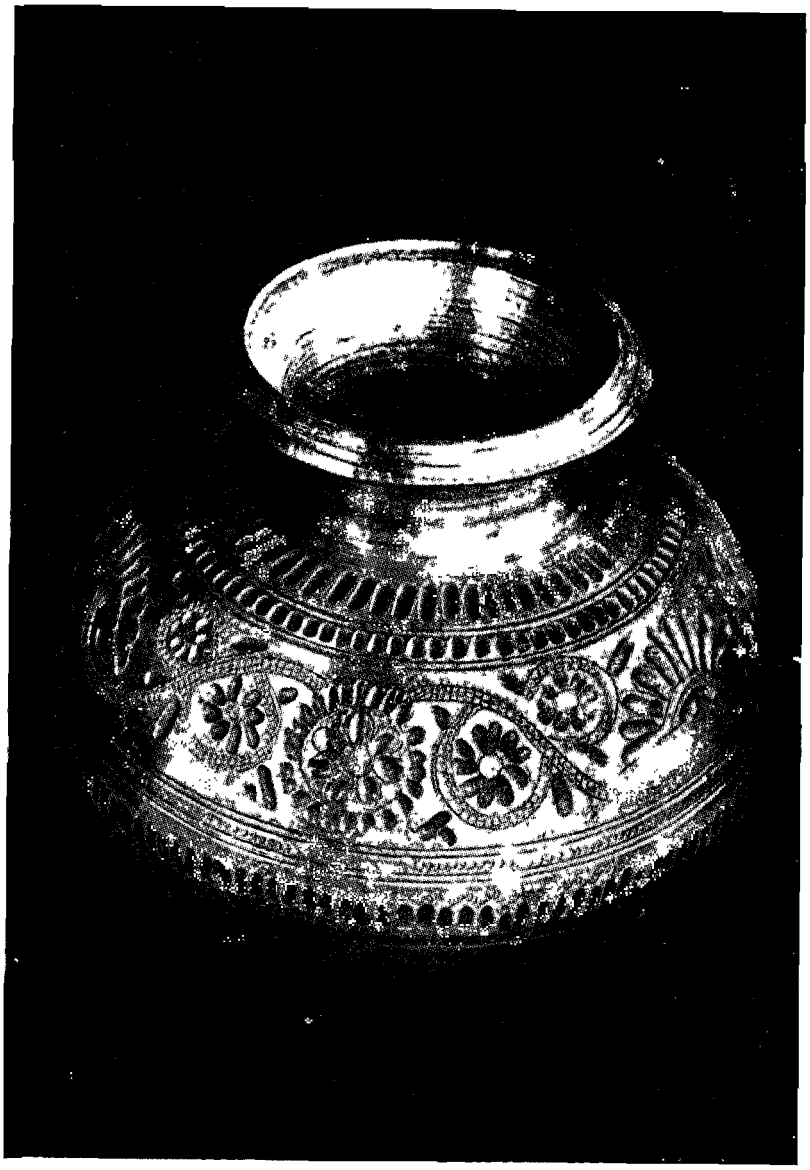


Water pot with profuse engravings and etched designs

SECTION I

INTRODUCTION

The knowledge of metals which helped the course of evolution from savagery to civilization was acquired and utilized in India from remote pre-historic times. Although iron among metals has finally emerged with unchallenged importance in the affairs of mankind, it was the other category of metals called non-ferrous, which was the basis of primary progress. The discovery of copper gave the early man a substance with infinitely greater possibilities than mere stone for making tools and weapons.

Antiquity of non-ferrous metals

2. Proficiency in the working of non-ferrous metals was acquired by the ancient people of this land several millennia ago. The discovery of a small bronze statuette, apparently of a dancing girl, found in the buried city of Mohenjodaro shows that as long as 5,000 years ago the people of this sub-continent had acquired noteworthy skill and proficiency in metal imagery. The level of artistic performance displayed in this specimen leaves no doubt that there must have been a long anterior period of development of the craft of casting in bronze and in similar alloys. During the reign of the Imperial Guptas in the 4th Century, A.D., India achieved the classical phase of perfection in arts and crafts. The famous Chinese traveller Hiuen-Tsang who visited India in the 7th Century, A.D., found a stupendous copper image of the Buddha about 80 feet high in Nalanda. The bronze Buddha found at Sultanganj, seven feet and a half high (now in the Birmingham Museum) is another marvel in metal statuary.* In Orissa, metal craft reached a high level of perfection during the rule of the Ganga kings from the 11th Century onwards. These kings were famous not only for building magnificent palaces and towering temples, but also for patronising figure-art and iconometry in metal as much as in stone. High proficiency in metal craft based on intimate technical knowledge involved in various manufacturing processes helped in those days the production of elegant and incomparable masterpieces in metal.

Disappearance of old specimens

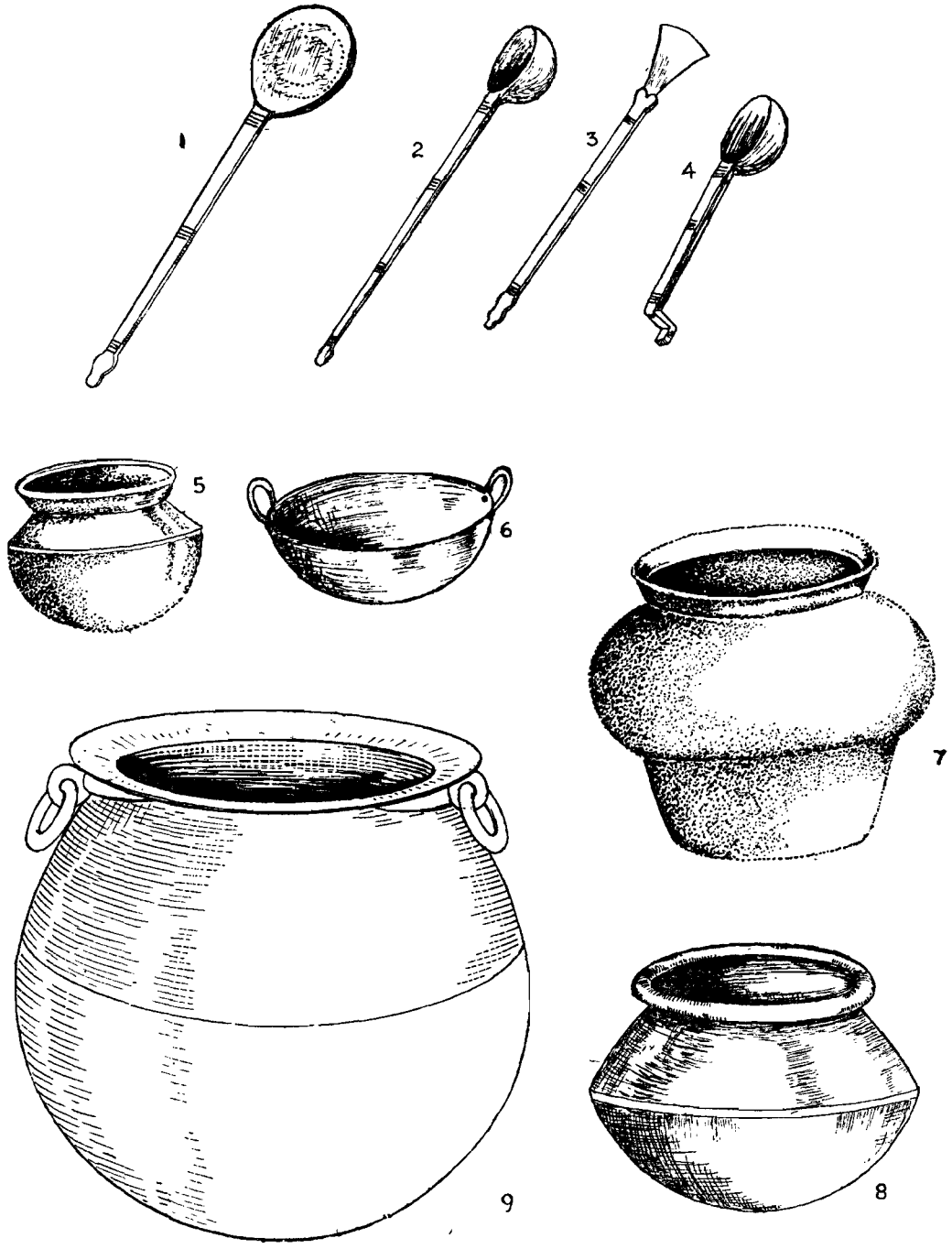
3. In spite of the flourishing state of the craft in the ancient and medieval times when a great variety of objects were produced and marketed, old specimens are not available now to any considerable extent for investigation and study of the full range of products of early days. This may be due partly to their disappearance in wear and tear or in natural process and partly to the removal of the more valuable objects by foreign visitors not only in the days of old but also in recent times. Fa-Hien, a distinguished Chinese pilgrim visiting India in the 4th Century, A.D., is reported to have removed boat-loads of Indian curios by water-route from Ceylon to China. Another famous Chinese traveller, Hiuen-Tsang is also noted for similar performance three centuries later when he succeeded in taking away from India many metal images, manuscripts, etc., which, in spite of loss and pilferage in course of his long and arduous movements, required not less than twenty horses to carry at the terminal point of his return journey. There must have been innumerable instances of disappearance of such antiquarian treasures of India in different periods of Indian History, continuing

* India Through the Ages by J. V. Furtado and K. C. Khanna, P. 114.



HOUSEHOLD UTENSILS

1. *Thali*—popular type with slanting walls; 2. *Thali*—popular type with short upright walls: 3. *Thali*—with art engravings; 4. *Thali*—with common floral engravings; 5. *Tha-saja*—rice plate with fixed curry cups; 6. *Thalia*—saucer; 7. *Thalia*—quarter plate; 8. *Bela*—bowl for eating watered rice; 9. *Kundi-kansa*—common food container; 10. *Tatia*—cup; 11. *Antabhanga kansa*—large curry pot with concave walls; 12. *Gina*—cup for vegetable curry; 13. *Bati*—small cup for condiments.



COOKING AND MISCELLANEOUS ACCESSORIES

1. *Jalichalu*—perforated ladle, 2. *Danki*—deep ladle; 3. *Pithapatia*—cake baker, 4. *Bhujangi*—ladle for special purposes; 5. *Maṇo*—measuring pot; 6. *Kadhei*—frying pan; 7. *Kundo*—miscellaneous receptacle; 8. *Atika*—cooking pot; 9. *Handa*—large cooking vessel for mass feeding.

right up to the end of the British rule. It is in course of such process that the inimitable Peacock Throne, the Kohinoor and millions of other priceless gems as well as a countless number of archaeological, epigraphic and numismatic treasures of India ultimately vanished from homeland and filled the palaces, national museums and commercial marts of Europe and other countries of the world.

Importance of non-ferrous metals

4. Non-ferrous metals had great importance at all times, and their use was extensive and varied. Although as a group, they ranked next to the finished products of iron and steel in aggregate weight, the quantity of manufactured non-ferrous metals far exceeded in total value of production until the advent of the industrial revolution in modern times, when iron began to play an increasing role.

5. The non-ferrous metals embrace a large range, from the precious gold and silver to the base metals, lead and copper. These metals as well as their alloys exhibit a variety of properties and applications far beyond the scope of iron and ferrous alloys. The most important aspects in which the properties of some of the non-ferrous metals excel those of common varieties of iron and steel relate to lightness in weight compared to volume, resistance to corrosion, electrical and thermal conductivity, fusibility and an extensive range of chemical activities.

6. In olden days, the importance of non-ferrous metals was highly recognized from various considerations. The properties of such metals were studied in order to determine their effects on the human system. The beneficial effects were many, as the findings showed, but in some respects there were harmful results too. Accordingly the metals were used in various forms, such as, plates, cups and drinking pots of gold and silver used by kings and noblemen and by those who could afford them, or medicinal preparations containing metallic oxides or solutions for prevention of diseases, and for maintenance of vigour and deferment of old age. An interesting account is available in an extract taken from the Pauranic literature* as follows:

> " In a medieval work, the Kalika Purana, plates of gold are described to remove excesses of the three humours and promote the strength of the vision; those of silver, favourable and inimical to bile, but calculated to increase the secretion of wind and phlegm; those of bronze, agreeable and intellectual, but favourable to undue excitement of blood and bile; those of brass, wind-generating, irritating, hot, and heat and phlegm destroying; those of magnetic iron, most beneficial in overcoming anasarca, jaundice and anaemia; those of stones or clay are inauspicious; those of wood wholesome, invigorating and poison-destroying. "

Versatility of alloys—Brass and Bell-metal

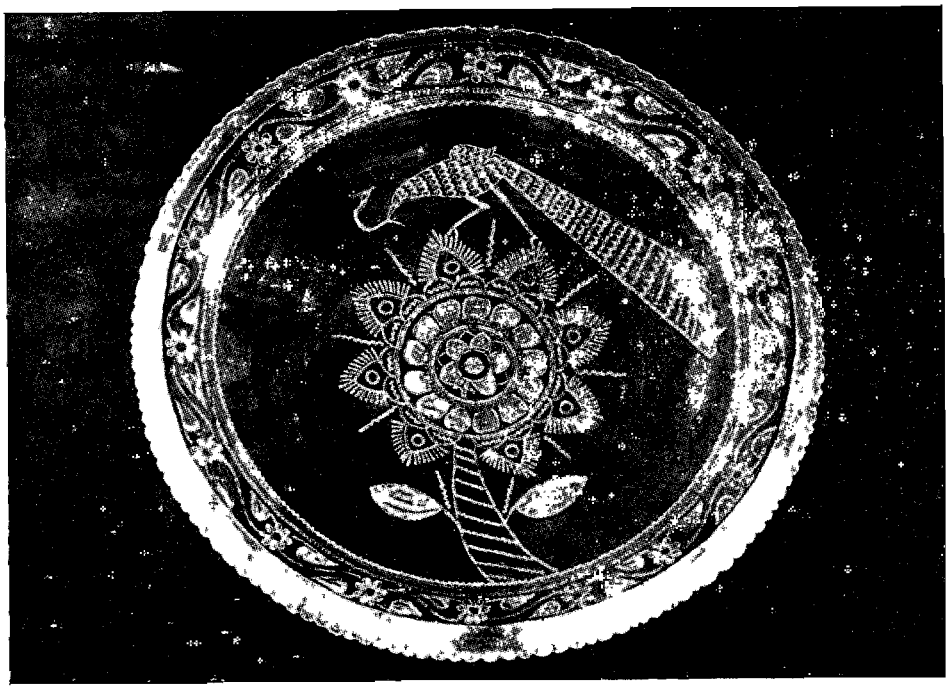
7. Some of the non-ferrous metals are of great commercial importance, such as, copper, while others like gold are distinctive in colour and elegance. But in their pure form, they lack in versatility needed for commercial use. The production of a large range of alloys by varying the combinations and compositions of these metals was intended to meet the specific requirement of quality necessary for particular purposes. Brass and bell-metal are the products of a few out of many possible metallic combinations. These two alloys offer a vast scope of utility—from the

* Observations of Dr. Rajendra Lala Mitra quoted in Indian Metalware by Jamila Brij Bhushan—Page 12.

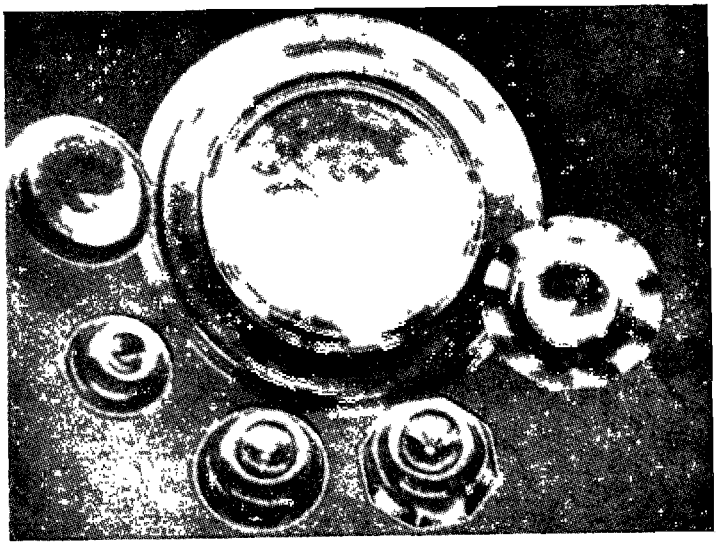




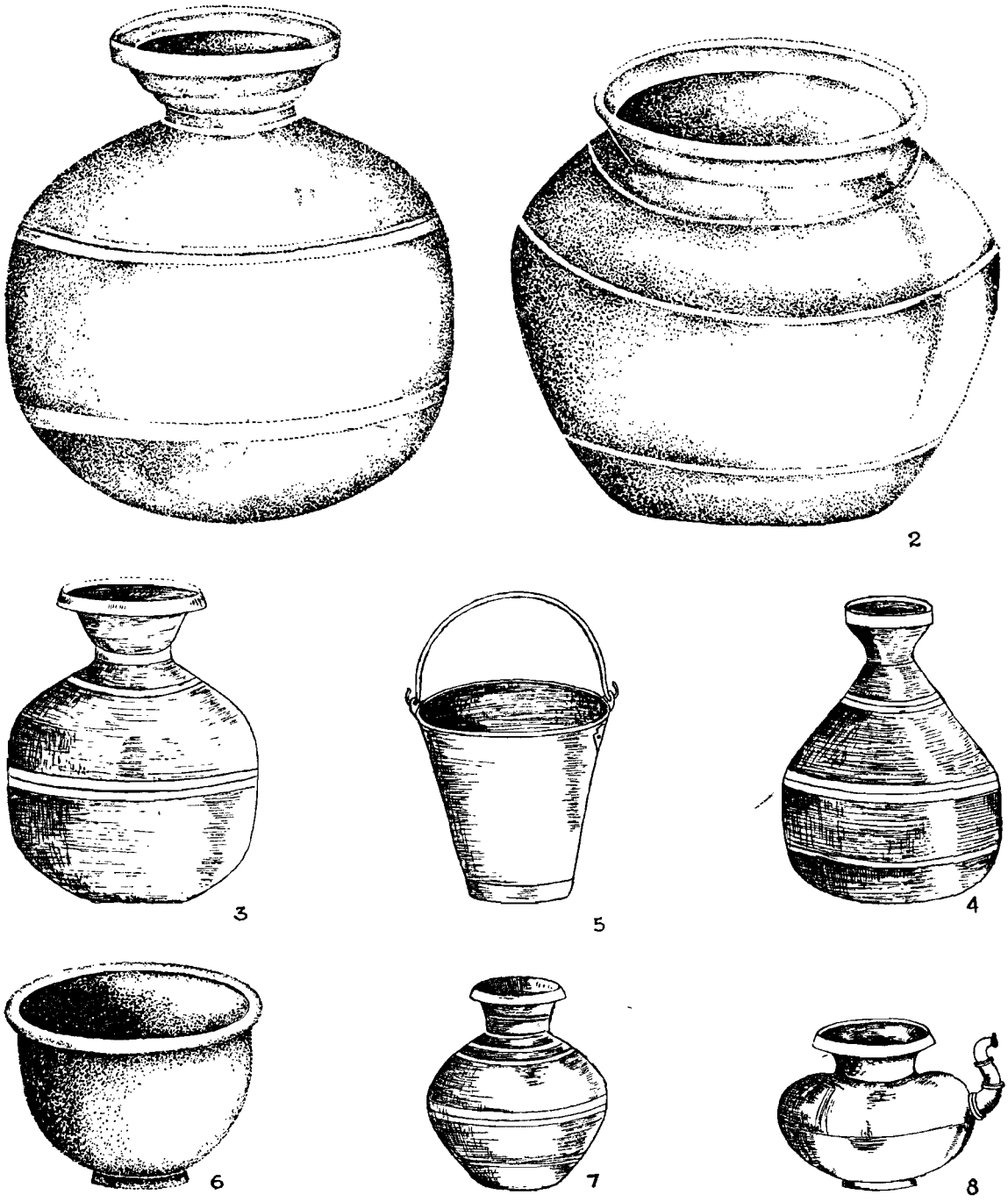
FLORAL ENGRAVINGS ON PLATES



ART ENGRAVING



THA-SAJA
(Plate fitted with curry cups)



HOUSEHOLD WATER POTS

1. *Baladia Handa*—large water container; 2. *Pakhala Handa*—large container of water, food or grains; 3. *Batuli*—container for fetching water; 4. *Gara*—another type for fetching water; 5. *Balti*—bucket; 6. *Nandia*—vessel for storage of water; 7. *Dhalo*—pot used for washing purposes; 8. *Gadu*—another type of washing pot.

housewife's outfit of domestic utensils to the priest's requisite of divine idols for worship, and the king's choicest decorative accessories.

Ranges and varieties

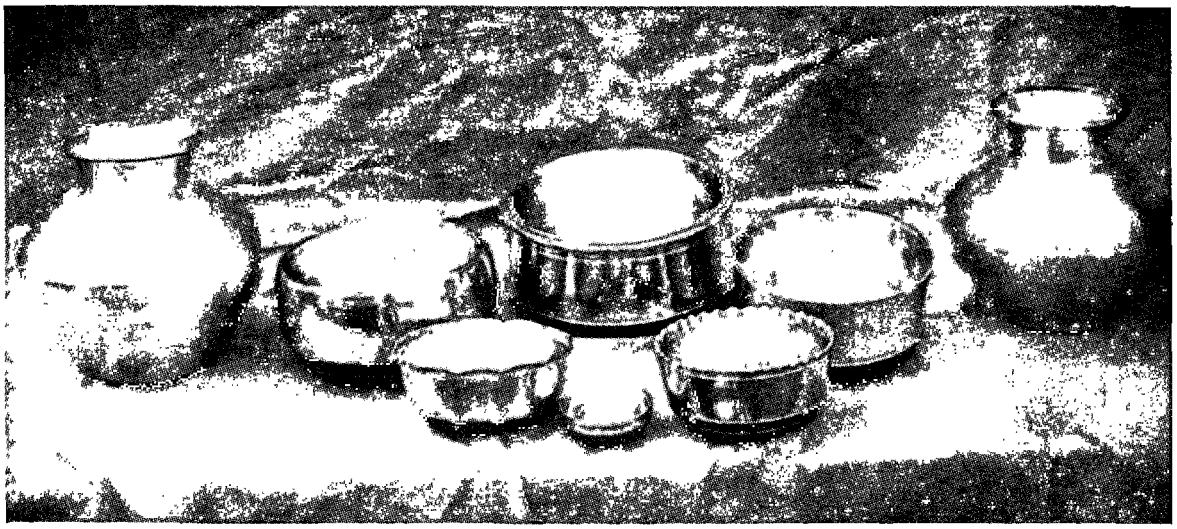
8. The royal patronage which the ancient metal craft received from the Kings of Orissa brought in its wake the extensive countrywide popularity of the products which in course of time began to grow in range and variety. From the level of a few domestic equipments which originally constituted the limited field of the industry, it boldly spread itself in various directions of utilitarian and ritualistic fields and succeeded in production of anthropomorphic representations of gods and goddesses and finally, of most fascinating objects of decoration. The deep interest displayed by the Royal household in the ceremonial objects and human and divine figures made of brass and bell-metal influenced the aristocracy and finally trickled down to the well-to-do sections of the people far and wide. On the other hand, the demand for common household articles, such as, metal cooking pots and utensils was growing in volume from the requirements of all sections of people, whether rich or poor. In this manner, a flourishing market developed in different parts of the kingdom. The excellence and universality of the products could not confine the demand to any particular territorial limit. The fame crossed the borders and an extensive extraterritorial market was built up. The products of Orissa's brass and bell-metal industry used to be sent out to neighbouring parts of Bengal and to countries beyond the southern border, besides meeting the growing demand at home.

9. The range of goods produced is wide. The types and varieties of brass and bell-metal products of Orissa extensively cover a vast number of objects. Each object, in turn, is made in many different sizes and shapes. The more popular category of products may be grouped under four main classes as mentioned below:

(i) ***Household utensils and pots***—They include a large variety of pots, vessels, receptacles and containers generally used for cooking and dining purposes and for storage of grains, foodstuffs and water. A few important items have been illustrated on adjoining pages, such as, plates (*thali*) of various types, half-plates (*thalia*), cups (*tatia*), bowls (*bela*), small curry cups (*gina*), water container (*gara*), bucket (*balti*), washing pot (*dhalo* or *gadu*), measuring pot (*mano*), frying pan (*kadhei*), ladle (*chatu*), etc.

(ii) ***Temple Accessories***— The range of this variety of articles is wide. Images of different gods and goddesses made of brass are manufactured for worship at home and in temples. Sacred lamp stands (*pili-saja*) and ceremonial lighters (*alati-kathi*) are outfits meant for lighting the deity's chamber and for paying homage to the deity with the aid ot lights. There are a number of accessories used at the time of worship, such as, cymbals (*jhanja*), bells and gongs (*kara-ghanti* and *mandira-ghanti*), incense burners (*dhupa-dani*), handle of winnowing tuft (*chamar*), etc., which are made of brass. The offerings of food (*bhog*) for the god are cooked in large sized brass pots (*handa* or *atika*) and are served to the devotees in brass plates and dishes. Bell-metal is not generally used for manufacture of accessories used in temples, because it is considered less sacred. Brass remains impolluted, but bell-metal may get polluted by touch of lower castes. So brass is always used as the material for offer of sacramental food for gods and guests, for instrumental accompaniment of devotional songs, for illumination of the deity's chamber and for various ritualistic necessities.

(iii) ***Luxury goods and Ornaments***— The cosmetic outfits of ladies, such as, collyrium container (*kajal-pati*) meant for painting



SOME ESSENTIAL PRODUCTS IN FINISHED STAGE



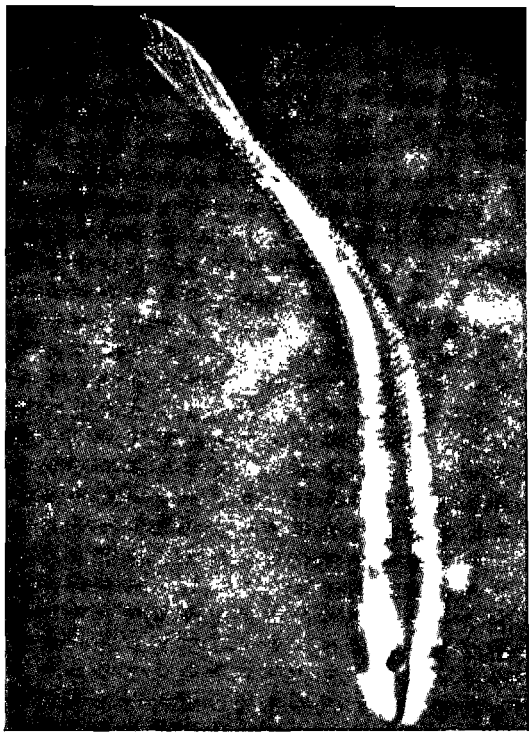
LARGE-SIZED COOKING POTS



LARGE-SIZED WATER POT

the eye-lid margins dark, the betel chewer's outfits, such as, the betel-box (*pan-peda*), the lime container (*chuna-khai*), the catechu sprinkler (*khair-jhada*), the spitoon (*pik-dani*), the tobacco-addicts' snuff-box (*nas-dani*) and a multitude of similar equipments are made of brass to suit the taste and fancy of well-to-do sections of the people. Women of low castes who cannot afford to use ornaments of costly metals take to wearing of brass or bell-metal ornaments. These ornaments are mostly worn on wrist, neck, nose and ears. The principal among such ornaments are *khadu*, *bala*, *chudi*, *anguthi*, *noli*, *dandi* and *kana-phula*. The popularity of such ornaments is, however, declining as cheaper and more attractive substitutes of plastic, glass or imitation materials are increasingly spreading in country markets.

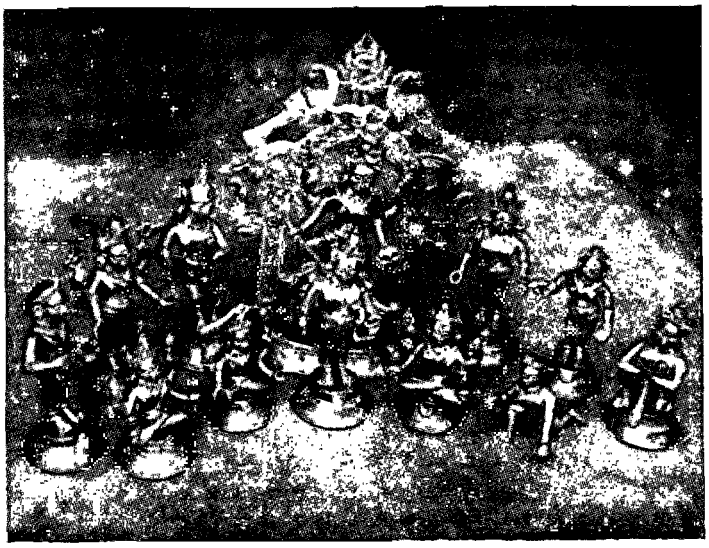
(iv) ***Decorative Wares and Curios***— The aristocrats have further demands on the imagination and creative talents of the artisans of brass and bell-metal. The artisan generally devises unique objects of decoration and ornamentation and is confident of finding admiring customers in art-lovers. At times, however, some fanciful requirements of the refined section of the population are ascertained by personal contact or through usual commercial channels, and the required objects are manufactured to suit the discriminating or fastidious taste of the patrons. Rose bowls, flower vases, flexible reptiles, animal figures, mythological images and anthropomorphic models in devotional or dancing poses are a few of the most notable specimens of the creative genius of the brass and bell-metal worker.



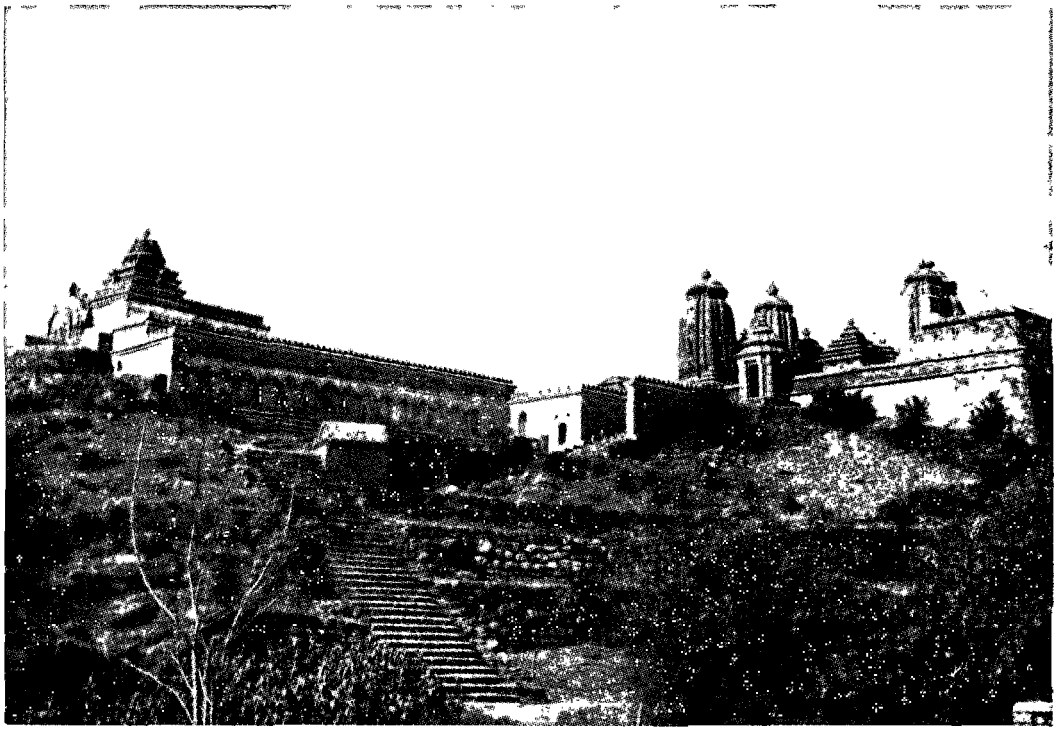
FLEXIBLE FISH



FLEXIBLE REPTILE



MYTHOLOGICAL IMAGES



NILAMADHAB TEMPLE AT KANTILO

[Enshrined is a charming statue of NARAYANA-VISHNU carved out of glossy black-stone, whose incarnation is believed to be Lord Jagannath of Puri]

SECTION II

LOCALITY OF SURVEY

10. There has been no systematic survey of the craft as practised in Orissa, and little has been written on the subject. It was, therefore, considered worthwhile to conduct a local survey in order to collect some basic information about the organization, structure and commercial aspects of the craft. A rapid survey was made with regard to several important centres of production in the State, but finally intensive investigation was confined to one of the great centres, *viz.*, village Kantilo in the district of Puri.

Kantilo

11. Village Kantilo stands on the right bank of the river Mahanadi, and is within the administrative jurisdiction of Police Station Khandpara in the district of Puri. The village is situated amidst picturesque surroundings of forests and rivers, on the confluence of the river Mahanadi with its tributary the Kamai, about 80 miles upstream from Cuttack. It is an ancient small town noted as a centre of commerce and trade for over a thousand years. A visitor may be struck at the first sight with the special features of the town and may aptly describe it as a town of temples and brasses. There are at least a dozen large and old temples, the most noted among them being the temple of Nilamadhab, which is sanctified by the worship of Lord Jagannath. Although the temple had extensions in recent centuries, there can be no doubt about the antiquity of the original structure. The legend connected with the establishment of the temple is told in the following words by a local chronicler:

> "In the golden age, Indradyumna, a king of Malwa sent out Brahmins to seek for Vishnu. In this process one of the Brahmins named Bidyapati wandered far and wide over hills and dales till he reached the country of the aboriginal tribe 'Shabar'. He picked up acquaintance in course of his journey with a hunter Viswabasu, a devotee of Lord Jagannath who used to go into the jungle, collect fruits and flowers and offer them to his Lord in secret. At least, Bidyapati won the confidence of Viswabasu who agreed as a proof of his friendship to show him the Lord in the form of a blue stone image at the foot of a tree. Ultimately a Raja of the Shabar tribe placed the image on a hillock beside the bank of the river. As habitations grew round the place of worship, the locality finally developed into the village of Kantilo''.

12. Kantilo is a large village with an area of 1,560 acres according to local revenue records and consists of 16 sectors, locally called 'Patana', forming the residence of 1,300 families of 6,377 souls in the Census of 1961. The villagers belong to 23 different castes, from Brahmin to untouchables, such as, *hadi*, *pan* and *kandara*. But the most important caste is the one which comprises members who are engaged in commercial and industrial enterprises and are called as *kansari* or *tambera*.

Number of workers

13. Brass and bell-metal industry is the main-stay of village Kantilo. According to the survey conducted in the village, the number of workers in brass and bell-metal was 1,103 engaged in 206 brass workshops

and 43 bell-metal workshops. The workers are drawn from both the sexes, males and females, and comprise skilled workers as well as un-skilled personnel. Further details are given in the statement below:

WORKERS ENGAGED IN BRASS AND BELL-METAL INDUSTRY IN KANTILO

No. of workshops			No. of skilled workers			No. of un-skilled workers			Total workers
Brass	Bell-metal	Total	Males	Females	Total	Males	Females	Total	
206	43	249	413	90	503	600	—	600	1,103

Castewise data

14. It was revealed in course of the survey that the occupation is not confined to the traditional castes of braziers but embraces many other castes living in the village who chose to follow the profession. The number of persons belonging to different castes engaged in brass and bell-metal industry is given in the following statement:

WORKERS DISTINGUISHED BY COMMUNITY

Name of the community	No. of workshops owned		No. of workers engaged	
	Brass	Bell-metal	Males	Females
1. Kansari ...	204	43	822	90
2. Teli ...	1	...	15	...
3. Thodia ...	1	...	60	...
4. Kamar ...	...	...	20	...
5. Keuta ...	...	...	10	...
6. Gauda ...	...	...	6	...
7. Gudia ...	...	...	6	...
8. Bhandari ...	...	...	36	...
9. Baishnab ...	...	...	5	...
10. Tanti ...	...	...	16	...
11. Karan, Chasa ...	...	...	17	...

SECTION III

RAW MATERIALS

15. The basic raw materials required for the manufacture of brass and bell-metal wares are copper, zinc and tin. Brass is an alloy of copper and zinc, while bell-metal is an alloy of copper and tin. With a view to appreciate the effects of amalgamation of these metals to form the required alloy, it may be of advantage to know about the metallurgical characteristics and general properties of the basic metals themselves.

Copper

16. As a metal of commercial importance, copper ranks next to iron and steel. It is a moderately hard metal and has sufficient strength for many structural varieties. It is easily rolled into sheet and run into wire. It has the greatest resistance to weathering and has the highest electrical conductivity, volume for volume of any metal or substance, next to silver. The metal has a distinctive reddish colour from an artistic standpoint, but this colour changes from shades of red to yellow as zinc is added to form different grades of brass. The normal boiling point of copper is high, *viz.*, 1,083°C.

17. Copper in its pure form is unsatisfactory for casting and welding purposes. This metallurgical deficiency is the consequence of the fact that copper in its pure state is remarkably porous because of release of gas from the body of the metal in the process of solidification. Another draw-back seen in day-to-day use is that the surface of pure copper, unless kept polished, varies in colour by tarnishing due to oxidisation, which gives a coating of some copper compound, namely, Cuprous Oxide (Cu_2O) or Cupric Oxide (CuO). Such coating of copper is analogous to the rusting of steel.

18. In malleability, copper is surpassed by gold and silver, and in tensile strength only by steel. But next to these metals, copper has high qualities particularly of durability and toughness. Copper cannot be easily shattered by blast. In hardness it assumes good results when worked cold.

Zinc

19. This is another useful metal for commercial purposes. It is mainly used for galvanising, which process protects iron and steel from corrosion. Zinc retards the penetration of oxygen and is, therefore, an excellent resistant to corrosion. In Great Britain, zinc is mostly used for brass making but in the U.S.A., it is generally used for galvanising. Zinc is unfit for cold rolling as it is composed of large grains, but its strength and ductility are satisfactory. Addition of copper makes it sufficiently hardened for working purpose. It is bluish-white in colour and its melting point is fairly high, *viz.*, 905°C.

Tin

20. It is a silver-white metal and is noted for retaining its bright finish. The outstanding properties of the metal are resistance to corrosion, fusibility, softness and pliability. It has low melting point (232°C.), ensuring easy metallurgical processes. This metal like lead is structurally weak but is highly plastic. It is readily cold rolled into thin foil. Its use, however, is limited because of its cost which is 6 to 8 times higher than that of zinc.

Alloys

21. The basic metals have got some deficiency or other as mentioned above. As a result they do not become immediately

suitable for commercial use. The deficiencies are removed by alloying one metal with another keeping in view the qualities required ultimately for the specific purpose for which the alloy is intended. One or more of the required quality, such as, malleability, ductility, machinability, toughness, tensile strength, etc., are ensured by combination of metals in an appropriate chemical process and in correct proportions. Very intimate knowledge and experience in the preparation of alloys is necessary for obtaining the correct quality; otherwise, the material may not become suitable for a particular purpose. If the alloy is out of proportions, it may respond poorly to casting, welding, rolling, drawing or other processes.

22. As mentioned above, different kinds of alloys are manufactured by varying the composition and proportions of basic metals. The metals making particular alloys are indicated below:

(i) Copper and zinc make binary brass.

(ii) Copper and tin make binary bronze or bell-metal.

(iii) Copper and zinc and tin make special brass or special bronze according to the proportion of zinc or tin.

(iv) Copper and zinc and nickel make nickel silver or German silver.

Effect of amalgamation of zinc with copper

23. Tensile strength which is poor in copper, increases with increasing zinc content up to a maximum of 40 per cent of zinc. Ductility also increases with zinc content but reaches a maximum at about 30 per cent of zinc. Casting qualities are greatly improved by such amalgamation. Welding quality also becomes satisfactory. Resistance to corrosion which is excellent in pure copper remains unaffected up to 20 per cent of zinc but thereafter it begins to fall off. Finally, the amalgamation of the two metals creates an advantage of commercial nature, namely, the cost of the alloy becomes lower since the price of zinc is less than that of copper.

Effect of amalgamation of tin with copper

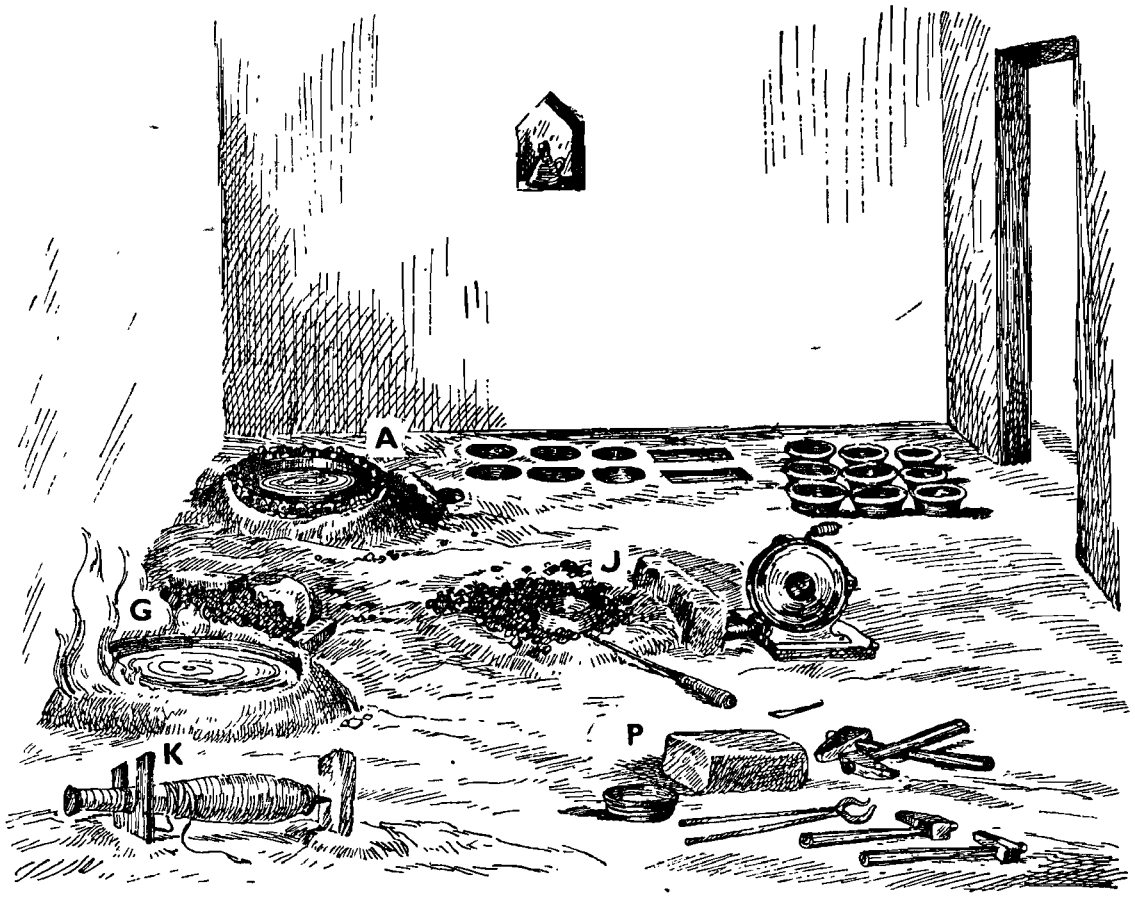
24. Copper in its pure state is unsuitable for casting because of its porosity. The process of casting is greatly facilitated by amalgamation of tin with copper. Brightness and polish are also ensured by such combination of the metals. The melting point of copper which is normally very high (1,083°C.), is considerably reduced by amalgamating tin with copper. The amalgum thus becomes more amenable to easy metallurgical process.

SECTION IV

PROCESS OF MANUFACTURE

Workshop

25. The workshop of a brazier is a small compact unit organized with a view to accommodate all the activities connected with the manufacture of brass or bell-metal wares. It is just one single room, or even a mere shed, usually not bigger than 15 feet long and 11 feet broad. In this room all the equipments necessary for the manufacture of the products are installed or kept arranged, and there is accommodation for all the workers, whose number is usually limited to 2 or 3 and occasionally exceeds that. A bigger hall is considered inconvenient, because it will necessitate more extensive movements of men and materials, resulting in unnecessary strain and loss of time. In case of small establishments, the work-shed is generally an adjunct of the residential premises of the artisan.



A VIEW OF SALAGHAR (WORKSHOP)

26. As the illustration above shows, the workshop which is locally called Salaghar has got five sections, namely:

(a) ***Auta-Sal***—This is the melting hearth comprising a circular vertical pit about 18 inches in diameter, narrowing downwards to a depth of 18 inches. It has a diameter of about 9 inches at the bottom. The bottom has an opening 6 inches in diameter which runs for about 20 inches in a slanting manner until it emerges at the floor of the workshop at a small distance from the rim of the hearth. This slanting hole is meant for transmission of air blast from a rotary blower. The bottom of the hearth is filled with broken tiles arranged so irregularly as to leave adequate inter-spaces for passage of air from the blower to the burning charcoal which fills the hearth. A melting pan made of steel is placed over the hearth and is heated by blazing charcoal below. In the illustration the melting hearth is shown by mark 'A'.

(b) ***Gadha-Sal***—This is the hearth meant for forging work. The hearth is made more or less on the same principle as the melting hearth but is specially utilized for heating of ingots and for other types of forging work. Dimensions are, however, different. The circular pit is 36 inches in diameter at the surface and 12 inches at the bottom, and is 18 inches deep. The second pit which starts from the bottom of the first pit is 7 inches in diameter and 8 inches deep, from which a slanting hole meant for air blast starts. The hearth is marked 'G' in the illustration.

(c) ***Jhala-Sal***—This is a smaller hearth meant for soldering purpose. In the illustration this part of the workshop is marked 'J'. It has a pit, heated with charcoal under fire and blast, meant for soldering parts of utensils or similar objects. It is 27 inches in diameter at the surface, 12 inches at the bottom and it is 17 inches deep.

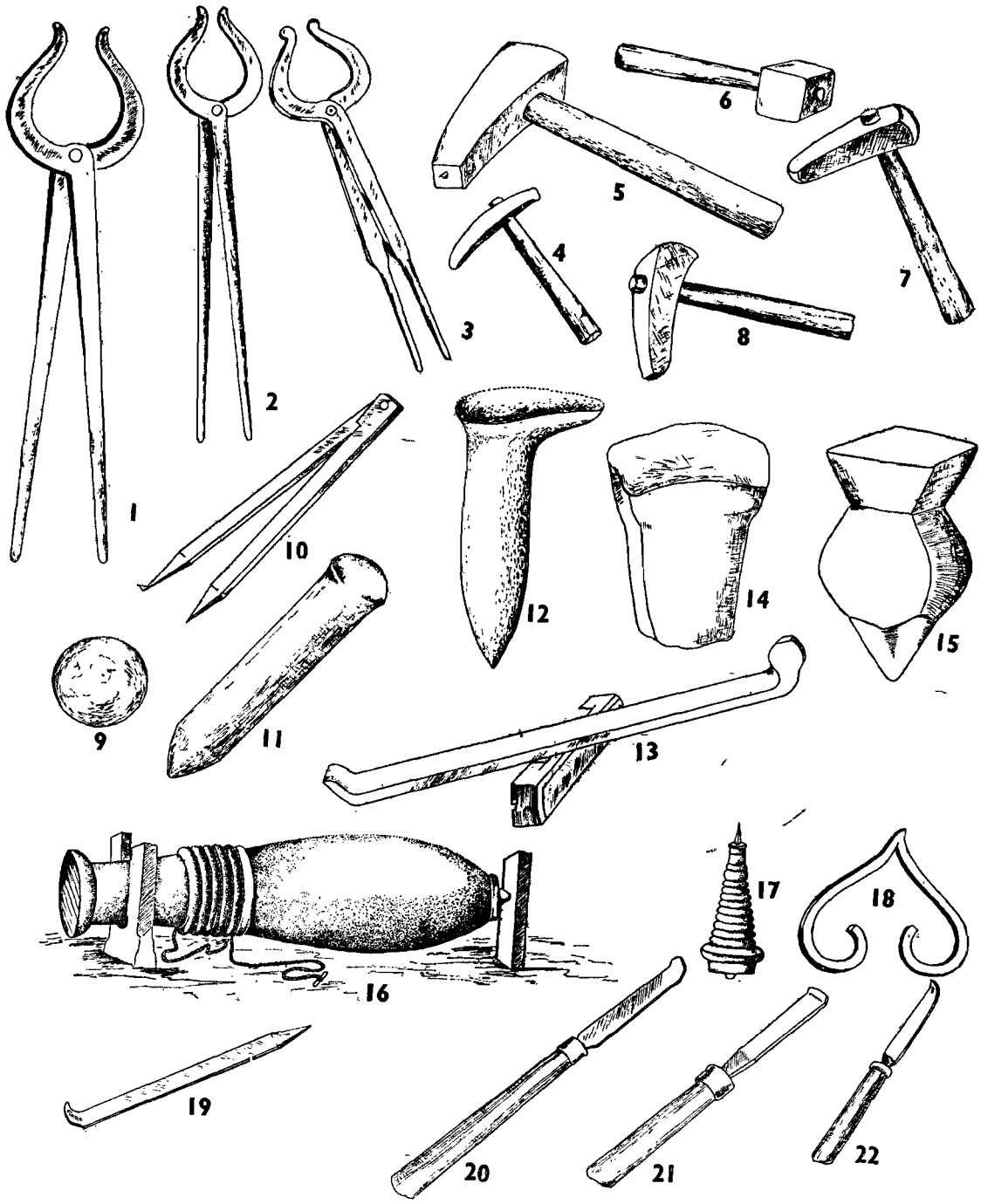
(d) ***Beating Unit***—One corner of the workshop is occupied by a stone anvil which is locally called *pathara* because it is a simple piece of granite stone. Beating process is carried on here with the help of hammers of different sizes and pairs of tongs of different varieties. The hammers are of different weights, the heaviest being about 20 lbs. In the illustration, the beating unit is marked 'P'. The workshop has one number of blower, either a hand operated leather bellows or a rotary blower. This blower is shifted and fitted into either the *Auta-Sal* the *Gadha-Sal* or the *Jhala-Sal* according to necessity from time to time.

(e) ***Lathe Shop***—Lastly, one corner has got a wooden hand-driven lathe, locally called *kunda*. An article under manufacture requiring turning operations is held in this machine which is rotated by manual process so as to allow chiselling or polishing work to be done. In the illustration this portion of the workshop is shown by mark 'K'.

Tools and Equipments

27. A number of simple country-made tools are required in the workshop for execution of various processes there. Most important among them are a variety of hammers, anvils, tongs, chisel, scraper, etc. Most of these tools are illustrated in the next page. In order to identify them by local names, each one has been serially numbered in the illustration, and the corresponding serial number below indicates the names of the tools.

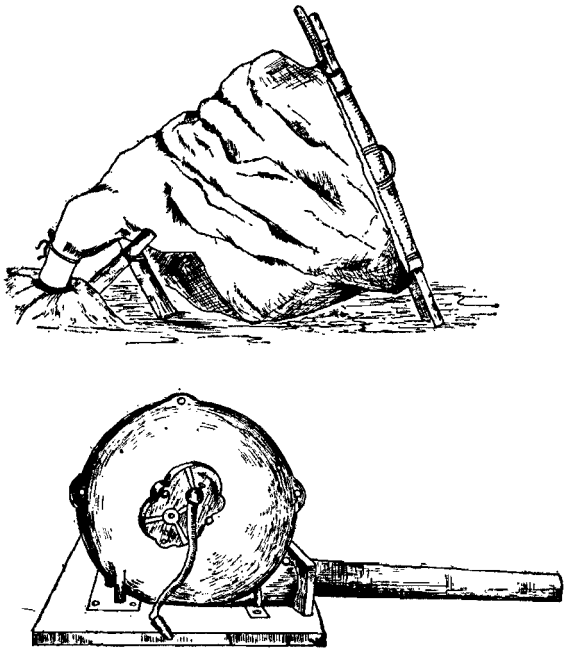
28. The supply of adequate quantity of air is necessary for the hearths, particularly for the melting hearths, which require a high temperature exceeding 1,000° Centigrade to enable copper to reach melting point. The flow of air is maintained by



TOOLS USED IN WORKSHOP

1. Dahan 2. Sandasi 3. Kundali 4. Mathena 5. Balochwta 6. Othapadia 7. Suanla 8. Kanto-hathudi 9. Gula 10. Kampass 11. Badagotialu 12. Kandhamara 13. Banko-sabala 14. Nehi 15. Samadana 16. Kunda 17. Bhanara 18. Makari 19. Pahan-kathi 20. Salankuri 21. Niheni 22. Gunaniheni

leather bellows, called *Chamada-bhati* or by rotary blowers, which are illustrated here. These equipments require strenuous physical labour, particularly when the hearths are raised to high level of temperature.



BELLOWS AND BLOWER

Manufacture of Brass

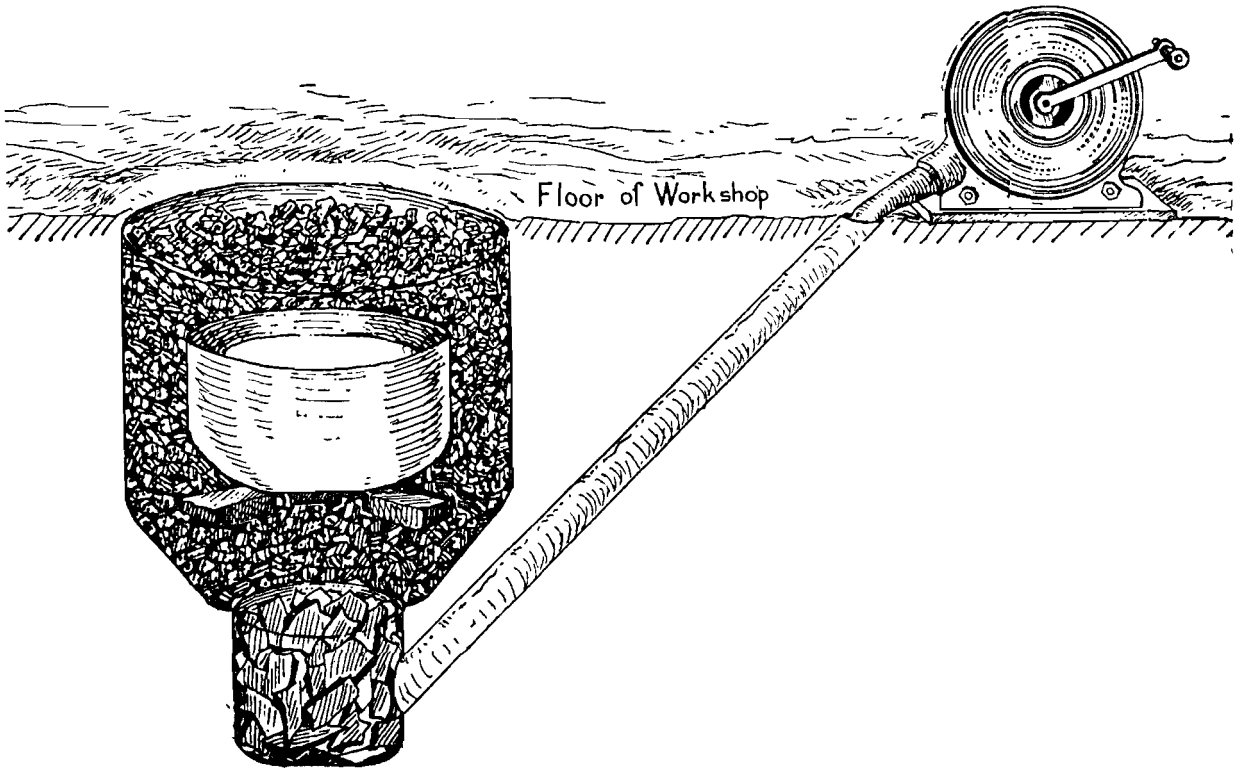
29. Brass is an alloy of copper and zinc and is formed by fusing together these metals in the ratio of 60:40 approximately. Copper requires more heat to melt as its melting point is 1,083°C., while the normal boiling point of zinc is 905°C. Therefore, copper is heated first and zinc is added to it later. Moreover, there is justification in melting copper first and adding zinc thereafter because of the fact that this process enables zinc to dissolve quickly before much of it can volatalise. Even so, there is some loss of zinc and it is not possible to keep the proportion correctly in all cases.

30. As copper is costlier than zinc, commercial considerations ultimately regulate the proportion of the two metals in such a way that the alloy may not be too costly for the local market. The proportions are thus liable to vary from one manufacturing locality to another. In village Kantilo the usual proportion is 45 seers of copper to 35 seers of zinc. The two metals when melted make 80 seers of brass. This is really not a high quality brass, because the correct proportion is 60:40 as mentioned above. In such a proportion, 45 seers of copper would require only 30 seers of zinc and not 35 seers. The addition of extra 5 seers of zinc in every 45 seers of copper is made on commercial considerations as zinc is cheaper than copper and it is necessary to keep the price of the alloy within reasonable limits in consideration of the prevailing market rate.

31. As copper and zinc are in short supply, the entire demand of raw brass cannot be met by manufacture of fresh alloys in the above manner. The production of raw material is supplemented by procurement of brass scrap from consumers in order to make up the gap between demand and supply. The scrap is procured by way of old and broken utensils collected by hawkers or retailers. Sometimes they are supplied directly by consumers in course of exchange of old for new brassware. The scrap is melted in the pan and its composition is tested. In case copper or zinc is found short in the composition, the particular component is added to get the correct alloy.

Brass melting hearth

32. The melting hearth comprises a series of two underground pits dug in the floor of the workshop. The first pit is made by opening a large circular hole 18" in diameter and 18" in depth, with the lower portion tapering into a diameter of 12". At the bottom of the first pit is dug a second small pit 8" in diameter centrally located. It is sunk 8" further below the bottom of the first pit. From one side of the second pit a slanting hole 4 inches in diameter is dug so as to open on the floor at a distance



BRASS MELTING HEARTH

of 18" from the rim of the first pit. This slanting hole is nearly 30" long from the floor of the workshop to the second underground pit. The second pit is then filled up loosely with broken tiles so as to leave enough opening space for air to pass. The head of this pit above the pieces of broken tiles is filled with adequate quantity of charcoal. The bottom of the first pit has three bricks over which an iron crucible for melting the alloy is placed. This crucible is nearly 15" in diameter and 8" in height. After the crucible is placed on the bricks the sides of the pit and the bottom are filled with charcoal to which fire is set and air is blown from a rotary blower through the slanting hole. The crucible is just large enough for receiving 45 seers of copper and 35 seers of zinc in 3 or more instalments in order to produce ultimately 80 seers of brass. After some quantity of metals is placed in the crucible, the top of it is filled with charcoal which keeps on burning along with the charcoal previously loaded at the sides and the bottom of the pit. The metal is thus subjected to high temperature which is easily obtained on account of the underground structure of the hearth not allowing thermal radiation. As soon as the first instalment of metals gets melted, another quota of metals is put into the crucible which is re-loaded with charcoal. In this manner, the process continues till all the metals are finally dropped into the crucible. The entire melting operation takes about 5 hours to complete.

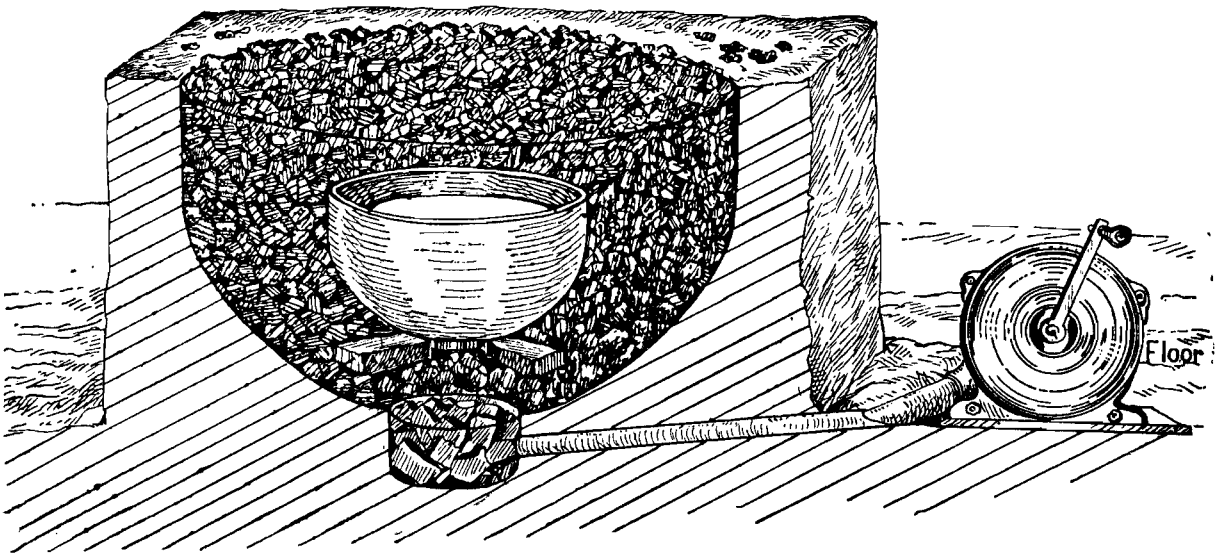
Manufacture of Bell-metal

33. Bell-metal is an alloy of copper and tin mixed in the proportion of 40:11. The

metals are melted in a special type of hearth by experienced artisans. Manufacture of bell-metal alloy unlike that of brass alloy is considered an expert's job. The special hearth for metling the alloy is described below.

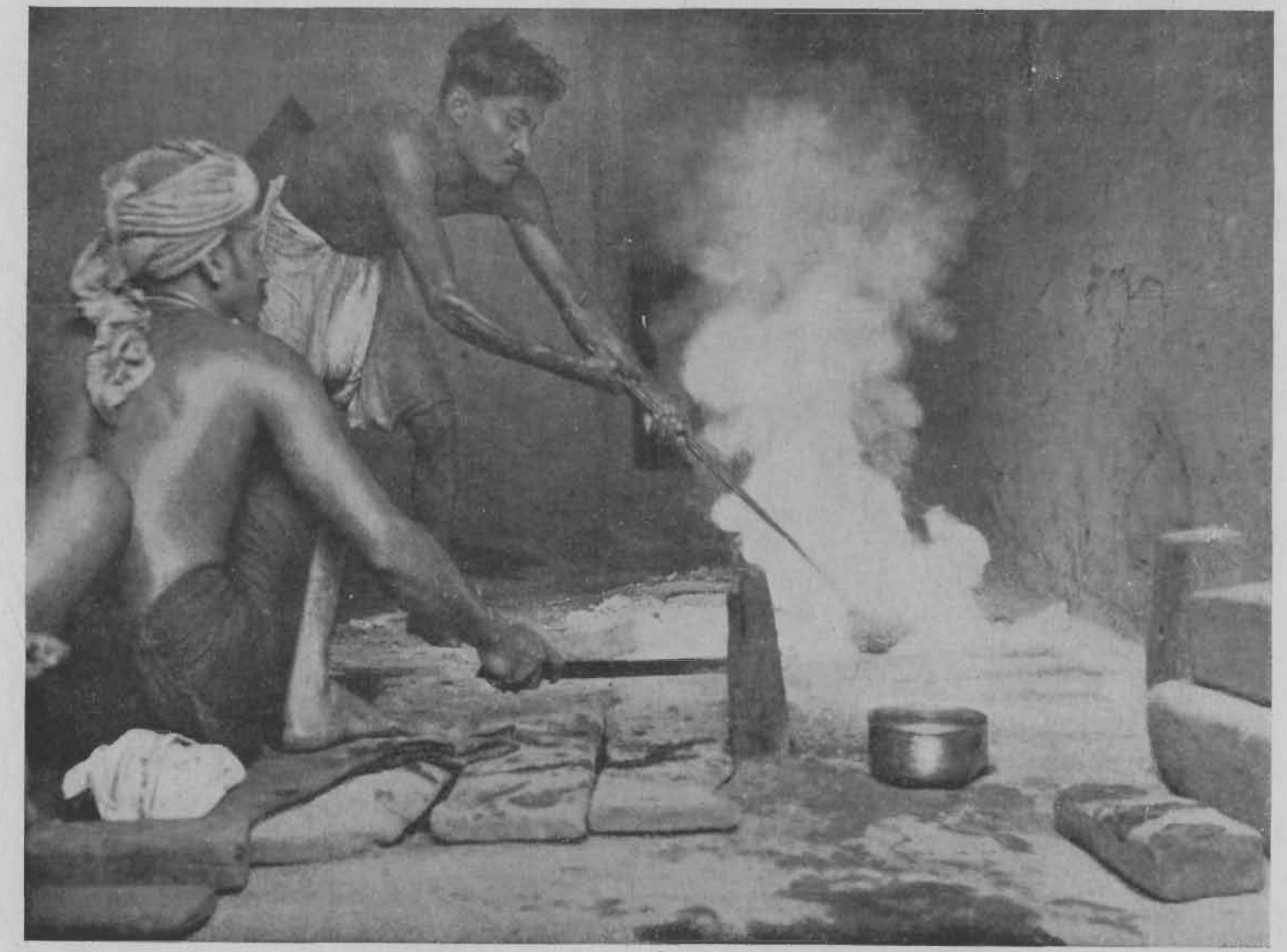
Bell-metal melting hearth

34. This hearth is seen in different sizes according to the requirement of the artisan concerned. The principle of melting the metals by application of heat is almost the same as in the brass melting hearth with the difference that the first pit is built over the ground level by heaping a mass of earth, and thus preparing a platform 27" high on the floor of the workshop. Inside this platform, a pit is dug. The usual size of the pit is 42 inches in diameter at the top, narrowing down to a diameter of 9 inches at the bottom, the height remaining the same as that of the platform, namely, 27 inches over the floor level. An earthen ridge 10 inches to 12 inches in height is sometimes built round the upper



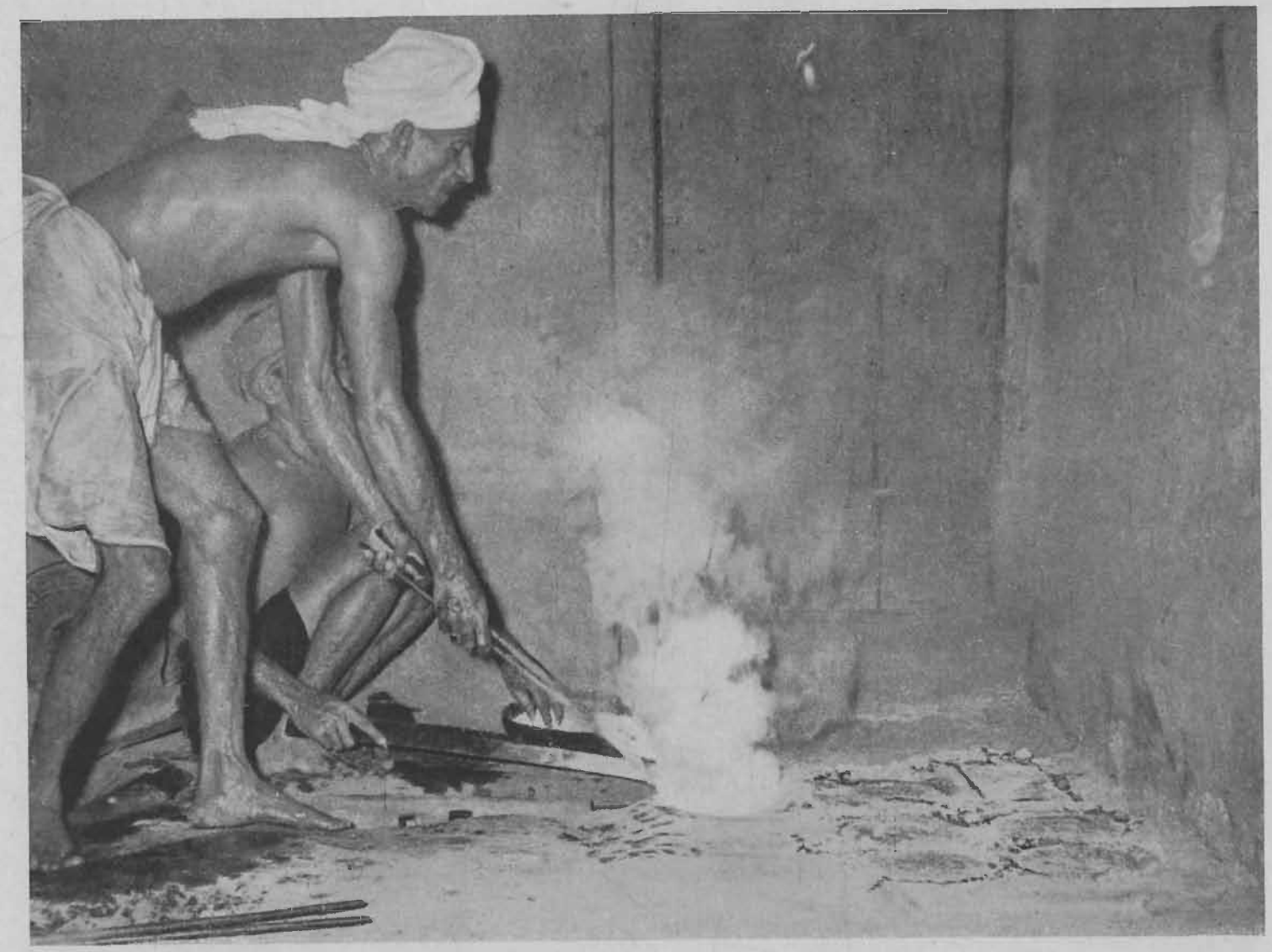
BELL-METAL MELTING HEARTH

rim of the pit over the top of the platform. A second pit is dug underground, just from the centre of the bottom of the first pit downwards, which is 9 inches in diameter and 6 inches deep. This second pit is filled with broken tiles in such a manner as to leave inter-spaces for passage of blast from the blower. The second pit has an opening on one side for admitting one earthen tube placed at an angle from the floor of the workshop. The rotary blower sends blast at the surfacing end of the tube and the blast passes through the tube into the second pit, and finally, making way through the loose package of broken tiles, emerges at the first pit to help charcoal keep ablaze. The first pit has already accommodated an earthen crucible, 17 inches in diameter at the top and 8 inches at the bottom, with charcoal packed between the walls of the pit all round the crucible. The crucible has a height of about 10 inches, so that when it is placed inside the pit, its upper edge is nearly 17 inches below the top of the platform. As the charcoal is enkindled and blazed, lumps of copper are dropped into the crucible, which are covered with a further charge of charcoal in order to induce intense heat required for melting the



MELTING HEARTH

Artisan taking out molten metal in a ladle



MOULDING

Molten alloy being poured into pits in the floor serving as earthen moulds.
(Artisan profusely perspiring due to intense heat)

copper lumps at a temperature above 1,083°C. Tin is added subsequently after copper has attained melting point. The metals are charged into the crucible in more than one instalment.

Metallurgical test by visual method

35. After hours of boiling in the intense heat of the hearth, when the melting process seems to reach a stage of finalization, the artisan starts testing a sample taken out of the liquid alloy, whether it is brass or bell-metal. A little quantity of the molten metal is taken out in a ladle and is poured on the floor. It looses temperature and becomes solid within minutes. This piece of sample is locally called *chanakh* and the metallurgical test which follows is known as *jyoti-dekha*. The test is done by beating one end of the solidified sample of alloy into a thin rod which is dipped into water and broken by hammering. The artisan then minutely observes the broken ends to see the correct colour of the alloy and the size of grains, the extent of homogeneity and smoothness in the structure, and judges if the fusion of the two metals is complete, or if any one of the two metals composing the alloy is in deficit. In case of deficiency of any type, remedial measures are taken. If any particular metal is not adequate in the composition, a further quantity is added to the molten alloy which is still in the melting pan in the hearth so that the correct consistency and composition can be maintained. The visual method of metallurgical test involves keen power of observation and considerable skill and experience. The test is repeated until the sample comes to a satisfactory standard.

Moulding

36. As soon as the melting is complete and the sample is tested and is considered to have attained the required standard, the liquid metal is poured into moulds to produce billets or ingots (*ghati*) of two types, round and oblong. The circular billets are used for manufacture of sheets while the rectangular or oblong ones are used for manufacture of solid pieces of various types or for casting process. The moulds are pots of burnt clay. Sometimes a portion of the floor of the workshop is dug into small pits to serve as earthen moulds. The moulds are smeared inside with castor oil before the liquid metal is poured in. This facilitates easy removal of ingots from the moulds.

37. The ingots are of different sizes according to the requirement of a particular product. The size and the approximate weight of ingots for making one large cooking pot or water storage pot weighing, for example, 36 seers are indicated below. Such a pot or *handa* is made of 3 ingots, namely,

(i) A circular ingot, 9 seers in weight for making the upper portion,

(ii) A rectangular ingot, 12 seers in weight for making the middle portion of the *handa*,

(iii) A circular ingot, 15 seers in weight for making the bottom of the *handa*.

Processes of Shaping: Beating method

38. The shaping of the product is achieved usually by two methods, namely, (i) by beating the ingot and (ii) by casting in moulds. In the beating process, the ingots are heated in a furnace and are beaten to the approximate shape of the product. The heating and beating is repeated for some time. In case of wares to be manufactured from sheets, the outline of the article intended to be produced is marked on the sheet and flat pieces are cut along these outlines. The shaping of the required articles is done by the flat

pieces of brass sheets being beaten into particular shapes by hammering them over a stake.

Casting

39. The process of casting is not generally applied to bell-metal wares in Orissa. It is mostly confined to brass wares. Casting involves four different operations, *viz.*, (i) making a model of the object, (ii) preparing mould of the suitable size and shape according to the model, (iii) melting the alloy, and (iv) pouring the molten metal into the mould. The mould is made either of clay or of wax. Delicate and artistic objects require wax mould while commonplace articles are made in clay moulds.

40. The clay mould for a drinking glass, for example, is made in the following manner:

A viscous oil is anointed on the inner and outer sides of the glass. Thereafter, some sticky clay is thickly plastered on the outer side. The inside of the glass is then filled up with a mass of the same kind of clay. The outer mould is vertically cut into two portions before the clay dries up. The inner and the outer moulds are then dried in the sun or near-by a fire-place. At the time of casting metal, the two halves of the outer mould are held together by a plaster of mud over the inside line. The inner clay mould is then kept inside in such a manner that the thickness of the unfilled intervening space remains the same on all sides. Molten metal is then poured into the empty space between the outer and inner moulds, which gets solidified in the natural process of cooling. It then assumes the shape of the required drinking glass.

41. Besides wax and clay, some moulds are also made in wet sand. This material is particularly popular in Andhra Pradesh from where a few artisans came down to Orissa in order to demonstrate the practice of using this new medium of mould. The Andhra artisans bring with them a special equipment for use in the casting process. One of the entrepreneurs of Kantilo, *viz.*, Sapani Sahu has started manufacture of *lota* by such special casting process, but the local artisans do not appear to be greatly interested in this process. The reason is not only the suspicion how far the products of such casting may become popular but also because of the reluctance of the local artisans to make a departure from their traditional techniques. The greatest virtue of the local artisans, *viz.*, high fidelity in the perpetuation of the standards and the techniques of their forefathers will run the risk of obliteration if they acquire preference for innovations.

Lost wax Process

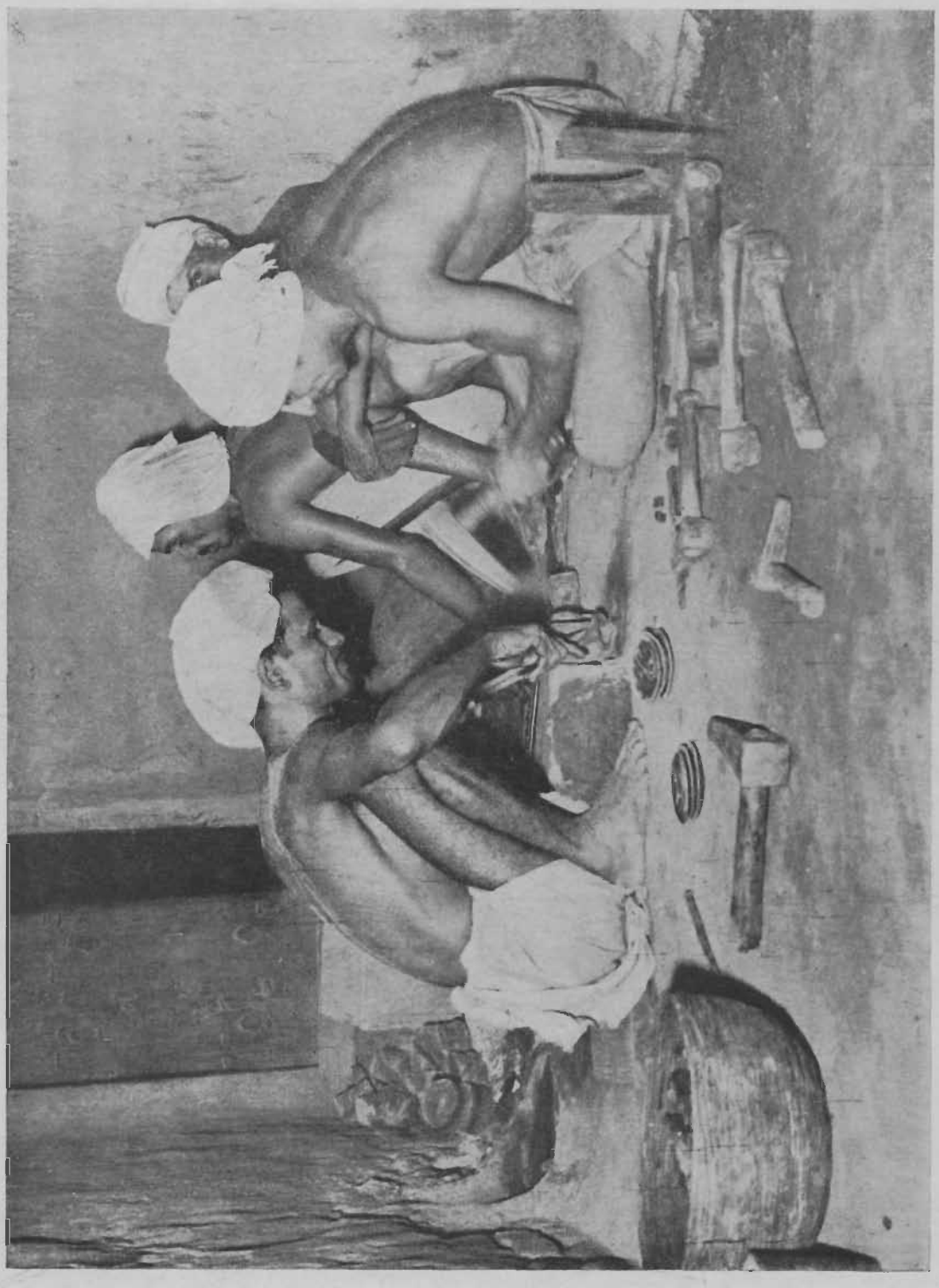
42. Another interesting technique of casting is known as the 'Lost wax Process'. At first, a model is made in wax. All the details that are to appear in the object intended to be cast are carefully and delicately worked out on the wax, the minutest not being spared. The wax model is then covered with a thin coat of special clay, which is allowed to dry up in shade. A day later, another such thin coat is applied and dried up and finally a third coating is thickly plastered. Two holes, one at the top and the other at the bottom are then bored through the plaster of clay so as to reach the wax. A quantity of the appropriate alloy in molten condition is then poured in through the top hole. The mass of wax contained in the model gets melted due to the heat of the molten metal and starts escaping from the lower opening. The metal takes the exact place of the wax and when solidified is released by breaking open the coat of clay. The cast figure comes out.

43. This metal figure is minutely examined to see if there are any moulding defects. Such defects are sometimes caused by the failure of the molten metal to flow fully and homogeneously through the



MOULDING OF INGOTS

Making of ingots of various measured sizes. The molten alloy is being poured into earthen moulds.



BEATING OF INGOTS



BEATING TO SHAPE



SOLDERING PIECES OF A LARGE HANDA

mould thus leaving gaps. Sometimes gases generated during the pouring of the metal fail to escape and get lodged in pin-holes. Such defects are considered minor and usual and are set right by soldering, chasing and embellishing with some simple hand tools. The final touches are given most cautiously so that the delicate artistic details of the original modeller in wax are not obliterated.

44. The principal disadvantage of the Lost wax Process is that only one piece can be made from a model. As the original wax model is allowed to escape in a liquid form and as the clay coat is broken down, it is not possible to prepare duplicates. In spite of this disadvantage, the process is still practised in some parts of Orissa, particularly in Mayurbhanj district.

Popularity of Beating Method

45. Among the various processes of shaping the brass or bell-metal wares, 'Beating' is more popular than 'Casting' in different centres of production in Orissa. Objects made by beating process are usually hard and durable. Moreover, bell-metal wares made by beating process can be further made strong by subjecting them to the process of tempering. But an article manufactured by casting process cannot be tempered. There are, however, some draw-backs in the beating process. A large number of implements are necessary for the beating process. In casting, the implements are few and simple. If the model or the mould has been successfully made, all the worries of casting process are over. Moreover, casting is less laborious than beating.

46. The articles made by casting process are mostly of the category of human and animal figures, ritualistic lamps, decorative articles, and articles of utility, such as, grain-measuring pot, *lota* and small cups. The ritualistic articles and figures of gods and goddesses are made in some of the manufacturing centres of Ganjam, Puri and Mayurbhanj, while articles of household utility, such as, *lota* are made in Baidyarajpur near Jajpur.

Turning

47. The process involves pieces of brass or bell-metal of suitable size being spun by a country made wooden lathe. This lathe is locally known as *Kunda*, and is a simple instrument made of wood by a village carpenter. It is worked by a piece of string wound round the central part of the trunk of the lathe and pulled by an unskilled labourer holding the two extremities of the string with two hands, pulling and releasing alternately. The bottom of the pot intended to be turned is tightly fixed to the outer end of the lathe by means of a sticky gum called *Jaoo*. As the lathe is rotated clockwise and anti-clockwise alternately, the artisan holds a sharp chisel and applies it to the portion of the pot requiring turning. The lathe is used not only for giving final shape to the article of manufacture by cutting away the unwanted bulk, but also to impart the required amount of polish by scraping and brushing.

Soldering

48. Some articles are manufactured not in one whole piece, but in more than one, which ultimately require to be joined firmly into one composite article by soldering. Soldering is the process of joining metal parts of an article under manufacture with the help of a metal alloy called *Pahan*. This alloy is manufactured by the artisan himself in the proportion of Brass 80: Tin 1: Zinc 8. The alloy is generally of a low melting point than brass which is meant for joining. The alloy is cut into small bits and kept in a cup containing borax powder and water. The equipment used for soldering consists of a soldering bit *(Sara ankudi)* and a hearth. The parts intended to be joined are cleaned and heated and are placed in correct position. Borax is applied at the place to

be joined. The small bits of solder are placed at the joining place and the surface is heated. The solder melts and runs into the joint when the soldering bit which has already been heated red is drawn slowly along the joint, allowing the solder to flow into the space between the parts. Finally, the soldering is finished by light strokes of hammer over the joint. These mild strokes help in imparting smoothness to uneven and irregular surface resulting in the process of soldering. The article is then taken over by a filer who files off any roughness that may still exist. The filer uses a number of files from coarse to fine in succession according to the requirement of the article in hand.

Tempering

49. Bell-metal utensils are sometimes subjected to the process of tempering. The pot is put over the hearth and when red hot, is brought out and suddenly dipped into water. This process of quenching in water is called tempering which imparts additional strength to the utensil. Sometimes tempering gives black colour to the article. The colour is rectified by light cold hammering as well as by polishing.

Scraping

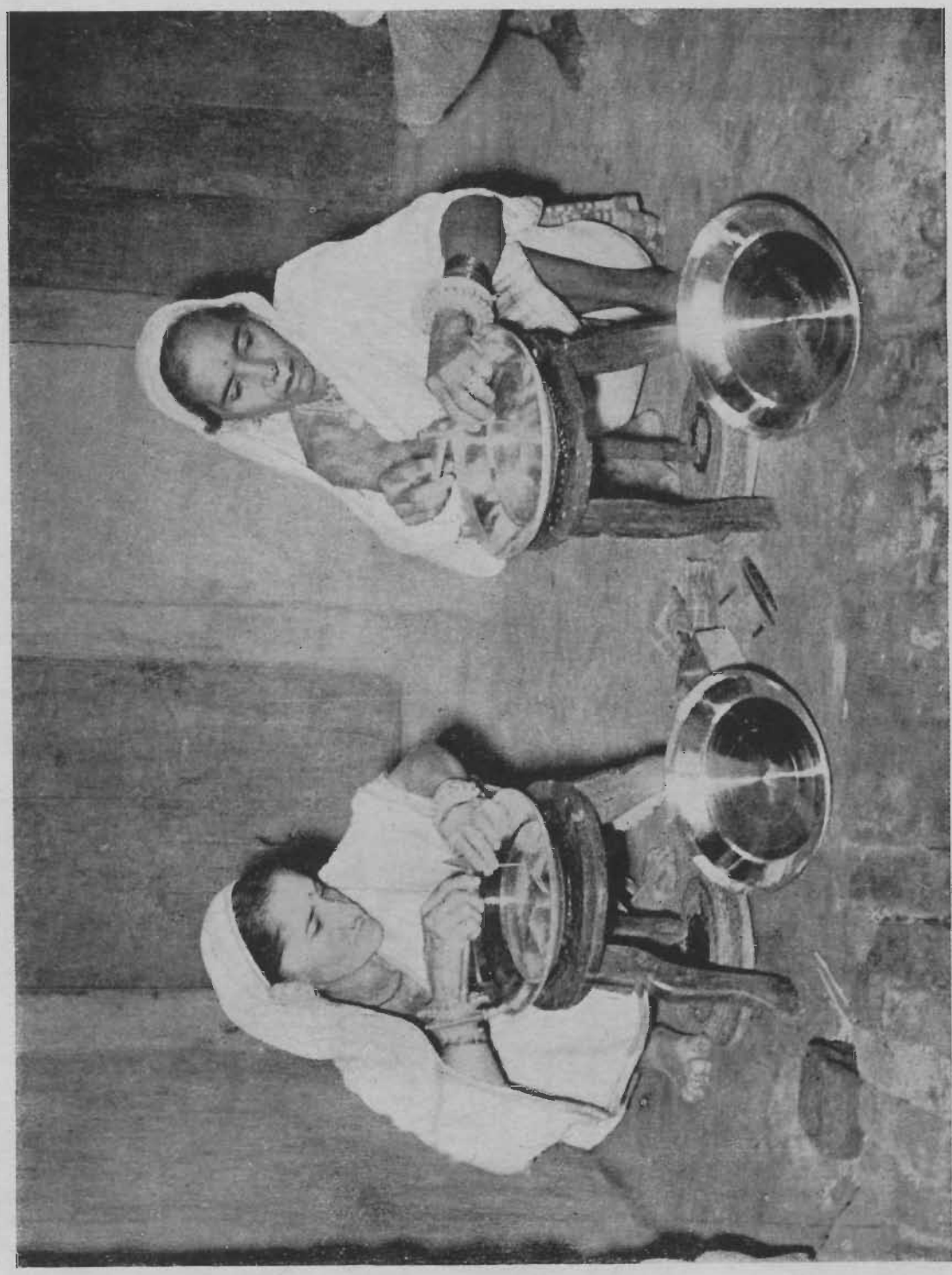
50. After the processes of soldering and filing and, if necessary, tempering are over the articles are subjected to scraping. Scraping may be done either by hand or by lathe. Scraping by hand is a simple and ancient process requiring no elaborate equipment. The scraper holds the chisel in one hand and the ware in the other, or between his two feet and scrapes the ware. The other method of scraping is with the help of an indigenous wooden lathe which ensures higher output. The vessel is mounted on the lathe by affixing a thick paste to the bottom of the ware and to one end of the lathe. The lathe is worked with a piece of string as a result of which the vessel revolves. The chisel or a pointed or sharp tool scrapes the revolving vessel to make the surface smooth. It may be possible to use a power-driven lathe in place of a hand-driven device. The power-driven lathe will eliminate the employment of a man to pull the strap for revolving the lathe. As, however, the manufacture is carried on in small household units, the hand-driven lathe or *Kunda* employs an otherwise surplus member of the family and does not become uneconomic. The installation of a power-driven lathe adds to the cost and brings complications of mechanical attention.

Engraving

51. In order to enhance the beauty and attractiveness of the manufactured wares, some artistic touches are given by the process of engraving. Sketches or designs are first drawn by an artisan having a good drawing hand on a particular product, such as, a plate or a cup or a *gara*. Generally floral or geometrical designs, figures of gods or goddesses or of temples, names of persons, etc., are chosen for engraving. The actual engraving work is left to a lady of the household in her leisure or even to a young girl, who with the help of a light hammer and a sharp punch follows the lines drawn by the senior artisan till the design is cut into the surface of the metal. Simple designs are however carved by the engraver free hand without the assistance of any markings on the ware.

Polishing

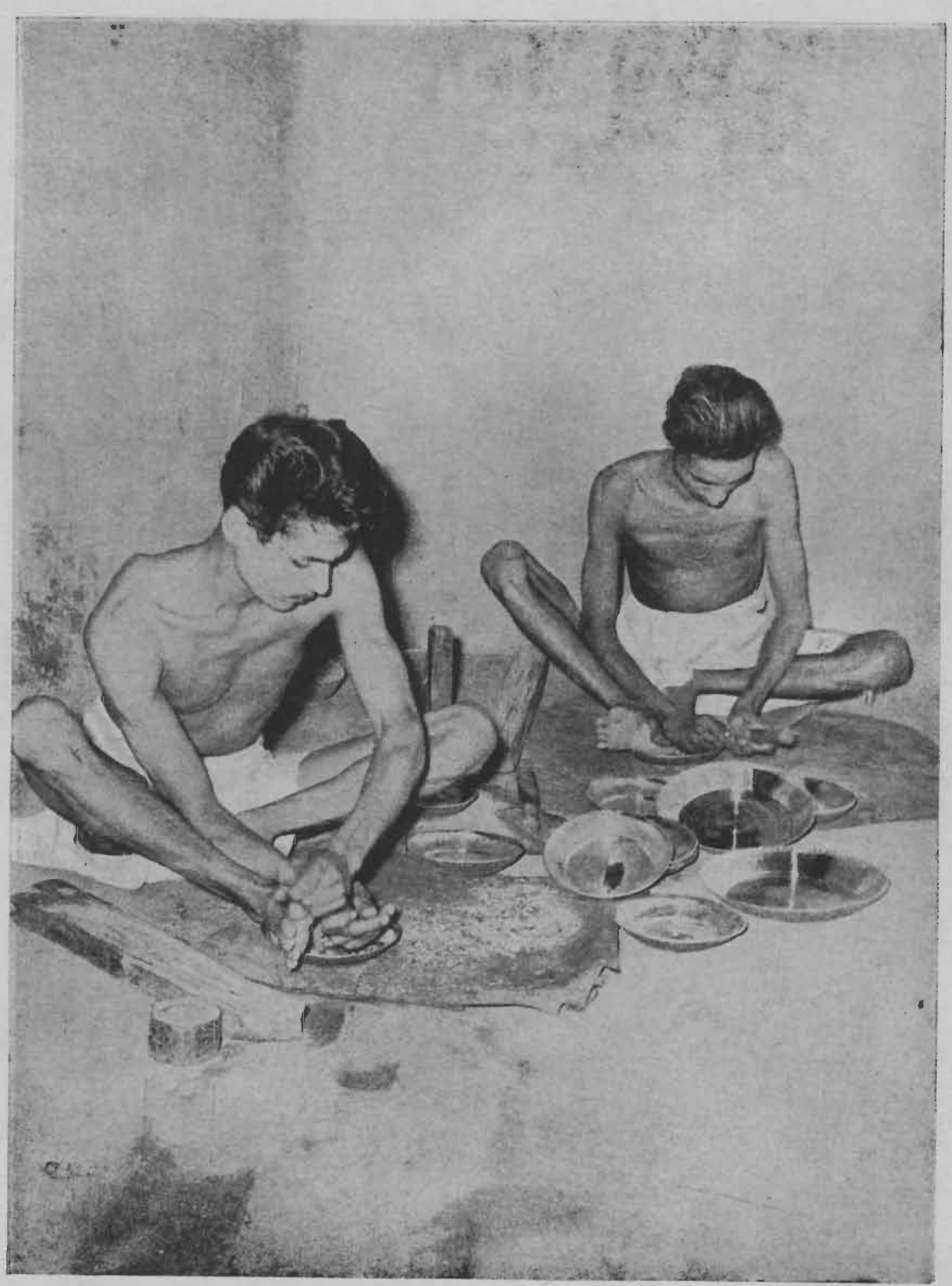
52. The marketability of the wares is considerably increased by imparting lustre and gloss by the process of polishing. Preliminary polish is given by many crude methods, such as, light hammering, scraping or rubbing. Thus, the method of polishing as practised in various centres of Orissa is based on simple manual process. Generally the final treatment which the articles receive comes to an end with light strokes on the anvil or some amount of vigorous scraping with a sharp chisel. At times, however, a little more elaborate



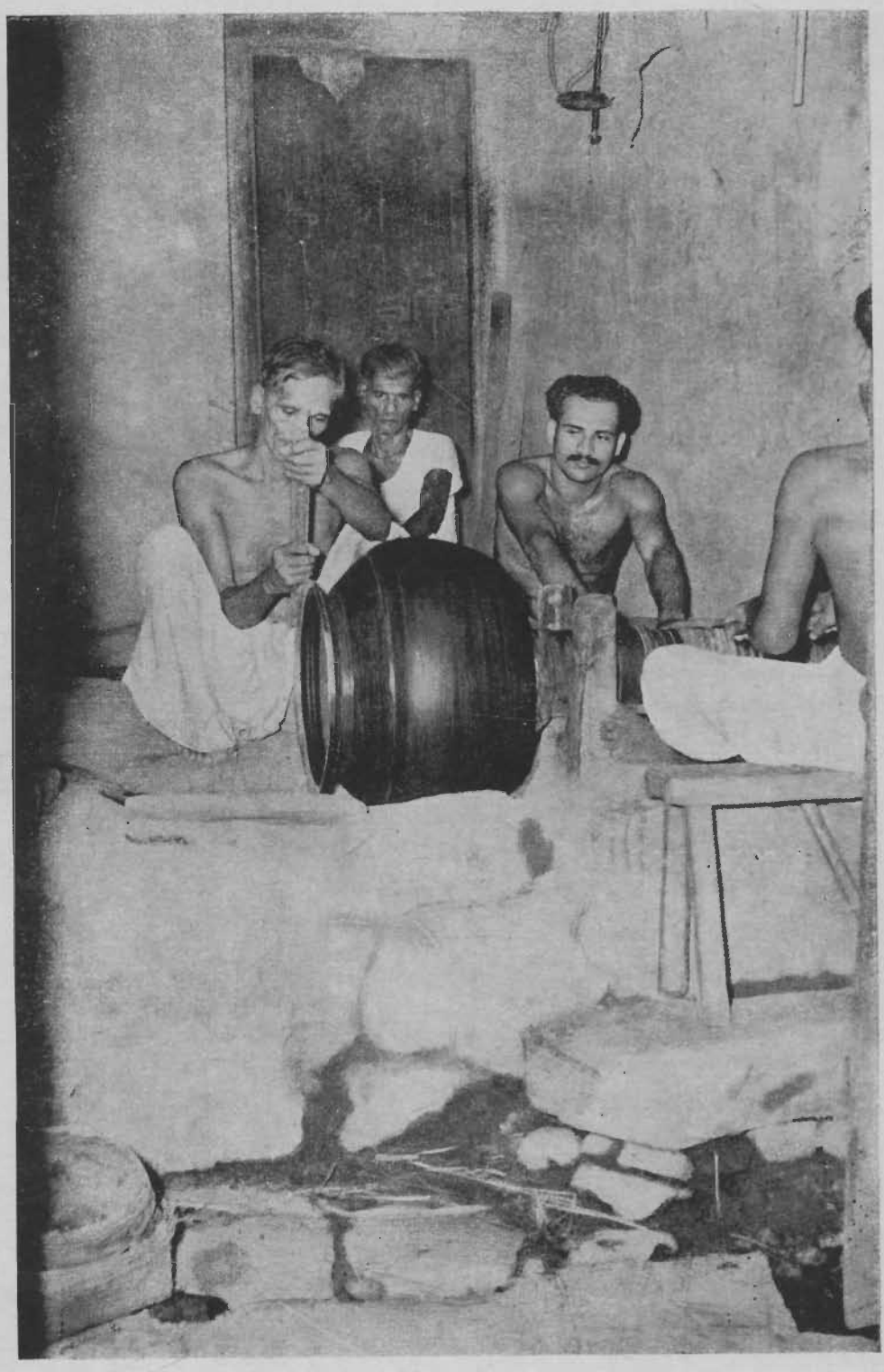
WOMEN ENGRAVERS AT WORK



FILING AND SCRAPING



SCRAPING TO POLISH



POLISHING A LARGE HANDA BY HAND-DRIVEN LATHE
It is a 3-man job



POLISHING WITH ELECTRICALLY DRIVEN CIRCULAR BRUSH

procedure is followed. The articles are first cleaned. Some kind of polishing compounds are applied. This is followed by vigorous rubbing either by hand or by feet. In case of a plate, for example, a person stands on it with a piece of rag placed between his feet and the plate and he swings to right and left or clockwise and anti-clockwise.

53. A common complaint about the brass wares produced locally is that the lustre and gloss which are given at the time of manufacture are lost within a few days. The goods become tarnished soon and require cleaning and polishing almost every day. It has long been felt that some sort of special skill and technical know-how should develop on the basis of special research work, so that a process may be discovered to enable the articles to retain the brilliance which is assumed at the time of manufacture.

54. In some centres final polishing is made by employment of a circular brush revolving with the help of a belt-driven device working with power. The vessel is simply held lightly against the revolving circular brush. With high revolution and soft touch it is possible to obtain high gloss. There is no industry in Orissa to give protective lacquers on the manufactured articles, nor is there any arrangement of polishing by means of electroplating the article as a part of the brassware industry anywhere in the State. Electroplating is in existence as an independent and separate industry but is nowhere allied with the industry of the brass and bell-metal workers. Electroplating is a process of giving a coat of a suitable metal on a particular article by the process of electrolysis. A few electroplating units which are found in the State are occupied with the business of plating with nickel some automobile parts, small machineries or miscellaneous articles. The bell-metal or brass articles meant for domestic and other ordinary uses are not subjected to electroplating process. In the absence of such facility, the brass and bell-metal products do not get the requisite gloss necessary for increasing the saleability of the articles.

SECTION V

ORGANIZATION OF THE TRADE

55. The brassware trade is almost entirely in the hands of certain specified castes, principal among which are Kansari, Kharuda, Tambera, Ghantera, Sitala and Thatari. They are dispersed over different districts in the State. In many villages they carry on their trade independently but in some localities they have formed co-operative societies, particularly with a view to get raw materials.

Man-Power

56. As the trade is in the hands of a few particular castes mentioned above, man-power is mostly drawn from amongst members of these castes. Both men and women are engaged in different aspects of the industry but sometimes members of other castes join as workers, particularly in the unskilled part of the work. Children are also employed in light jobs.

57. The survey carried out in village Kantilo showed that the number of establishments engaged in brassware industry is 206 and in bell-metal industry 43. The number of skilled whole time workers engaged in all these 249 establishments, is 503, *viz.*, Males 413 and Females 90. In addition, there were 600 unskilled workers all of whom were males. Thus the establishments numbering 249 employed 1,103 workers, skilled and unskilled. Out of these workers 912 persons, *viz.*, Males 822 and Females 90 came from one caste alone, *viz.*, Kansari. The remaining workers came from different castes living in the village, *viz.*, Teli 15, Thodia 16, Kamar 20, Keuta 10, Gauda 6, Gudia 6, Bhandari 36, Baishnab 5, Tanti 16 and Chasa 17.

Workshops

58. Out of 249 establishments in Kantilo, the largest number belonged to middle-sized ones, employing 4 to 5 persons each. The statement below gives the number of workshops by size of employment.

No. of workshops	Size of workshop, *i.e.*, number of persons engaged in each workshop	No. of workers engaged		
		Total	Males	Females
1	2	3	4	5
48	2 to 3 persons ...	162	117	45
189	4 to 5 persons ...	856	816	40
9	6 to 7 persons ...	63	58	5
3	8 to 12 persons ...	22	22	Nil

Technical training

59. The workshop provides technical training for young boys of the family. They attend the workshop during working hours and watch their elders engaged in different processes of manufacture. They begin by lending a helping hand in small and simple items of work, and are gradually drifted to undertake the more onerous ones. In course of a couple of years or so when the apprentices are sufficiently grown up and are physically fit for hard strenuous work, they are engaged in one of the sections in the workshop. In this manner they gradually take the position of whole time skilled workers. There is no facility whatsoever for them to go to a training centre organized specially for this purpose. They have no opportunity of learning new technique or benefiting by new ideas. The traditional pattern of training which they get in their family workshop becomes the sole basis of their technical experience and efficiency. In getting such training, they consider it advantageous to specialize in the manufacture of a particular type of product, such as, a *gara* or a *handa* and so on. Such specialists become sure of quicker outturn and better finish and ensure higher earning.

Supply of raw materials

60. The availability of raw materials presents considerable difficulty. The principal metals are procured either directly from Calcutta or from Cuttack, but the supply position is uncertain. Sometimes production suffers on account of inadequate supply of these metals. It is roughly estimated that in village Kantilo at least one week's idlenss is forced upon the artisans every month for want of raw materials. Another type of difficulty relates to varying impurity of metals. When the basic metals are available they are quite often below the standard quality. Firstly, the quality differs according to the different sources of supply. For example, tin imported from China is regarded as the highest in quality. Next in quality comes the tin from Malaya. Lastly is the tin from other sources of origin, which is regarded as quite inferior. According to a local dealer of the metal, tin from China is regarded 100 per cent pure, from Malaya 98 per cent pure and from other sources which fills Calcutta markets, about 85 per cent pure. Secondly, there is the widespread mischief of adulteration. The Calcutta market is most notorious for such activity. The result is, when the metals are in the hands of the artisan, he pays for them all right, but has no guarantee about their quality and purity. He suffers firstly in money and secondly in loss of time and energy in testing the quality of the metals. It is then obligatory for him to make the quality control tests again and again. This is necessary because the metals of different grades of purity need different ratios to be fixed, so that finally the artisan may get the correct qualty of alloy for manufacture of ingots.

61. Formation of Co-operative Societies of the workers in brass and bell-metal is helpful in the procurement of raw materials. The principal metals required for the industry are copper, tin and zinc. If there is a co-operative society under which the artisans are working, it is possible to get periodical quotas of these metals by arrangement with the Government. There are also some arrangements for supply of these metals to independent workers in the trade, although regularity is not ensured.

62. As the supply of basic metals is not regular, the artisans depend partly on such supply and partly on collection of old utnesils through retail dealers. The retailers are glad to increase the scope of their business not only by selling new articles but by collecting the old and broken ones from consumers by way of exchange. The price offered for old utnesils is nearly 60 per cent of the new utensils. This rate is

considered satisfactory both on the part of the consumers and the tradesmen.

Dispersal of Industry in Districts

63. It is possible to build up figures relating to the number of establishments and the number of skilled workers engaged on full-time basis in the brass and bell-metal industry in different districts of the State. Such information is available scattered in millions of Census Schedules prepared during the General Population Census of 1961. The principal schedules from which the information can possibly be gleaned are the House Lists and the Household Schedules relating to every household in the State. The figures gathered from these schedules are presented in Appendix at the end of Book II in a consolidated manner for each police station in the State. The names of villages and towns where the brass and bell-metal industry existed in 1961-62 have been shown in this Appendix, arranged police-stationwise, together with the total number of establishments, and total number of skilled personnel in each police station. A districtwise summary is given below for convenience of study.

STATEMENT SHOWING NUMBER OF ESTABLISHMENTS AND NUMBER OF SKILLED PERSONNEL ENGAGED IN BRASS AND BELL-METAL INDUSTRY IN DISTRICTS OF ORISSA

District	Number of establishments			Number of skilled workers engaged		
	Total	Rural	Urban	Total	Rural	Urban
1	2	3	4	5	6	7
Cuttack ...	687	614	73	1,400	1,208	192
Puri ...	711	708	3	1,370	1,360	10
Balasore ...	195	185	10	433	399	34
Mayurbhanj ...	153	152	1	299	297	2
Ganjam ...	431	377	54	997	872	125
Baudh-Khondmals ...	45	39	6	80	70	10
Koraput ...	129	117	12	240	222	18
Kalahandi ...	99	90	9	198	185	13
Sambalpur ...	788	749	39	1,976	1,887	89
Bolangir ...	184	165	19	334	291	43
Sundargarh ...	41	41	...	96	96	...
Dhenkanal ...	531	351	180	1,150	751	399
Keonjhar ...	152	135	17	339	310	29
ORISSA ...	4,146	3,723	423	8,912	7,948	964

64. It will appear that there are 4,146 establishments in Orissa dealing with brass and bell-metal products. They are mostly situated in rural areas although the towns are not completely free from activities relating to this industry. The total number of skilled workers engaged full-time in the business is 8,912 in the State. The industry is principally concentrated in five districts, *viz.*, Sambalpur, Cuttack, Puri, Dhenkanal and Ganjam. The other districts which have important brass and bell-metal centres are Balasore, Keonjhar, Bolangir and Mayurbhanj.

Important centres of manufacture

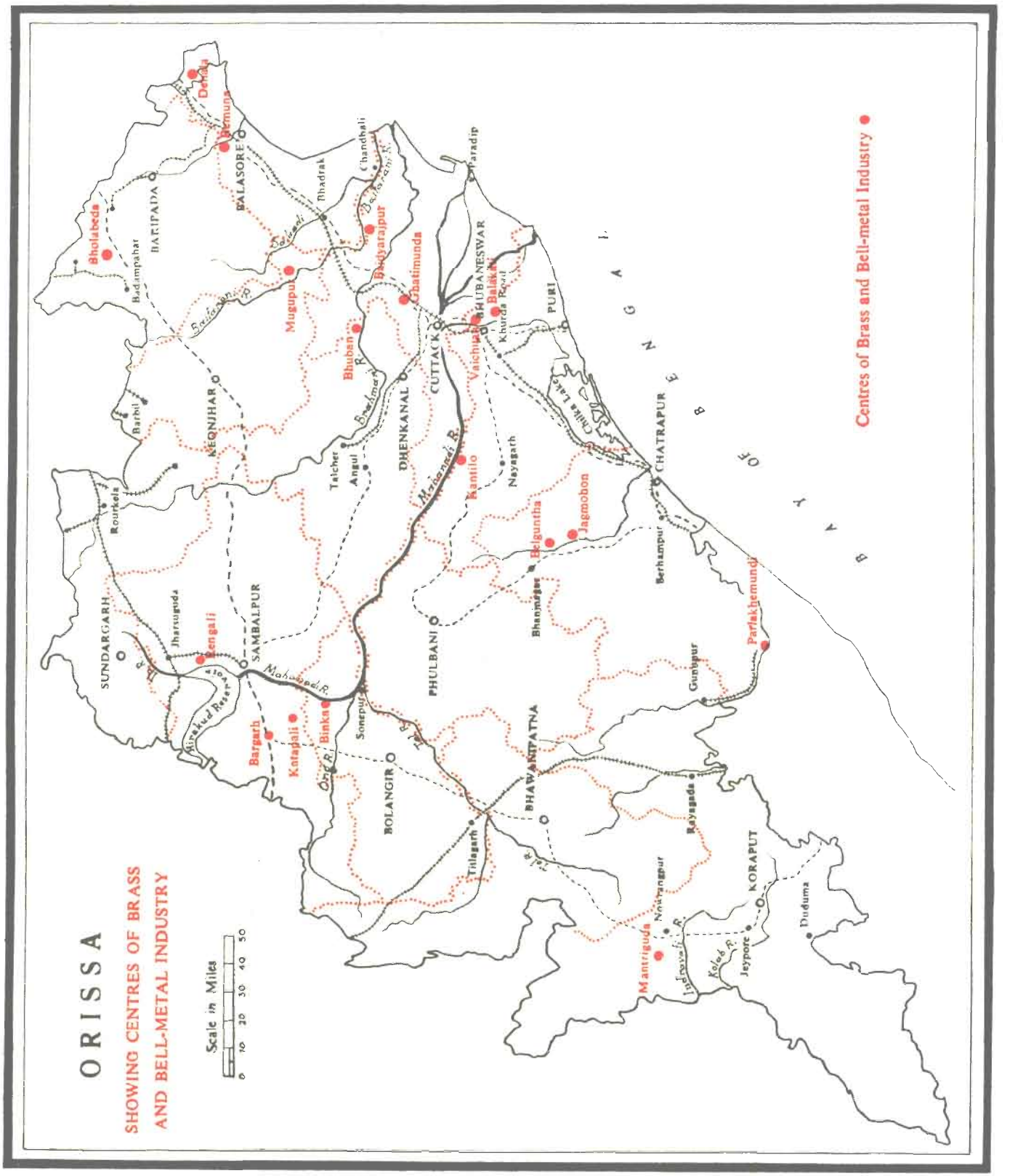
65. There are several hundred villages in different parts of the State where the industry is in a flourishing state. A few of the important centres of manufacture of brass and bell-metal wares is given in the statement below. Some of the principal centres are shown in the map of Orissa facing this paragraph.

CENTRES OF BRASS AND BELL-METAL PRODUCTION

Cuttack District	
Baidyarajpur	(Jajpur PS)
Bhatimunda	(Tangi PS)
Bindanima	(Tigiria PS)
Kanpur	(Kanpur PS)
Puri District	
Kantilo	(Khandpara PS)
Khalisai	(Khandpara PS)
Pratapsasan (Balakati)	(Balianta PS)
Bainchuan	(Balianta PS)
Muktapur	(Khurda PS)
Ganjam District	
Jagamohan	(Aska PS)
Bellaguntha	(Bhanjanagar PS)
Boirani	(Purushottampur PS)
Balasore District	
Remuna	(Remuna PS)
Dehala	(Bhograi PS)
Dhenkanal District	
Bhuban	(Bhuban PS)
Pohali	(Dhenkanal PS)
Bolangir District	
Bolangir town	
Binka	(Binka PS)
Sambalpur District	
Katapali	(Bargarh PS)
Gandhitikara	(Attabira PS)
Kulta tukra	(Attabira PS)
Rengali	(Katarbaga PS)
Bijepur	(Bijepur PS)
Sundargarh District	
Tangarpali	(Sundargarh PS)
Koraput District	
Mantriguda	(Nowrangapur PS)
Keonjhar District	
Keonjhar town	
Mugupur	(Anandapur PS)
Mayurbhanj District	
Bholabeda	(Bisoi PS)
Chitrada	(Muruda PS)

Centres noted for specialities

66. All the manufacturing centres in the State produce various articles of utility, more or less of the same type. The preference for common types everywhere is due to the fact that the articles of utility of standard types have got the most extensive market. There are, however, some centres which specialize in products not


ORISSA
SHOWING CENTRES OF BRASS AND BELL-METAL INDUSTRY
Scale in Miles
0 10 20 30 40 50
Centres of Brass and Bell-metal Industry
BAY OF BENGAL
Bholabeda
Badampahar
BARIPADA
Bhemuna
Dehala
BALASORE
Bhadrak
Chandbali
Baidyarajpur
Mugupur
Bhuban
Ghatimunda
Paradip
BHUBANESWAR
Balakati
Khurda Road
PURI
CUTTACK
Vaichuan
Chilka Lake
CHATRAPUR
Barbil
KEONJHAR
Talcher
Angul
DHENKANAL
Kantilo
Nayagarh
Rourkela
Belguntha
Jagmohon
Berhampur
Bhanjnagar
Parlakhemundi
SUNDARGARH
Jharsuguda
Rengali
SAMBALPUR
Mahanadi R.
PHULBANI
Gunupur
Hirakud Reservoir
Bargarh
Katapali
Binka
Sonepur
BOLANGIR
BHAWANIPATNA
Rayagada
Titlagarh
KORAPUT
Nowrangpur
Mantriguda
Jeypore
Duduma

manufactured in other localities. In fact, there are a few centres which have acquired widespread reputation for certain specialities. The names of centres and the speciality for which they have become famous are indicated below.

CENTRE OF PRODUCTION	SPECIALITY
1. Baidyarajpur (Dist. Cuttack)	(i) *Lota*, locally called '*mugudi*' made by casting process
	(ii) Curios
2. Bhatimunda (Dist. Cuttack)	(i) Large sized *handa* made by beating process
	(ii) Curios
3. Kantilo (Dist. Puri)	(i) Large and heavy *handa*
	(ii) Idols and images by casting process
	(iii) Curios
4. Bainchuan (Dist. Puri)	Pressed plates, which are popular in West Bengal
5. Nayakpatna (Dist. Puri)	Ding-dong bells for temples
6. Bellaguntha (Dist. Ganjam)	(i) Flexible brass fish
	(ii) Flexible cobra snake
7. Patrapur (Dist. Ganjam)	*Medha*, a semi-circular design at the back of an image of god supported over a suitable pedestal
8. Remuna (Dist. Balasore)	(i) Plates and dishes with low walls
	(ii) *Bela* (trough) and cups
	(iii) Curios
9. Bhuban (Dist. Dhenkanal)	(i) *Anta-bhanga bela*
	(ii) Curios
10. Katapali (Dist. Sambalpur)	*Baithi-laga bela*
11. Bholabeda (Dist. Mayurbhanj)	Ornaments for Adibasis
12. Chitrada (Dist. Mayurbhanj)	Ornaments for Adibasis
13. Balakati (Dist. Puri)	Small *handi* (cooking pot)

SECTION VI

ECONOMIC ASPECTS

67. Brass and Bell-metal industry is mainly a household industry. The proprietor is not only the entrepreneur and manager, but also a worker in the trade. The industry is capital intensive. The cost of materials is as high as 70 per cent of the investment, while labour consumes the remaining 30 per cent. The annual turn-over in the State of Orissa is of the order of Rs. 50 lakhs, out of which Co-operative Societies numbering 39 in the State cover about Rs. 32 lakhs, leaving the balance for manufacturing units outside the co-operative fold.

Working Capital

68. It is generally not possible to ascertain the amount of working capital employed in the brass and bell-metal industry which is of the category of household industry. The person in charge of management seldom keeps any record to show what amount of working capital was utilized at any particular period. It is, however, possible to estimate approximately the capital utilized in tools and equipments, and on the visible stock of raw materials. The working capital is always small in comparison with the extent of business carried on, for a portion of the transaction is carried on either on the basis of credit or by some form of mutual assistance between the members of the trade and the co-operative society, if any. Some amount of capital seems to remain locked up in the form of liquid assets, such as, goods in process or as unsold stocks or stocks distributed to retail dealers.

Extent of Financial Assistance available

69. The State Government have a scheme of Development of Handicrafts, under which some amount of financial assistance is provided for the Brass and Bell-metal Co-operative Societies in the form of loan for working capital or subsidy for general management of the business. Moreover, loans for working capital are also sanctioned under the State Aid to Industries Act, or are available from a Central Co-operative Bank to which the Society is affiliated. The loans granted by the Government either under the Development of Handicrafts scheme or under the State Aid to Industries Act usually carry low rate of interest ranging between 2½ to 5 per cent, but the loans available from Co-operative Banks have higher rate of interest, necessitating subsidization by the State Government with a view to reduce the burden on artisans.

70. Besides grant of loans towards working capitals, Management Subsidies are also granted to members of Co-operative Societies in order to meet the supervisory cost, house rent, tools and implements and construction of godowns. The Government of India bear the entire amount of expenditure on subsidy granted to co-operatives.

71. Although the forms of financial assistance are satisfactory, the volume is quite small. In the State of Orissa all the loans and subsidies mentioned above are limited to an annual provision of about Rs. 1,50,000/-. There are 39 registered Co-operative Societies in Orissa, covering 1,760 families of brass and bell-metal workers, out of which 26 societies were given financial assistance in the above mentioned forms in 1964-65. The quantum of assistance offered by Government is considered to be inadequate. The artisans

have to look for further assistance from other sources.

Indebtedness

72. Indebtedness among the artisans is prevalent to a noticeable extent and is not tending to decrease in spite of the well established condition of the industry. The loans granted by the co-operative society are intended to cover the purchase of raw materials, but as the amount of loan from this source is not adequate, recourse is taken to loans from private money-lenders and sometimes from wholesale dealers, who generally meet about 75 per cent of the artisans' loan requirements. The wholesaler grants the loan with a view to bind the artisan for sale of his goods to the creditor. Loans are also incurred for meeting social obligations or personal necessities and are repaid generally under some form of constraint or hardship. In most cases, marriage and illness are the reasons behind loans. The artisans attach usual importance to social prestige and cannot avoid such customary exigencies as caste-feast and presentations on happy as well as mournful occasions, even though such obligations drive them into the harmful practice of incurring loans.

Cost of Production and Margin of Profit

73. The cost of production is dependent upon some factors, such as, the price of raw materials, the rates of wages, the over-head and incidental charges. In recent years, there has been considerable rise in the price of raw materials. The rates of wages have also increased, though not sharply. But the price level of finished products of brass and bell-metal has risen just to a moderate extent. This is an achievement of the trade and the artisans say that this has been possible by lowering the margin of profit. Perhaps things are not so simple as explained by them. Possibly the proportion of the costlier metal in the alloy has also been reduced in order to counteract the considerable rise in the price of raw materials. During the course of local investigation, an effort was made to find out the probable cost of production and the margin of profit.

74. Raw materials were available to the artisans in village Kantilo in the early part of 1963 at the following rates:

Copper	—	Rs. 6.24 per kg.
Zinc	—	Rs. 2.37 per kg.
Tin	—	Rs. 27.27 per kg.

75. The production cost of one kg. of manufactured article of brass and bell-metal was worked out in the following manner:

(i) For an article of brass weighing 16 kgs.

	Rs. P.
Copper — 9 kgs. @ Rs. 6.24 ...	... 56.16
Zinc — 7 kgs. @ Rs. 2.37 ...	... 16.59
Charcoal	... 12.00
Chemicals	... 2.25
Wastage, wear and tear ...	... 3.00
Wages (6 unskilled @ Rs. 2/- and 4 skilled @ Rs. 3/- per day) ...	... 24.00
Total Rs.	... 114.00

The total cost of production of an article weighing 16 kgs. being Rs. 114.00, the cost per kg. works out to Rs. 7.13.

(ii) For an article of bell-metal weighing 10.2 kgs.

	Rs. P.
Copper — 8 kgs. @ Rs. 6.24 ...	... 49.92
Tin — 2.2 kgs. @ Rs. 27.27 ...	... 59.99
Charcoal	... 8.00
Chemicals	... 1.75
Wastage, etc.	... 2.25
Wages (4 skilled @ Rs. 3/- and 2 unskilled @ Rs. 2/- per day)	... 16.00
Total	...137.91

Thus the cost of production per kg. of bell-metal is Rs. 13.50.

76. With the cost of production worked out as above and the market price ascertained locally in the year 1963, the margin of profit per kg. of brass and bell-metal is indicated below:

Name of metal		Cost of Production	Market price of finished products	Margin of profit
Brass	...	Rs. 7.13	Rs. 7.50 to 8.25	Rs. 0.37 to 1.12
Bell-metal	...	Rs. 13.50	Rs. 14.25 to 15.00	Rs. 0.75 to 1.50

77. The profit as indicated above is shared between the manufacturer, the wholesaler and the retailer. Sometimes, the manufacturer and the wholesaler is the same person, but sometimes there is a middle man between the manufacturer and the retailer. So the profit is usually divided between three agencies till the product is in the hands of the consumer. The margin of profit itself is quite small, and after division between three agencies which may not necessarily be in equal proportion, there will be just a little available for each, not commensurate with the labour and capital involved, and not comparable with the profits accruing from other professions or trades. How then is this industry surviving, if not actually thriving? This can be explained by the fact that the manufacturers do not maintain proper proportion of metals in the alloy. As copper is costlier than zinc, the brass ingots must be taken to contain much less copper than the standard ratio of 9 copper: 7 zinc. Similarly, in the case of bell-metal, the costlier of the two component metals, namely, tin must be less in proportion to the other metal, copper, than what is indicated in the standard formula of 22 tin: 80 copper. In this manner, the manufacturers of ingots are able to offer the material at rates lower than the rate worked out for brass and bell-metals of good quality. The trade, even when in the hands of a co-operative concern, does not follow a uniform pricing policy at all times, and the margin of profit varies from one manufacturer to another. The actual profit made at the stage of ingot-making is difficult to ascertain, as the proportion of metals in the alloy is a trade secret, not revealed to official investigators or to rivals in the trade. The profit, however, at subsequent stages of manufacture of finished articles, and of sale to the consumer, is known to be fairly adequate.

SECTION VII

CONCLUDING REMARKS

78. The industry is not in a declining stage, but is striving to raise its level of production under hard conditions. It has to survive against many new rivals. The incursion of stainless steel, aluminium, ceramic and plastic wares into market has brought about a serious competition against traditional materials. The changes in the latest patterns of household and utility wares, the replacement of old materials by new substitutes, the uncertainty in the availability of raw materials and the rising trend of price level, all these have contributed to the enormity of the problems facing the industry. Yet the industry has saved itself from adversity or decline, and is making progress, howsoever slow may be the pace. It has some vitality of its own, and the source of its strength lies behind a few traditional factors, such as, the brazier's genuine love of his ancestral craft and the conventional association of brass and bell-metal with the age-old culture of the land. These metals are inseparably linked with many rituals, festivals and ceremonies observed day-to-day by the people. Apart from any religious or sentimental consideration, the metals have intrinsic economic worth, because of the durability of the material and the resaleability of the old and worn-out articles. Brass and bell-metal are held as a standard in property, and are acceptable in the form of security offered for incurring loans, or in repayment of debts.

79. All these merits, however, do not necessarily ensure invulnerability to danger from competition by rival materials. Progress in science and technology may any day succeed in offering a more versatile material in the service of mankind. There should, therefore, be unceasing efforts for improvement, so that the industry is streamlined and reoriented to suit the ever-changing conditions of the market, the refined tastes of the fastidious patrons and the increasing craze for ultra-modern designs.

APPENDIX

Distribution of Brass and Bell-metal industries in different police stations of Orissa

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—CUTTACK	
City Police Stations	4	14	**Cuttack City**
Tangi	195	430	Ramgarh, Kandarkana, Ganarba, Bhatimunda, Saranga
Salepur	36	70	Murudabad, Ghantalo, Badakhiri, Jairampur, Kusupur, Tilda, Champapur, Imamnagar, Raghabpur, Puran, Chandradeipur, Bhagabanpur
Gobindpur	1	1	Kulakaijanga
Jagatsingpur	5	5	Ajodhyapur, Singarpur
Tirtol	5	11	Chardia
Banki	15	26	Santarapur, Talbast, **Banki**
Baideswar	3	3	Baideswarpatana
Jajpur	168	313	Kolatha, Santarapur, Badachapai, Routarapur, Jahanpur, Govindpur, Jafharpur, Akarpara, **Jaipur**
Barchana	65	135	Nanpur, Balichandrapur, Panasudha
Dharamsala	92	201	Laxminagar, Pahanga, Kalando, Patapur, Kulagan No. 1, Atalapur, Mirjapur No. 2, Bamphu, Arangabad
Sukinda	5	14	Dhamanagadia
Korai	6	7	Barada, Jahna
Kendrapara	7	25	Ambura, Bazar, Kusiapal
Patamundai	1	1	Dhanamandal
Patkura	1	1	Patkura
Athgarh	2	5	**Athgarh**
Tigiria	18	25	Bindanima
Baramba	19	38	Talamundali, Kankadajodi, Banamalipur
Kanpur	21	34	Kanpur, Kanakpur
Narsingpur	18	41	Chakraprasad, Sagar
Total for District Cuttack	687	1,400	

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—PURI	
Puri Town	3	10	**Puri**
Sadar	6	11	Dolagobindpur
Brahmagiri	1	2	Jenapur
Satyabadi	7	12	Banapur, Jayapur, Ketakipatna
Delang	3	12	Patnapur
Pipli	19	34	Kulasikharapatna, Thanathana, Kusida
Nimapara	3	3	Kotakusang
Gop	2	7	Ogalapur
Balipatna	13	30	Garedipanchan, Bhakarsahi, Bindha, Budhangadeuli
Balianta	231	421	Bhalurihat, Bentapur, Pratap Sason (Balakati), Hirapur, Kakarudrapur, Bhubanpur
Khurda	35	65	Kuaputa, Muktapur, Narasinghpur, Raipur
Begunia	3	4	Naupatna, Baksipatna
Bolgarh	1	1	Phiriphiripatna
Fategarh	22	43	Sason, Madhapur, Pathuria, Banamalipur
Khandpara	280	563	Khalisahi, Puania, Mareikana, Kantilo
Gania	22	40	Gania, Bijayanagar, Belparapatna
Daspalla	12	18	Krushnasaranpurpatana, Gantagharpatana, Jagannathpurpatana, Jamusahi
Nuagaon	2	3	Jagannathprasad
Odagaon	2	2	Kural, Odagaon
Sarankul	33	69	Hariharpur No. 2, Panchiridamanpur, Haridabandha, Panchumu, Godimada
Ranpur	11	20	Nrusinghpurtangisahi, Baramula, Ranapurgada Ranapur (B)
Total for District Puri	711	1,370	

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—BALASORE	
Balasore	8	29	**Balasore**
Simulia	29	61	Chakradharpur
Khaira	8	8	Ghusurigaria
Soro	11	28	Banaparia, Dalingia, Khantapara, Sahaspur
Remuna	84	172	Purusottampur, Shyamraipur, Rudrapur, Madhupur, Bagampur
Basta	1	2	Bagda
Raibania	11	20	Baradiha
Bhadrak	16	19	Erara
Dhamnagar	11	40	Khaparpada
Tihiri	1	1	Dolsahi
Chandbali	7	30	Mahulia, **Chandbali**
Basudebpur	4	10	Iram
Nilgiri	1	3	Jemadeipur
Berhampur	3	10	Naupal
Total for District Balasore	195	433	
		DISTRICT—MAYURBHANJ	
Badasahi	2	2	Chekamara Samil Madhupur, Tungasul
Betnoti	2	4	Bhalia
Muruda	5	7	Jhatiada, Chitrada
Suliapada	19	42	Sardiha, Khadisul, Masinakati
Kuliana	15	48	Balidiha, Pariakoli, Kamta
Bangriposi	3	6	Tilow (Tilou), Badsul, Majhigan
Rairangpur	1	2	**Rairangpur**
Badampahar	10	21	Nangalsila, Kendrei, Pandugandi, Jurda
Bisoi	11	11	Bholbeda
Gorumahisani	8	15	Sundhal
Bahalda	20	27	Bahalda, Soso, Kaduani, Kankha, Kuchaipal, **Manbir**
Tiring	2	2	Bhalugoda
Karanjia	11	20	Saranggarh, Karanjia, Dihajori

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—MAYURBHANJ *(Contd.)*	
Jashipur	12	23	Papada, Bolanposi, Niunti, Dhatikia, Anlabeni, Khandabandha, Sannai
Thakurmunda	11	23	Dakaipal, Gahandiha, Bharandia
Udala	2	3	Athapada, Jualia
Khunta	19	43	Kenduamundi, Kudiakhunta, Purunabaripada, Tikayatpur
Total for District Mayurbhanj	153	299	
		DISTRICT—GANJAM	
Chatrapur	13	36	Jaganathpur
Rambha	19	47	Patrakanhupur, Sabilia
Purushottampur	101	181	Magurapunja, Boirani, Billipoda, Gobba, Purushottampur, Sitarampur
Hinjili	30	61	Kanchuru
Kodala	4	6	Polasara, Ramagodo
Berhampur Town	14	38	**Berhampur**
Berhampur Taluk	19	31	Khodasingi, Racho, **Gopalpur**
Nuagam	6	10	Nuagoda, Nuapoda (a), Chodiapoda, Dabhar, Dabaharpurusotampur
Jarada	46	166	Nuapentha, Kesapur, Lalakamagam
Bhanjanagar	28	51	Kalimba, Baunsalundi, Udra, Nuagam, Kulado, Jamulei, **Bellaguntha**
Tarasingi	1	1	Baniapalli
Buguda	22	49	Buguda, Adipur, Panchabhuti, Rauti, Mangarajapur, Chamanda, Khamarpalli, Patadhar
Bodogodo	2	6	Barasingi, Kanagiridi
Aska	94	233	Mamudhia, Nandigaro, Jagamohana
Gangapur	13	31	Nimina, Binjhagiri
Parlakhemundi	7	13	Lohasiripur, Baghosola, Kasinagar, Garoba, **Parlakhemundi**
Serango	10	31	Santoshpur, Gaiba
Ramagiri	1	3	Laxmipur
Mohana	1	3	Baghomari
Total for District Ganjam	431	997	

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—BAUDH-KHONDMALS	
Baudh	9	14	Chandrapur, **Baudh**
Manamunda	7	15	Guvelipadar, Maheswarpinda
Harbhanga	6	11	Bukesinga, Kutijhar
Baliguda	16	30	Barakhama, Jakaripada, Nilipada, Badulipadar, Jarginaju
Kotgarh	1	1	Bandiguda
G. Udayagiri	5	8	Padikia, Nandini, Gudrigam, Subalaya
Raikia	1	1	Risuguda
Total for District Baudh-Khondmals	45	80	
		DISTRICT—KORAPUT	
Dasamantapur	3	6	Dasamantapur, Barbaghri
Nandapur	1	1	Talakinibar
Semiliguda	4	9	Sindhiput, Mathalput
Padwa	3	4	Khinoboro
Nowrangapur	13	33	Mantriguda, Patramunda, Sankumuli
Pappadahandi	8	12	Jamuguda, Maidalpur, Usigan
Tentulikhunti	9	9	Charamula
Jeypore	9	21	Majumunda, Jaganathpur, **Jeypore**
Kotpad	4	8	**Kotpad**
Kodinga	2	6	Rajora
Umarkot	4	10	Bamini, Kandei, Khadanga
Dabugam	10	17	Dabugam, Dungariguda, Sanaolama, Bandimala, Medana
Jorigam	16	28	Chitabeda, Palasagan, Pujariguda
Malkangiri	5	12	Tondapalli, Boilapari
Venkatapalam	3	5	Padia, Nandibeda
Mathili	2	9	Amboguda
Rayagada	5	5	Kuli
Bissamcuttack	8	8	Jigiri
Ambodala	6	11	Pajenapadar, Kardanga, Dhepaguda

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—KORAPUT *(Contd)*	
Gunupur	5	7	Mahipanga, **Gunupur**
Gudari	7	16	Bentaguda, Derigan, Madhupura
Padmapur	1	2	Nuagar
Puttasingi	1	1	Pindaguri
Total for District Koraput	129	240	
		DISTRICT—KALAHANDI	
Sadar	3	6	Dadpur, Naktiguda, Nasaigaon
Kesinga	4	6	Kashrupada, Gurjimunda
Madanpur-Rampur	5	12	Saidalanga, Sadelgochha, Terakela
Lanjigarh	1	2	Tentulipanga
Kashipur	8	19	Baiganguda, Ramgiri, Lakhrish, Sindurghati
Dharamgarh	8	11	Telipalas, Chilchila, Sandhikuliari
Kegaon	10	26	Kendumundi, Kachharpadar
Junagarh	2	2	Junagarh
Koksara	7	14	Phupgaon, Sankenduguda
Jaipatna	4	6	Mangalpur, Hirapur
Nawapara	5	20	Kurumpuri, Lakhna
Jonk	4	6	Bisora, **Khariar Road**
Komna	10	18	Tarbod, Kantapali, Kendetara, Sunabeda
Khariar	7	12	**Khariar**
Sinapali	21	38	Babebir, Sinapali
Total for District Kalahandi	99	198	
		DISTRICT—SAMBALPUR	
Sambalpur	15	42	Takba, **Sambalpur**
Rengali	6	16	Dhulunda
Lakhanpur	3	7	Thebera
Brajarajnagar	21	65	Jurabaga, Tileimal

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—SAMBALPUR *(Contd.)*	
Burla	1	2	Kardola
Dhama	2	8	Amkoni, Dhama
Jujomura	1	1	Bhandarimal
Sason	5	5	Baham, Sanatanpali
Katarbaga	156	372	Talabira, Rengali, Jharghati, Katarbaga, Basupali Samasingha, Kulhiamal
Jharsuguda	7	16	Hansamura, **Jharsuguda**
Laikera	4	8	Sarangaloi
Bargarh	141	269	Turunga, Katapali, **Bargarh**
Jagdalpur	9	33	Kotna, Saraikela, Chardapali
Padampur	9	22	Padampur, Chandipali
Gaisilat	5	8	Khuntpali, Phiringimal
Melchhamunda	3	8	Ambamunda
Sohela	2	8	Ranjari, Sohela
Bijepur	55	282	Para, Bijepur, Rangmatia, Gathiapali
Barpali	3	11	Kainsir, Barpali
Bheden	10	45	Bheden, Remenda
Attabira	241	488	Amalipali, Janhapara, Kadobahal, Larambha, Gambharipali, Tamparsara, Sindurbahal, Brahmantukra
Bhatli	1	2	Tukurla
Ambabhona	6	17	Badjampali, Bangapali
Deogarh	13	39	Gangnan, Gandam
Riamal	26	84	Golabandh, Khuntabandh, Tuhilamal, Bhitarpad, Kansar
Barkote	14	42	Bhatsingh, Jarakot, Golabandh, Saida, Balanda, Mardang, Bolani
Naikul	12	36	Kausulibahal, Karlaga, Aunli
Kuchinda	5	14	Saida, Kuchinda, Belbuda
Govindpur	2	3	Dumermunda *(Bada)*, Burubuda
Mahulpali	2	4	Bilung
Gourpali	3	5	Kumkapali, Kuagola
Rairakhol	4	11	Nusura, Dimirikuda, Telsing, Badbahal
Naktideul	1	3	Chandrapur
Total for District Sambalpur	788	1,976	

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—BOLANGIR	
Bolangir	34	78	Dabkani, Madhiapali, Michhapali, Mayabarha, **Bolangir**
Loisingha	3	6	Budelbahali
Tusra	22	55	Deogaon, Kharda, Joogimara, Kumberpadar
Patnagarh	7	16	Barbahal, Bhainsa, Hirli, Rengali
Belpara	9	9	Dungripali, Nunhad
Khaprakhol	3	6	Mahulrundi
Sonepur	3	3	**Sonepur**
Tarbha	13	20	Tarbha
Binka	73	100	Binka
Dungripali	1	2	Sukha
Birmaharajpur	5	10	Subalaya, Kadodar
Titlagarh	2	2	**Titlagarh**
Kantabanji	7	13	Bongomunda, Maingaon
Sindhekela	2	14	Salebarat, Chantipala
Total for District Bolangir	184	334	
		DISTRICT—SUNDARGARH	
Sundargarh	7	12	Rajpur, Rangimunda, Tangarpali
Lephripara	2	5	Kurumkela
Hemgir	1	1	Khapurikachhar
Bhasma	4	16	Mundagaon, Lamti
Talsara	5	18	Talsara, Kinjirkela
Bargaon	1	2	Talimunda
Rajgangpur	1	1	Bheluadihi
Bisra	8	12	Khuntgaon
Bonaigarh	12	29	Kenapali, Badbaurkela, Bonaigarh, Sangogua
Total for District Sundargarh	41	96	

(Names of Towns are shown in bold types in Column 4)

Police Station	No. of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—DHENKANAL	
Sadar	74	125	Luni, Indipur, Beguniapal, Oukhamapatna, Ratanpur, Sogarpasi, **Dhenkanal**
Gondia	74	122	Majhipal, Karmulpatna, Baisinga, Arnapur, Kabatabandha
Kamakhyanagar	17	44	Dholapasi, Baisinga, Bangura, Mahulagoda
Parjang	13	35	Pangatira, Mahabirrod, Barjhara, Kalda, Brahmanbedhia, Kamarachasisahi
Bhuban	189	429	Kaisiri, Talankbereni, **Bhuban**
Angul	12	38	Barsinga, Tulsipal, Bauligarh, Talmulsasan, Gadatalmul, Kadala
Purunakote	1	2	Dandasinga
Jarapada	28	51	Tubey, Kanjra, Barkerjang, Korara, Durgapurtanginisahi, Jarapadapanasahi, Kumursinga
Chhendipada	24	58	Bhaialijungle, Kosala, Padapada, Tangiri, Khamar
Bantala	8	28	Khinda, Joramuna, Sankhapur
Talcher	4	4	Brajanathpur, Gaham
Colliery	1	1	Solada
Kishorenagar	3	3	Dhudurupal, Natada
Thakurgarh	2	7	Tileswor
Handapa	17	49	Ranibhuin, Urukula, Gobardhanpur, Kanteikolia, Luhumunda
Rasol	46	102	Ambalundi, Karanda, Chitalpur, Panchapada, Babandha, Gobindapur
Pallahara	8	24	Khemela, Nizgarh, Jhimiripali, Baradihi
Khamar	10	28	Ranja, Khamar, Barakalapal, Mundubeda, Hansala, Debahali
Total for District Dhenkanal	531	1,150	
		DISTRICT—KEONJHAR	
Sadar	24	43	Maidankel, Kalisuin, Dimiria, **Keonjhar**
Patna	19	43	Katarabera, Kantiapada, Dhanurjayapur, Tikayatpatna
Ghatgaon	15	35	Sanamasinabila

(Names of Towns are shown in bold types in Column 4)

Police Station	No .of Establishments	No. of Skilled Workers	Villages and **Towns** where industry exists
1	2	3	4
		DISTRICT—KEONJHAR *(Contd.)*	
Harichandanpur	11	30	Nakitipasi, Manoharpur
Pandapara	1	5	Balabhadrapur
Telkoi	6	20	Nuagoda
Kanjipani	2	4	Dhaladihi, Panasuan
Anandapur	47	94	Kanto, Vogapur, Anandapur, Nilapur, Mugupur, Sarbeswarpur
Ramchandrapur	1	4	Samukanendi
Champua	7	32	Angulia, Hastinapur, Katalposi, Chingudiposi
Baria	18	27	Kanshora (Ka), Bhanda
Barbil	1	2	Bhadrasahi
Total for District Keonjhar	152	339	

GLOSSARY

Pittala	...	Brass
Kansa	...	Bell-metal
Tamba	...	Copper
Ranga	...	Tin Pewter
Dasta	...	Zinc
Kansari	...	Skilled worker in bell-metal
Gadha	...	Artisan
Kora	...	Helper engaged in beating
Pasia	...	Helper engaged in miscellaneous work
Bhatia	...	Rotary blower worker
Ghati	...	Ingot, billet
Kantika	...	Two cups placed one inside the other in beating process
Jaoo	...	Adhesive paste for fixing articles to lathe
Chanakh	...	Sample taken out of melting pot for metallurgical test
Jyoti-dekha	...	Visual metallurgical test
Pahan	...	Soldering alloy
Achhu	...	Clay mould
Koi	...	Crucible for melting alloy
Nehi	...	Iron anvil
Pathara	...	Stone anvil
Kunda	...	Wooden lathe
Chamada-bhati	...	Bellows
Jodata	...	Fork held in left hand
Kundali	...	Fork held in right hand
Tadgat	...	Water tank for quenching hot products
Chuta	...	Light hammer
Matha	...	Process of finishing by light hammering
Nihani	...	Scraper
Sandhasi	...	Fork

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SURVEY OF TRADITIONAL CRAFTS

BOOK THREE

SILVERSMITHY OF JARBHA

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Year of Investigation

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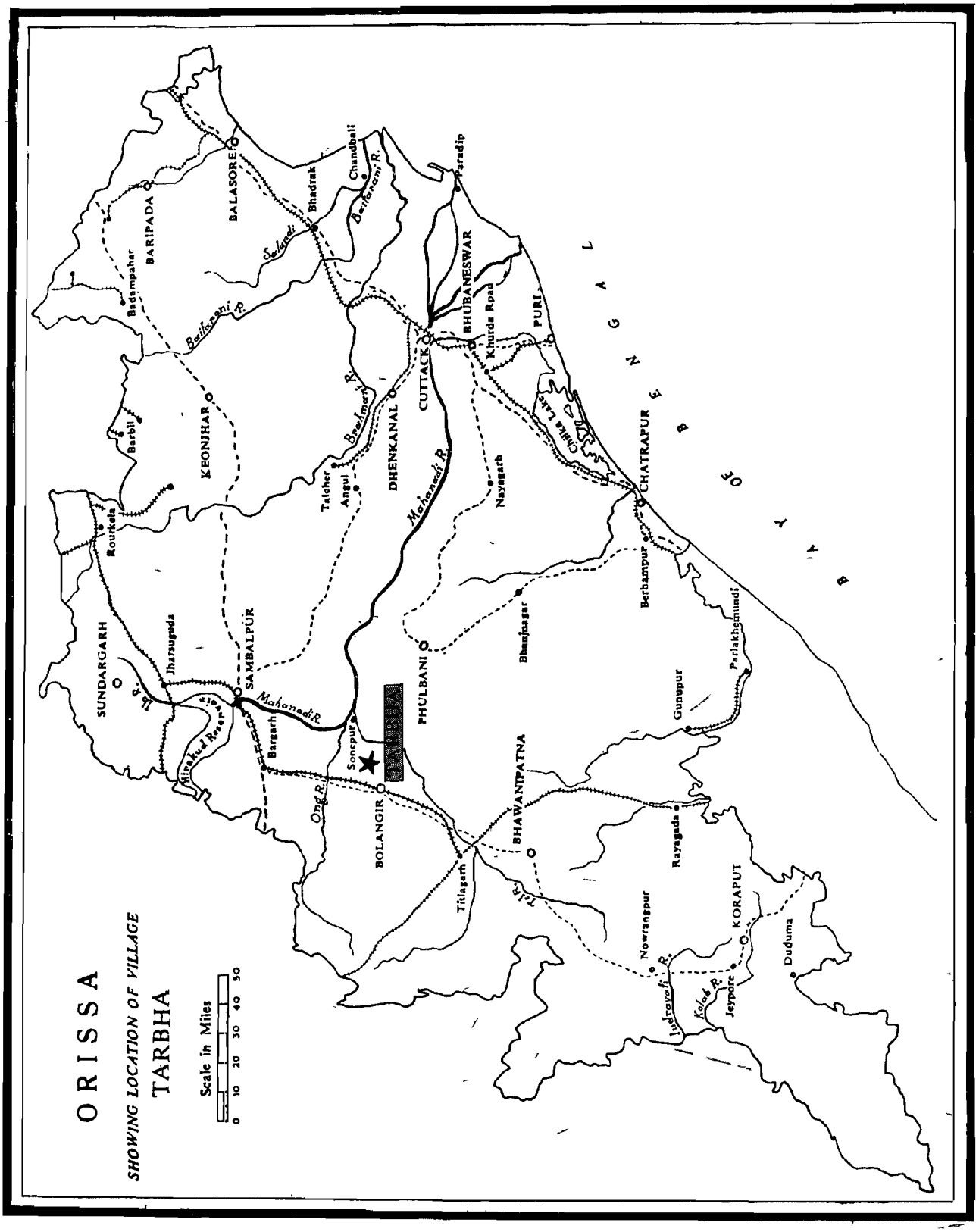
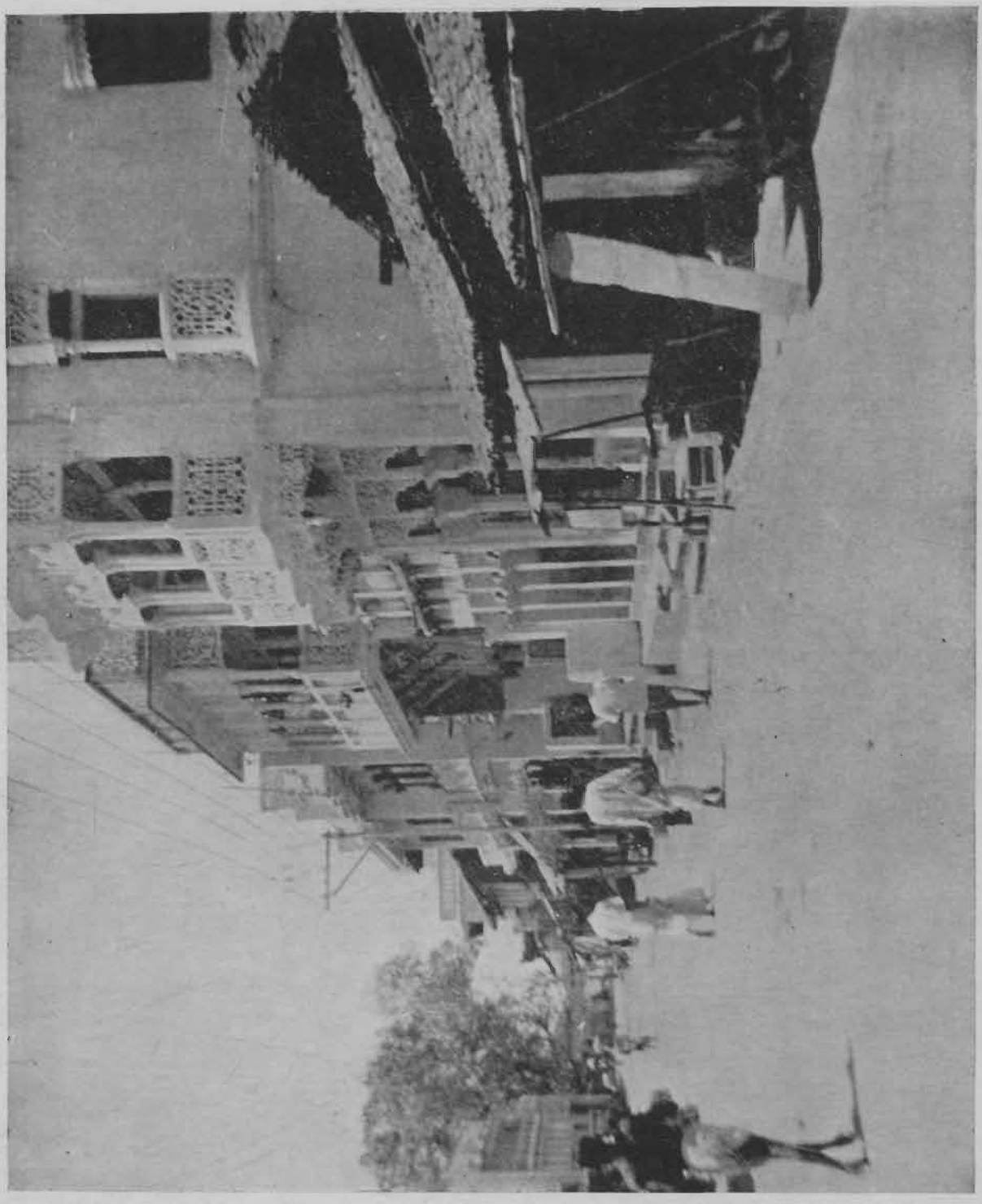
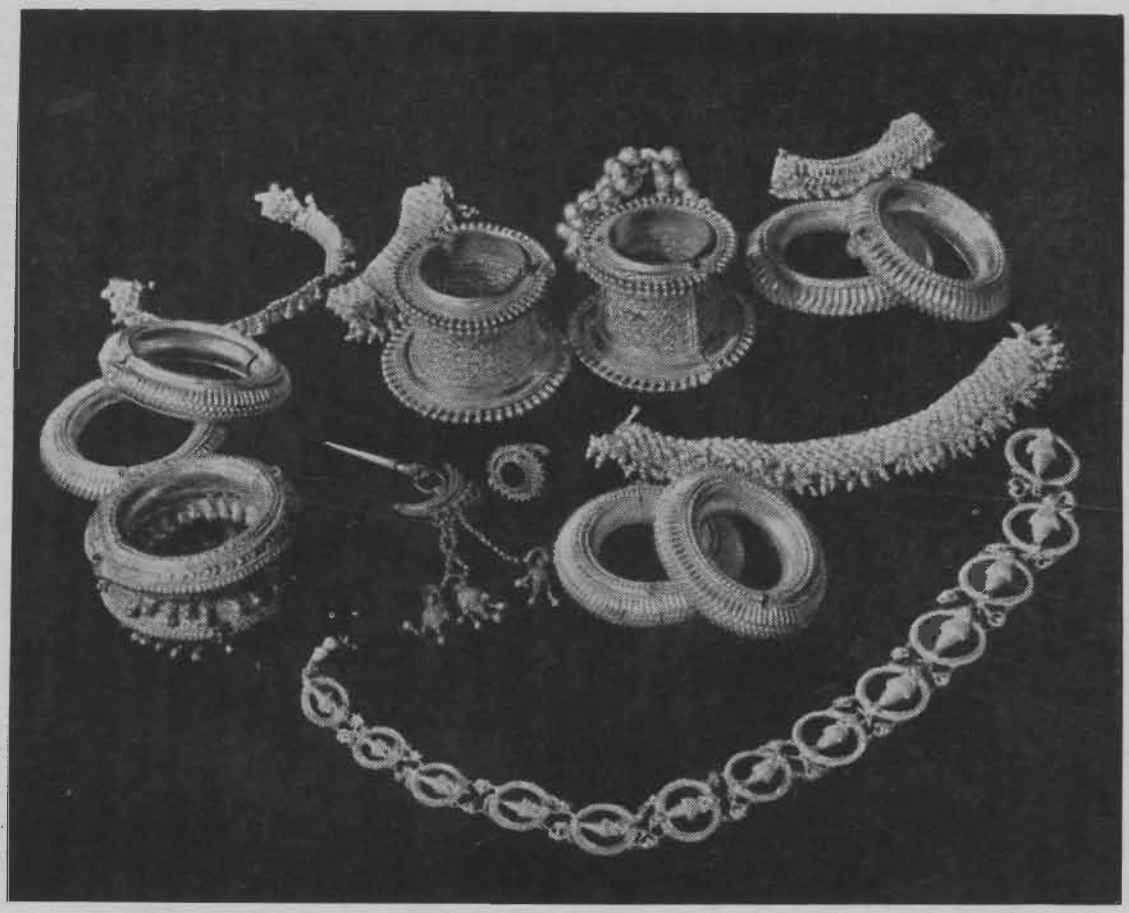
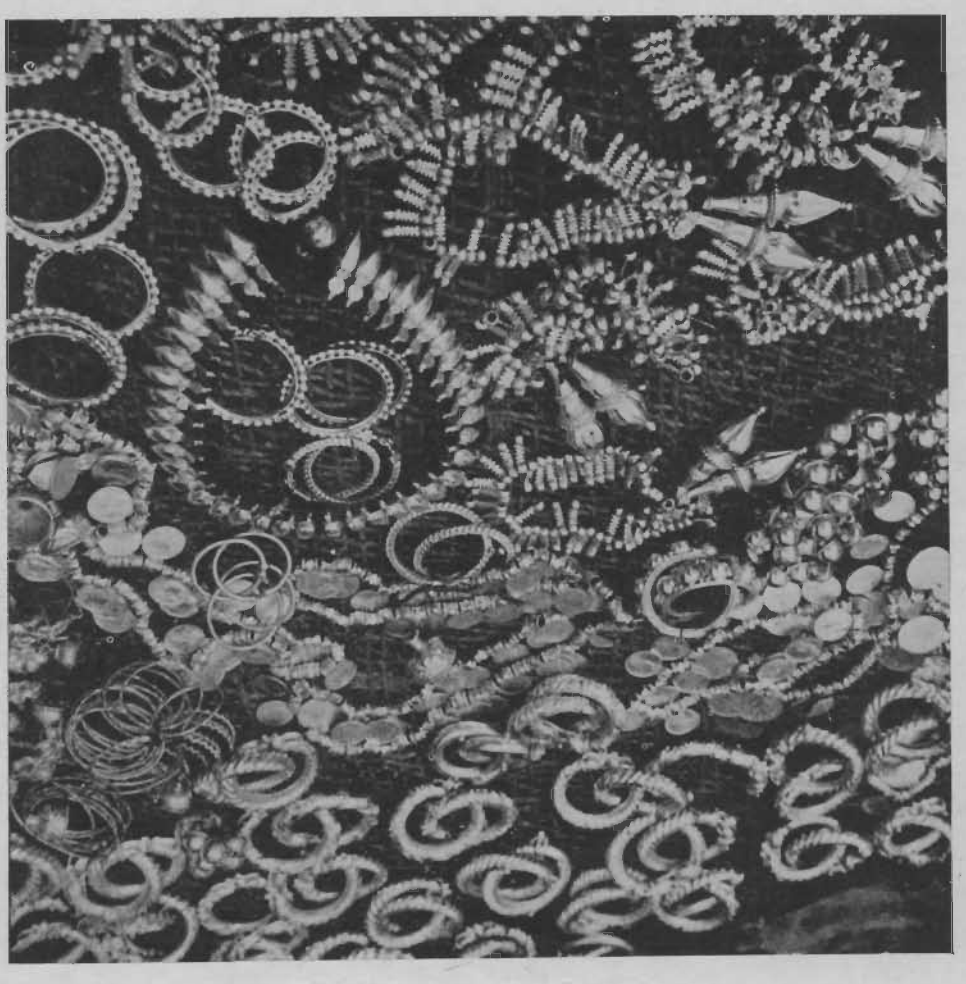

ORISSA
SHOWING LOCATION OF VILLAGE
TARBHA
Scale in Miles
0 10 20 30 40 50
BAY OF BENGAL
BALASORE
BARIPADA
Badampahar
Bhadrak
Chandbali
Baitarani R.
Salandi
Paradip
BHUBANESWAR
Khurda Road
PURI
CUTTACK
Chilka Lake
CHATRAPUR
Berhampur
Parlakhemundi
Gunupur
Nayagarh
DHENKANAL
Brahmani R.
Talcher
Angul
Mahanadi R.
KEONJHAR
Barbil
Rourkela
SUNDARGARH
Jharsuguda
SAMBALPUR
Mahanadi R.
Hirakud Reservoir
Bargarh
Sonepur
TARBHA
PHULBANI
Bhanjnagar
BOLANGIR
Ong R.
BHAWANIPATNA
Titlagarh
Tel R.
Rayagada
KORAPUT
Nowrangpur
Indravati R.
Kolab R.
Jeypore
Duduma



A street of Tarbha



A collection of silver ornaments mostly in use



Varieties of silver ornaments



A village belle of Orissa studded with ornaments

SECTION I

INTRODUCTION

Orissa has had a tradition of turning out fine specimens in silversmithy. Exquisite pieces of filigree of silver made at Cuttack, often as models of the famous temples of Bhubaneswar and Puri and of boat-voyages reminiscent of maritime trade of Orissa of by-gone days have not only earned a reputation in the vast Indian subcontinent, but have also found a way into international markets. The present study, however, relates to a specific type of silversmithy as practised in village Tarbha, even though it does not possess the same artistic exuberance as that of Cuttack. Whereas the smiths of Cuttack serve largely to an aristocratic sense of ornamentation, those of Tarbha cater to the needs of a vast mass of rural people, whether poor or well-to-do.

The village

2. The village Tarbha lies in Sonepur Subdivision of Bolangir District of the State. It is only 18 kilometres from the district headquarters of the same name, and is approachable by the Bolangir-Sonepur all weather road. Buses run by the State Transport Service of Orissa ply on this route. The village Bahirasar lies at the 18th kilometre point from Bolangir on this road. Tarbha is only half a mile from this point, being farther away from the road to the east. A small river of some width, namely, Nibrutijor, being a tributary of the Suktel, itself a tributary of the Tel and the Mahanadi, flows on the way, thus preventing all weather approach to Tarbha from the Bolangir-Sonepur road. During winter, spring and summer seasons, buses, however, ply into the village through the dry bed of the Nibrutijor. Tarbha has a population of a little more than 5,000. A distant view of the village presents it as a cluster of good many double storeyed buildings, with a few huts around. There is a temple at the approach and a mosque at the back. A few jeeps and cars are often seen passing into and out of the village in season. A good trade in silver ornaments is carried on all the year round. There is the headquarters of the local Panchayat Samiti in this village. Besides, the village also enjoys the location of a medical dispensary, a tehsil office, a police station, and post and telegraph offices, as well as primary and middle schools separately for boys and for girls and a high school for both. There is a distinct mark of prosperity about the village. All agree that the village had its prosperity derived largely from the craft of silversmithy.

Growth of the craft

3. The establishment of the village is shrouded in the dark past. Nothing of much value is known about it. The village is situated at the border of the two erstwhile princely states of Bolangir and Sonepur. There are a few ancient families of 'Paiks', that is, of peasant-militia of Orissa, still staying here. Some years back, during renovation, a good number of swords, daggers and the like were found from a tank in the village. Correlating this with what we heard at the spot, the village was originally settled with the families of a number of 'Paiks' engaged in the duty of guarding the border at this point between the two ex-princely states. People of other communities, such as, Brahmin (priest), barber, washerman, potter, fisherman, weaver and others were settled in the village. Besides these original settlers, the following communities also live in the village. They are: 'Kansari' (brass and

bell-metal workers), silver-*cum*-goldsmiths, 'Khadura' (also a sub-class of bell-metal workers specializing in bangles), 'Mali' (florist), 'Karan' (officials of feudal courts, calligraphists and record keepers), 'Teli' (oilman), 'Gauda' (milkman), 'Gudia' (sweetmeat maker), 'Sundhi' (distillers), 'Lohara' (iron-smiths), 'Ghasi' (sweepers and scavengers), Rajput, Marwari and Mohammedan. Tribal communities like Kandha and Saura are also found in the village. Among the most ancient ones, a few families of gold-*cum*-silversmiths were residing in the village and were carrying on their traditional occupation of preparing ornaments with gold and silver. In those days, gold was very scarce, and only a few well-to-do people could afford to use silver ornaments. A large section of the people satisfied their desire for ornamentation with brass and bell-metal. The few silversmiths of Tarbha could, however, serve to this limited and meagre demand. Such demand had a steep rise due to manifold changes in social, economic and political conditions, and with it, the traditional craft of silversmithy in the village, not only did experience a good spurt, but also underwent rather thorough significant metabolism. And this is of comparatively recent occurrence.

4. While writing about the history of the ex-princely state of Sonepur and about Orissa in general, in his books, 'Sonepur in the Sambalpur tract' and 'Orissa in the making', Sri B. C. Mazumdar failed to note anything about Tarbha, whereas he duly emphasized the industrial and commercial importance of Binka and Sonepur. The earliest available records mention Tarbha only as a village with a weekly market. However, by the first decade of the present century, the weekly market of Tarbha had grown to be one of the five important trade-centres in the entire region of feudatory states of Orissa. The following passage is worth quotation from the "Bengal Gazetteers—Feudatory States of Orissa".

> "There were no central markets of great importance, but Kantilo in Khandpada, Anandapur in Keonjhar, Bhuban and Dhenkanal in Dhenkanal and Tarbha in Sonepur were important markets. At the village Tarbha on the Patna border, there is an important trade-centre on which the export trade from Baudh, the Kandhmals, Patna and Kalahandi concentrates and from there finds its way either to Sonepur or Binka for shipment on boats along the Mahanadi or travel on road to Sambalpur".

5. There is significant omission of any mention of the craft of silversmithy in Tarbha in this narration. It is hard to believe that a craft, which was as prosperous as at least only few years back, if not at present, would have escaped notice at narration in the Gazetteer. On the other hand, it shows that the craft achieved its development only after the time of narration, that is, after the first decade of the present century.

6. In this connection a few facts of the anterior past may be brought out to correlate with the study of the growth of silversmithy at Tarbha.

7. Kantilo in Puri District has been a big centre of manufacture and trade in brass and bell-metal utensils. For several centuries back, traders from Kantilo had travelled in all possible directions throughout the State selling their wares. Nearly 200 to 250 years back, one Kansari family from Kantilo came and settled at Tarbha. It was that of the late Paramanand Sahu. He used to come to Tarbha for carrying on business before he finally settled there. Subsequently a few other Kansari families from Kantilo and from Katapalli, a village in Baragarh Subdivision of Sambalpur District, came and settled at Tarbha. Prior to them, a few Khadura families were already at Tarbha, who were preparing crude ornaments of brass and bell-metal.

The Kansari families, who settled at Tarbha, not only found a good trade in brass and bell-metal utensils, but also took to making ornaments of those crude metal in order to cater to the coarse needs of the unsophisticated people of the area. This condition prevailed till about the last decade of the last century. In the meantime, trends of liberalisation in social, economic and political realms were working. The people were developing a taste towards use of silver ornaments, if not gold. In earlier days, there was a sort of social inhibition for the common folk to use silver and gold ornaments. By about the time spoken of, because of liberal ideas, this said inhibition was not fully effective. The people were gradually preparing silver ornaments for their females, particularly on the occasion of marriages. On the whole, the demand for silver ornaments was gradually increasing which the then existing silversmiths could not cope to meet. The intending customers used to supply silver to the smiths and place order for making the ornaments; the smiths only had to prepare the ornaments for payment of making charges. There was thus absolutely no problem as to procuring raw materials, marketing, etc., the vexed problems of any traditional craft. The smith had to face essentially a technical problem and he failed to solve it. Obviously it was a situation where the demand for making the ornaments was so large that the smiths simply could not find enough time and energy to meet with. It was so reported that in some cases the intending customers would supply the silver and would order making of necessary ornaments in connection with the marriage of a daughter or a sister, as early as five or six years prior to the actual ceremony, but even then the smith would not be able to deliver the ornaments in time. In order to oblige the smiths to deliver the ornaments for the ceremony in time, the intending customer, usually a cultivator, would occasionally present to the smith selected vegetables and pulses. Sometimes out of disgust, the customers ceased running to the smith, thereby foregoing claims to satiation of their orders previously placed. There was thus ample field and scope for any other clever man taking to this craft. The descendants of the Kansari craftsman, who had trekked long distances from Kantilo to Tarbha in search of trade, were exactly the type of people to take advantage of this inviting situation. Their traditional craft had definite technical affinities with that of silversmithy. The transition from making the brass and bell-metal ornaments to making silver ornaments could not be very difficult, if not easy. In fact, many customers induced these Kansaris to take to making silver ornaments. The great-grandsons of Paramanand Sahu, namely, Hari Sahu, Duryodhan Sahu, Dasharath Sahu, Krushna Sahu, Brundaban Sahu, Ratnakar Sahu and others chose to face the challenge. Some of the enterprising craftsmen sought employment with the traditional gold-*cum*-silversmiths of the village. Some also picked up friendship with the other smiths. By this process they tried to learn the details and intricacies of the craft. Some others also applied their own ingenuity of mind by themselves trying to make ornaments of silver. The kind of affinity between their two metal crafts was perhaps the basic factor in the successful metabolism of the craft of silversmithy in respect of its content of technical personnel. By the time the traditional silversmiths came to know of the attempts of Kansaris at their techniques, it was too late. The Kansaris learnt the craft of silversmithy. Soon the whole perspective of the craft and its trade changed.

8. The new smiths not only turned out wares in good quantities, but also multiplied their numbers quickly as they taught their newly acquired art to their kin with deep fervour. They made ornaments to prior order from the customers, who delivered to them the metal. The much

harassed customers now found that the new smiths could supply ornaments within a few days or a couple of weeks at best of placing orders. Orders for supplying ornaments gradually piled up and the smiths also cleared them with required energy. These smiths soon took to preparing readymade ornaments in order to serve at once any demand at any time of the year. At this stage, it seems, the smiths began adding a lot of alloys to the chief metal, silver. They used to buy silver and other raw materials in retail from such centres as Bolangir, Sambalpur, etc. Having satiated the ready demand available, these smiths also appear to have taken some steps, though not very intelligent and forward looking, to sell their wares in distant places. Less enthusiastic ones entrusted their wares to some others on the understanding to pay a part of the net proceeds. The later persons, sometimes themselves and sometimes with hired labourers, carried the wares and went on hawking to such distant places as Rairakhol and Deogarh in Sambalpur District, Baudh in Baudh-Khondmals District and Phuljhor in Madhya Pradesh. Comparatively more enthusiastic ones hired labourers, when necessary, and went on hawking themselves. Besides their own wares, they also took on some agreed basis wares from other smiths. This later category of people, in due course of time, turned out more to be traders than the artisans. Soon the market expanded and the smiths found themselves with regular handsome income. The genius of the new smiths perhaps exhausted itself here. These artisans did not pay much attention to improve the designs. On the other hand, the alloy content of the ornaments was increased step by step which decreased the quality of the ornaments. They persisted with the old method of buying the metal in retail, and as a result, could effect no economy on the score of procuring raw materials for the craft. The initiative taken to expand the market was perhaps very crude. It is really surprising how they could think only of sending on sling-loads and head-loads with labourers ornaments to quite distant places in order to seek popularising their wares and expanding the market. The method was obviously crude, primitive, unimaginative, time consuming and expensive too. Obviously the recurring cost was high. To make matters worse, the new artisans learnt no lessons in frugality. Whatever income was earned was squandered away in leading an easy and comfortable life. They made no accumulation of capital. On the whole, the picture turned out to be one of those who, having learnt a good yielding trade from others and having carried it on, giving foster-child treatment to it, that is, making no improvements to it, whereas deriving and utilizing all possible benefits from it, soon killed the hen that used to lay golden eggs. The situation was one that expectantly awaited the arrival on the scene of a few frugal men, with hard sense of business, able to provide good capital for the trade and with a broad imagination, to seek fruitfully to expand the market.

9. It came about in 1912. One resourceful businessman, Shri Puranmal Agarwal came to Tarbha that year. He studied the problems and prospects of the craft and knew he could make good use of it. He started with supplying at the spot the raw materials, chiefly the silver and alloys. The artisans, who previously were having to trek long distances to buy the metal, now found the same being sold in retail in their own village. They purchased from the said businessman. Soon, however, this businessman thought it fit to employ a part of his capital in purchasing the ornaments turned out by the artisans. He fixed up a few agents whom he would entrust with those ornaments for sale on the basis of sharing a part of the profit. The trader took care that these agents had some established business connections, and soon he found the trade well off to a good

start. The market expanded. The businessman started supplying silver to the artisans on the agreement that they would make the ornaments, deliver back to the trader and take their wages, *i.e.*, making charges. This arrangement proved very successful as the artisans, already badly impoverished, found no other way out for a living. On the other hand, having had no other problems, such as, procuring of raw materials and marketing the ornaments, the artisans engaged themselves solely to making the ornaments. Naturally they made per day more ornaments than before and could earn good income, though enterprise was no longer with them. As a result, the business prospered. He could issue 3,000 tolas of silver per week. The price of silver in those days was 9 annas per tola, and a good artisan could earn about Rs. 1-8-0 per day. The artisans engaged in the craft increased rapidly and the trader earned huge profits. Other businessmen were also attracted to the trade. By 1935, about 70,000 to 80,000 tolas of silver ornaments were produced per month. About 150 families were engaged in the craft. Ornaments were marketed in Sambalpur, Bargarh, Jharsuguda, Deogarh, Sohela, Bodasambar areas, Kalahandi and Dharamgarh, and Chakradharpur and Jamshedpur in Bihar and Raigarh, Chhapa, Sadaichaki in Madhya Pradesh.

10. While the trade prospered, several businessmen had entered into the field. The spirit of competition came to hold sway. Ornaments are essentially a thing of luxury. The trade in it would, therefore, always sharply fluctuate with the rise and fall in general economic well-being of the people. Particularly when the people live a very low level of life, marginally finding out slight resources for purchase of ornaments, the economy being largely based on agriculture, the trade in such luxuries is bound to be very fluctuating. It has been found out that the craft of silversmithy had a decline from 1935 to 1942 when demand had very badly fallen and stocks had accumulated. Sharp competition among several businessmen made the matter worse. They did not issue silver to the artisans. Some of them suffered bad losses and many artisans were forced to leave the craft. In order to help save the situation, the seven more important men of the business formed a society with a capital of one and a half lakhs of rupees. The society was given the name of "Annapurna Company". It was an unregistered society and was in fact a loose combination of the few traders. To an extent, this helped the purpose of salvaging the craft. Demand for the ornaments also began to increase. Again the craft achieved prosperity during this period. There was an offer from the bordering princely state of Bolangir-Patna that the artisans and the traders shift their business to Bolangir. The administration of Bolangir state was comparatively more organised and orderly. However, there was the Patna Customs Act, 1937 in force in that state. It was elaborate and exacting. The traders of Tarbha refused to shift to Bolangir, but agreed to have a branch of their trade in nearby Bahirasar village, which was in Bolangir state. Since then, a few silversmiths have been established at Bahirasar and are seen at present working there. The Annapurna Company, which was, after all, a mutual loose pooling of resources, had no strict rules of business. The partners, who had combined, soon thought of utilizing the society to serve their own individual interests even to the detriment of the society. Some partners sought to further their own individual business through the company. Some also undertook under-hand dealings with the artisans in order to make private gain outside the company accounts. Other partners took notice. The society was liquidated in 1945. Since that date, the business is going on on the basis of individual enterprise.

11. From 1945 to 1955 the craft had a very good growth. It spread to nearby villages. There was excessive rainfall in

1955 and a serious drought in 1956. The crops were almost totally destroyed during these two years. The business had suffered very badly then. However, with bumper crop of 1957, the craft soon recuperated itself. The trend of prosperity was naturally expected to continue to manifest thereafter.

12. The craft of silversmithy was learnt and was being practised by the people of various communities. Being detached from its traditional content, the craft had come to be really a cottage industry. As this was profitable enough, anybody who could command an adequate amount of technical skill could practise this craft. At the height of prosperity, the people of nearby villages also took to it. It also subsequently spread. At present, the following villages within an area of two miles radius around Tarbha have also the artisans producing silver ornaments. They are:

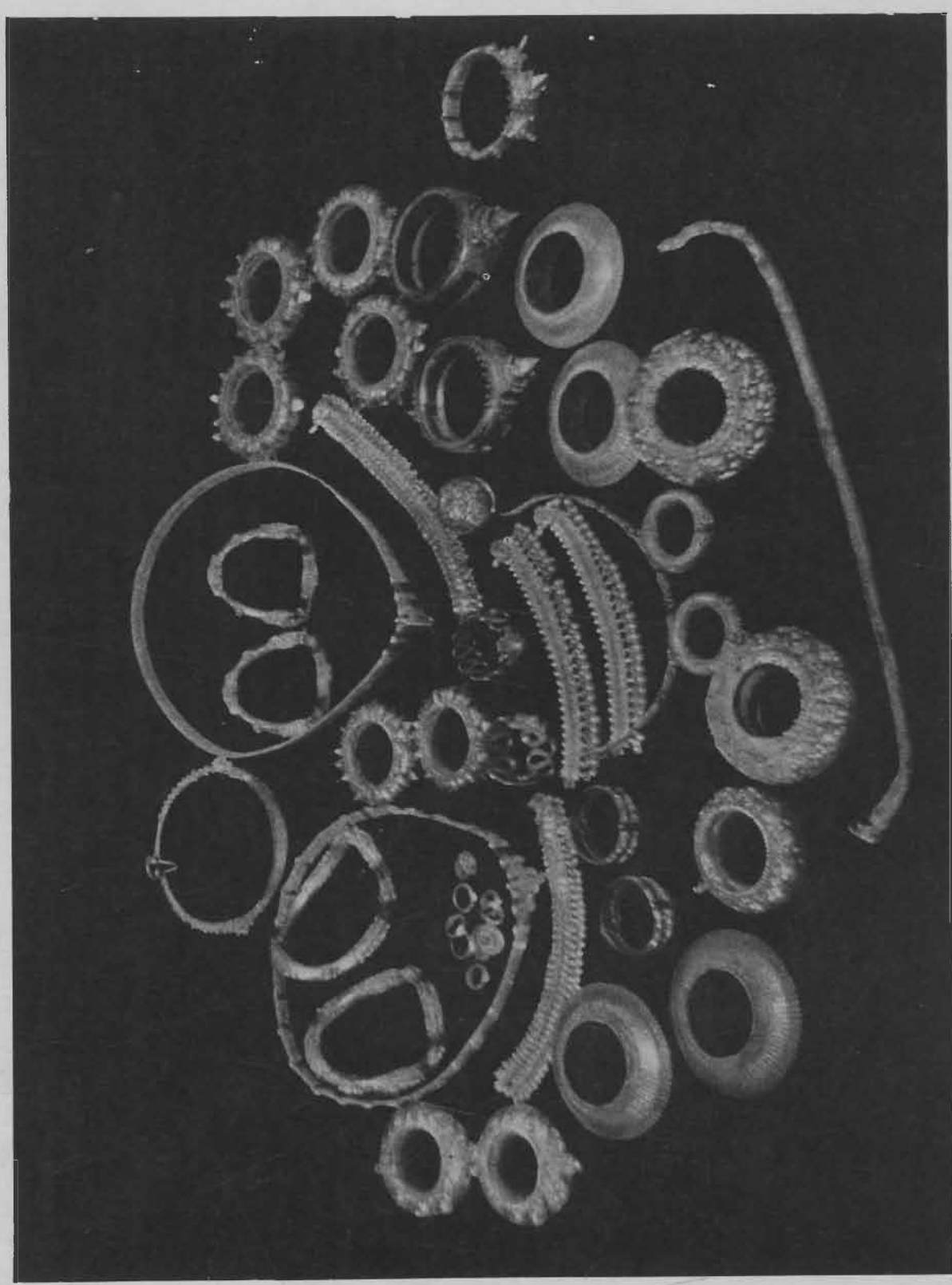
1. Antarda
2. Arjunda
3. Bada Bhairab
4. Bahirasar
5. Gaja
6. Jhar Tarbha
7. Khaliapali
8. Manhira
9. Nichhapali
10. Phatamunda
11. Ratha Pali
12. Saragaj
13. Shibtula

However, all these artisans function around Tarbha as their centre. They receive raw materials from the big traders *(Sahukar)* of Tarbha, and also deliver the produced wares back to the latter. A study of the craft at the central village will help to reveal the whole story of it. Accordingly, the present study, though confined to a single village, has been undertaken.

13. Most of the articles that the artisans produce are ornaments. The people generally in the lower rungs of the society, that is, poor peasants, labourers, small traders and artisans themselves use such ornaments. A definite tendency was observed of the customers appreciating simpler varieties of such ornaments.



Another street of Tarbha where the houses of artisans are situated



Ornaments produced at Tarbha

SECTION II

THE ARTISANS AND THE ARTICLES PRODUCED

14. The artisans of Tarbha produce mostly ornaments. Women in these parts of the country profusely dress themselves with such ornaments. Men are also found to wear ornaments, but sparingly. They are, however, giving it up in recent times. Still one can see a good number of males wearing hand-bangles made of brass or silver and silver ear-rings. However, the ornaments used by women are very much elaborate and varied. All these are not, of course, made of silver. Women, young girls and newly wed ladies particularly, wear a few pieces of gold, usually in their ears and noses. At other parts of the body, silver ornaments are generally used.

Various ornaments

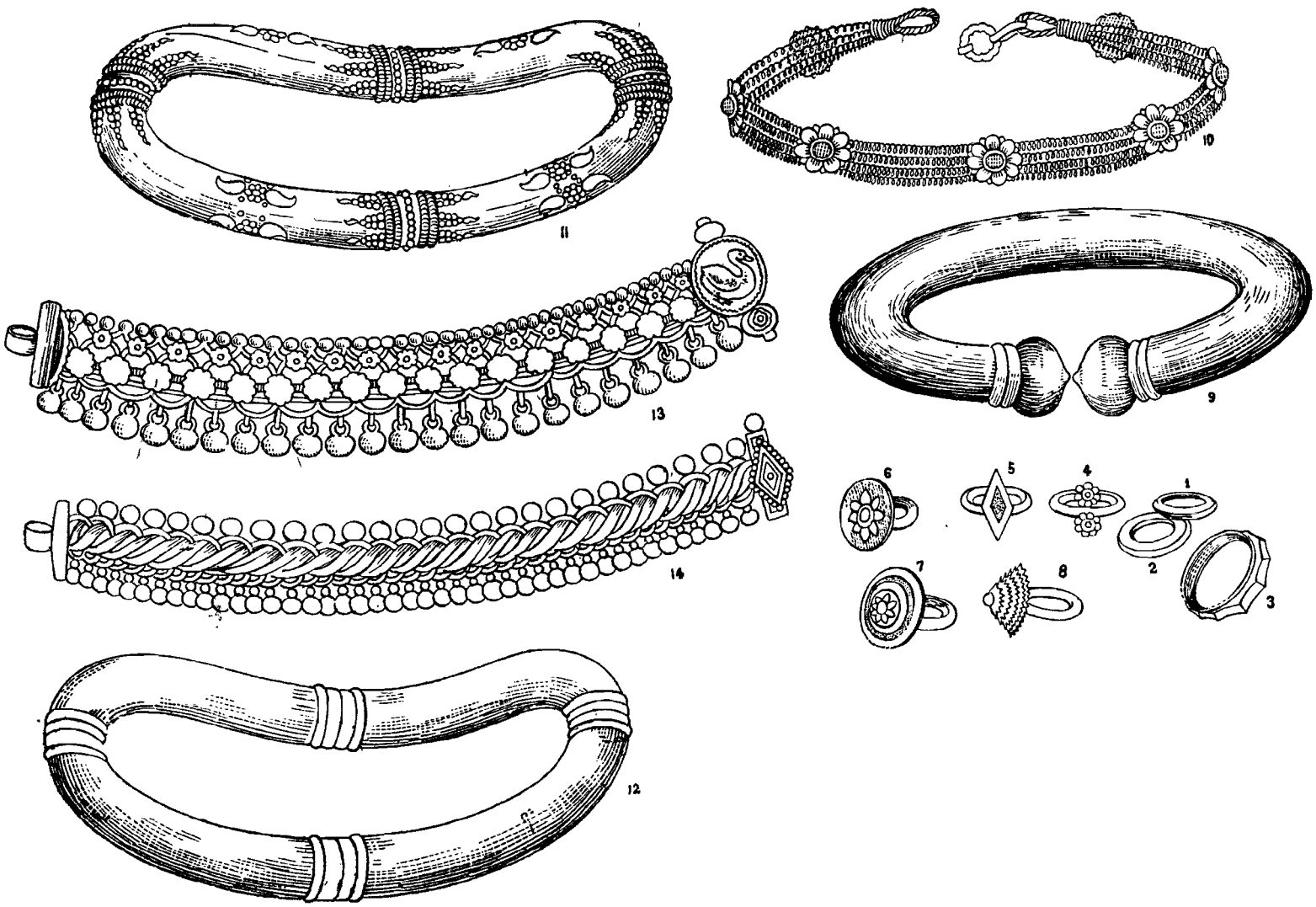
15. Different kinds of silver ornaments worn by the women of this area are described below:

(1) ***Mudi*** (foot-finger ring)—The least ornament of a woman is the ring called *Mudi*, worn on foot-fingers. It is a round shaped band, about $\frac{1}{4}$th of an inch in width in the surface and would be $\frac{1}{2}$ to $\frac{2}{3}$ inch in girth. It weighs nearly $\frac{1}{2}$ tola. The width of the band facing upwards, when worn on the fingers, is a bit more than the width of the band towards the earth below the fingers. There is no much variation in the type of this foot-ring.

(2) ***Angustha***—The ring worn on the toe is called *Angustha*. It is but a bigger ring of a little different shape. Its girth would be nearly 1 inch or slightly more. The width of the band all round would be $\frac{3}{8}$th of an inch. This ring is not round shaped at the edges as the other finger rings are. Its two edges take the shape of several small straight lines joined together in a circular manner so as to form the ring. Its edge takes the geometric shape of a hexagon or an octagon.

(3) ***Tudal***—It is a simple anklet, tubular and nearly round in structure worn by the women. The original shape of it was round. Subsequently it has taken oval shape. It is plain in surface over the tubes, but with small beads at the joints. It weighs 10 to 15 tolas each.

(4) ***Painri***—It is another kind of foot ornament worn just over the ankles in place of *Tudal*. It is also made of tube, round surfaced upwards. It takes a little more than oval shape and is a bit curved to one side. This portion remains towards the inner side of the ankle, the other round shaped portion, remaining outside for show. It has got several striped bands with circular lines therein and clusters of over-laid beads in conical shapes at two sides of each band. There would be 4 such bands of overlaid ornamentation on each *Painri*. Between two such bands, there are two pairs of flower-buds around a heap of small beads arranged in a circle. A *Painri* weighs about 6 to 12 tolas. Its girth lengthwise would be 4 to 7 inches, and breadthwise $2\frac{1}{2}$ to 3 inches. The type described above is called *Rua Painri*. The over-laid beads, the band and the flower-buds are what are called *Ruas*. When these beads and over-layings are not there, and the ornament takes the shape of a simple plain surfaced tubular piece of round oval shape, it is called *Sadha Painri*, i.e., plain *Painri*. This ornament also is gradually falling into disuse. It is largely because this is an inflexible ornament of fixed shape, and the women experience a



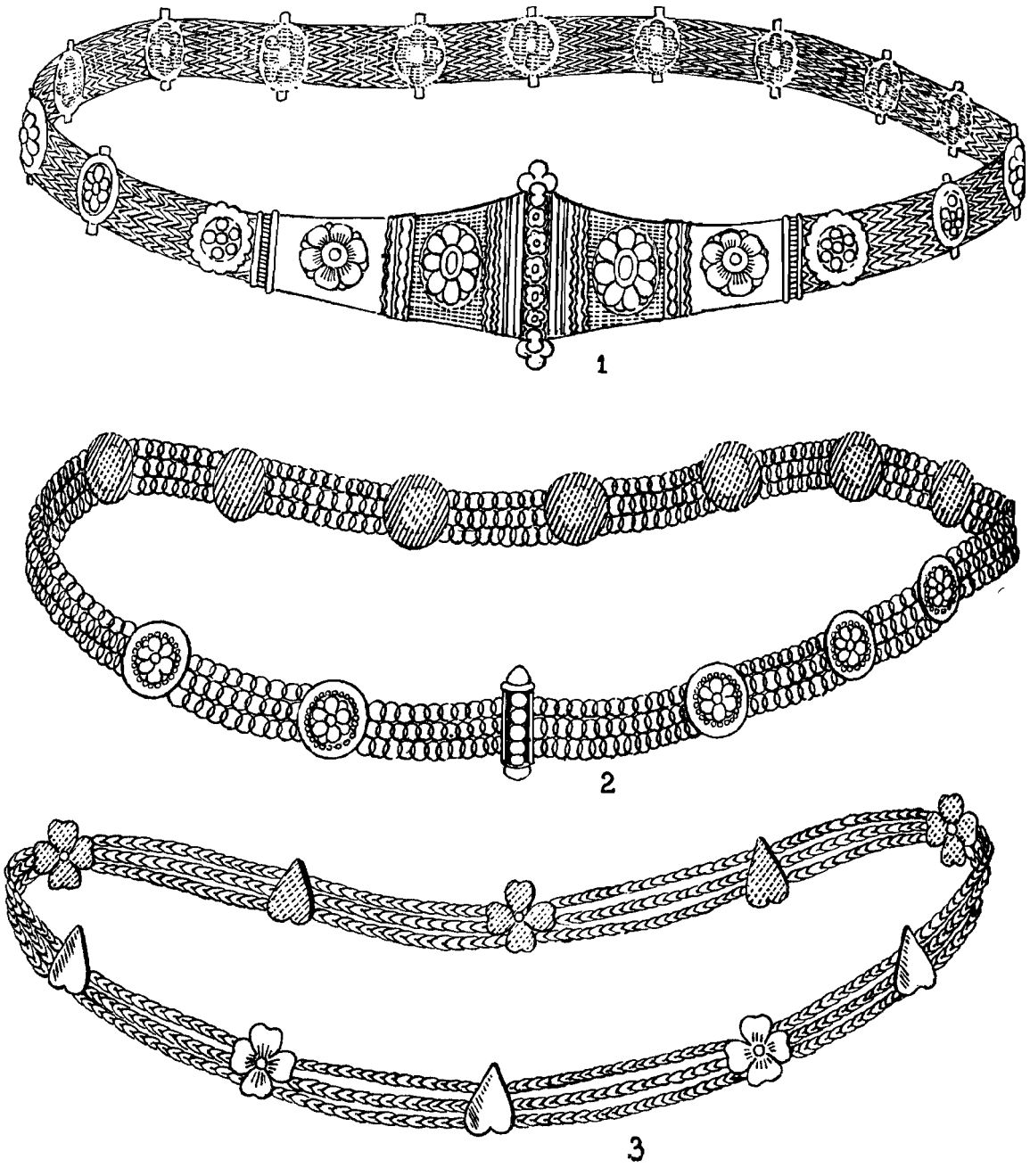
A FEW ORNAMENTS

1 & 2. Mudi (foot-finger rings). 3. Angustha (toe-ring). 4, 5, 6, 7 & 8. Mudi (hand-finger rings).
9. Tudal. 10. Jiuntia. 11. Rua Painri. 12. Sadha Painri. 13. Phula Paijam. 14. Kadi Paijam.

lot of difficulties while putting it round all through the palm of the foot and over the ankle and also getting it out.

(5) ***Panjal*** or ***Paijam***—It is the most commonly used ornament of the foot. Being an ornament of modern style it has become popular. This ornament is flexible in nature with inter-lacing of several circular chains joined together having small flower shaped silver pieces. Its structure is not of a tube, but is of several chains and small metal pieces set on a flexible plate of small width. The upper-most row of the ornament is made of small circular metal pieces. They are not joined to each other but every alternate, on the two sides, and each of the two in the middle are linked together by two wires to another flower-shaped piece below. Such flower-shaped pieces form the second row. These pieces are again joined, by means of two wires, to the bigger flower-shaped circular pieces set below on the thin middle plate. The latter pieces form the third row and impart durability to the ornament, being set on to the plate. Each of these flower pieces is hinged to the other by means of wires of semi-circular shapes. As if forming small sectors at the lowest portions of this semi-circular shapes, there would be small wires joined to each other. This gives the impression of a two pronged intertwined rope work. From this, hang the small hollow balls with small stone pieces inside. Thus the *Paijam* gives the impression of a band of lace work joined to each other. At one side of it, will be one coin-like metal piece with the carving of some fancy object, say a flower or a swan, on it. The coin is embossed on a metal stick of some width. On the two ends of the coin, there would be two circular or oval metal pieces, sometimes with further carvings on these, all embossed to the metal stick. Behind the coin, there is a slot. On the other side of the *Paijam*, there is a simple metal stick to which is attached a small circular hasp. At the time of wearing it, one end of the *Paijam* is turned round the ankle and bolted to the other end. It becomes easy to wear and easy to take it out too. The width of the *Paijam* is nearly one to one and a half inches, and the length is 4 to 9 inches. It weighs 7 to 10 tolas. The ornament produces a sweet jingling sound while the wearer walks. A simpler variety of *Paijam* has also been given in the sketch. Above the metallic balls and the chain like rope work, and below the row of circular plates above, there is a chain of inter-laced metal wires. The two sticks of the two sides are almost similar in structure as in the above variety, except that instead of a coin embossed to a side, a metallic rhombus with small beads at the edges and similar lines inside in-laid is embossed to a stick on one side. The length and breadth of this *Paijam* are similar to the earlier variety. Whereas the earlier variety has a superiority for ornamentation, the latter has it for greater flexibility. The earlier variety is more costly than the latter.

(6) ***Guinchi*** or ***Gunchi***—This ornament, meant for the waist is made largely of intertwined and closely knit silver threads into various patterns. It takes the shape of inter-laced chain of varying widths. This ornament has three varieties, depending upon the pattern of knit-work. One variety is called *Phula Guinchi*. The breadth of the chain will be 1" to 1½". Sometimes it can be up to even 2". The chain appears to be formed of five or six prominent lines. At regular intervals, fixed on to the chain, are small thin silver plates of oval shapes, which really serve to hold together the rows of threads. Flower-works are inlaid on these plates. The length of the chain would be nearby 18" to 30", depending upon the girth of the wearer's waist. The two ends of the chain are joined together by means of inter-laced slots and a silver stick for a staple. The chain is broader at these two ends than in the middle. A panel of flower works inlaid on a small plate is soldered on



VARIETIES OF GUINCHIS

1. Phula Guinchi. 2. Kadi Guinchi. 3. Chain Guinchi.

to the row of inter-laced slots. At the two sides of it, there are three lines each creating two panels on each side and on those panels, shapes of flowers are inlaid.

Only young and grown up ladies wear this ornament round the waist. The open band is put round the waist and is then slotted. The portion at the slots having fine works of ornamentation is put to a side.

The variety having the pattern of knitting, which gives the impression of several rows of small metallic circles on the band, is known as *Kadi Guinchi*. The breadth of the band is nearly one third to one inch. The breadth is uniform all along its length of 18" to 30", that is, the portion at the slots is not broader like the type described above. The thin, oval shaped silver plates holding on to the band together do not have any ornamented designs. This is a simpler type and is worn by both males and females and by children, young and old.

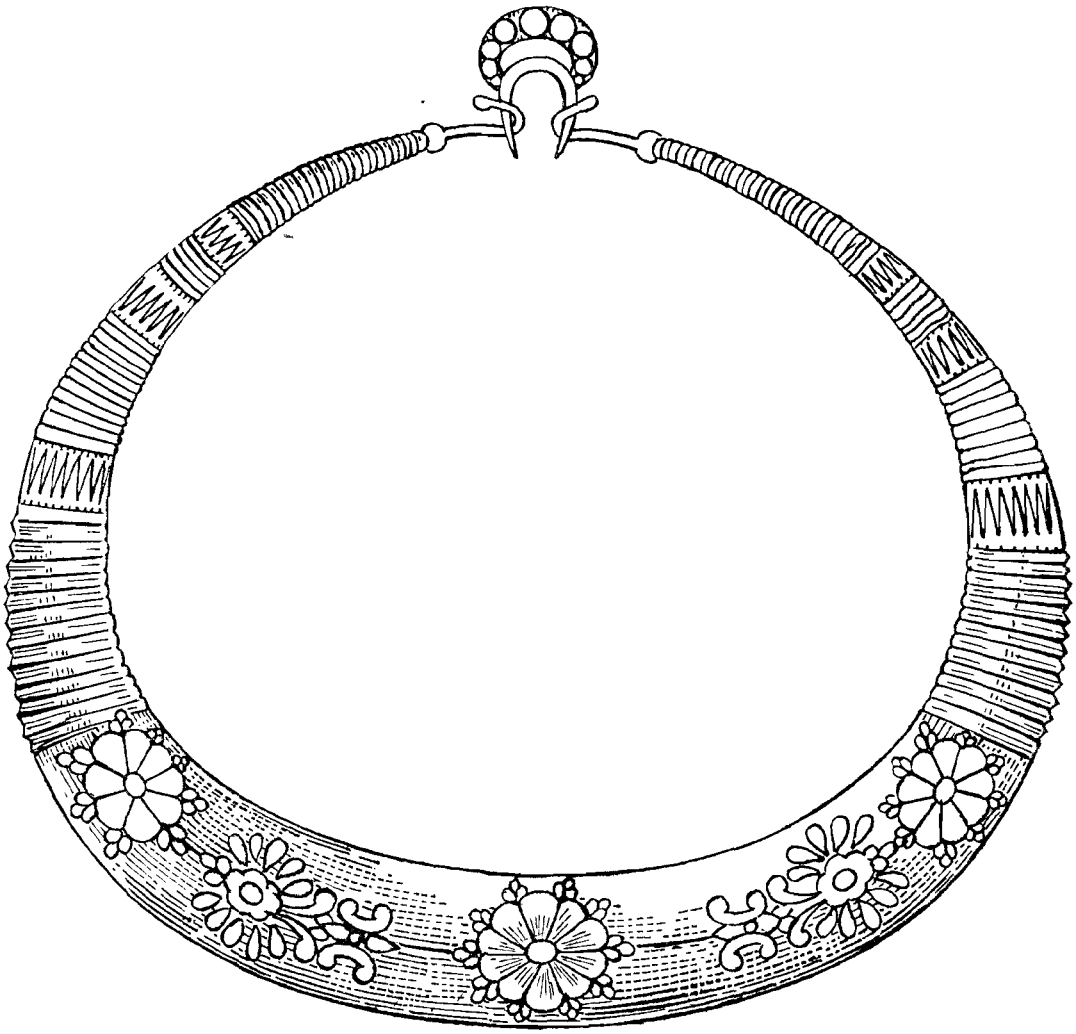
The other simpler variety is called the *Chain Guinchi*. It is of similar length and breadth as the two previous types. The difference is that the pattern gives the impression of only a few simple thread lines running parallel to each other throughout the course. However, the shape of silver plates holding the chains together is not of oval shape, but is of the shapes either of flowers or flower-buds in the outlines. No inlaid work is made on these simple plates. Usually small boys and girls put round their waists this variety of *Guinchi*.

The first variety of *Guinchi* may weigh up to 50 tolas, whereas the latter two varieties have lesser weights.

(7) ***Khagla***—This is a neck-wear, and is used generally instead of, and sometimes along with, a necklace. This ornament is made of a solid flat strip of silver curved into a round shape. The two ends are narrower in width, gradually widening towards the middle. These two ends are joined with a replaceable hook and are placed at the nape of the neck while the widest portion falls towards the woman's bosom. Fine silver threads are tied round and round, from the two ends almost to the half on the two flanks. Shapes of flowers, separately prepared, are soldered on to the body of the ornament. Two couples of flowers of similar shapes and designs are often embossed on two flanks of the *Khagla*. Sometimes, added to it, another shape of a flower is embossed on to the middle point of the round strip, the portion that falls on the wearer's chest. Wiring of fine silver threads around the strip stops just above the points where the two couples of flower-shapes are embossed. The lower portions remain mostly plain except for the embossed flower-shapes. This ornament is rather popular more with the tribal girls than with others. The circle of the *Khagla* has a diameter approximately of $4\frac{1}{2}$". A *Khagla* weighs between 7 to 25 tolas. This ornament is widely used.

(8) Some women also wear very simple silver chains, which are but silver threads inter-twined together into some pattern and weigh 2 to 3 tolas each.

(9) ***Jiuntia***—This is also a neck-wear. It is made of fine silver threads inter-twined into shapes of small beads. Four such rows of circling threads run round a periphery of nearly 8 inches. Flower-shaped silver pieces are soldered on to these rows, which hold these on together. The two ends are closely tied together with ordinary cotton threads, with which a type of hooks is improvised. In order to keep with the white colour of the silver ornament, some cotton threads of fitting colour are used. This is a simple type of ornament and is gradually falling into disuse as the people gather more of sophistication. It weighs 5 to 7 tolas. This is worn just above the *Khagla* round the neck, and together with the *Khagla*, it covers a good strip of space round the woman's neck.

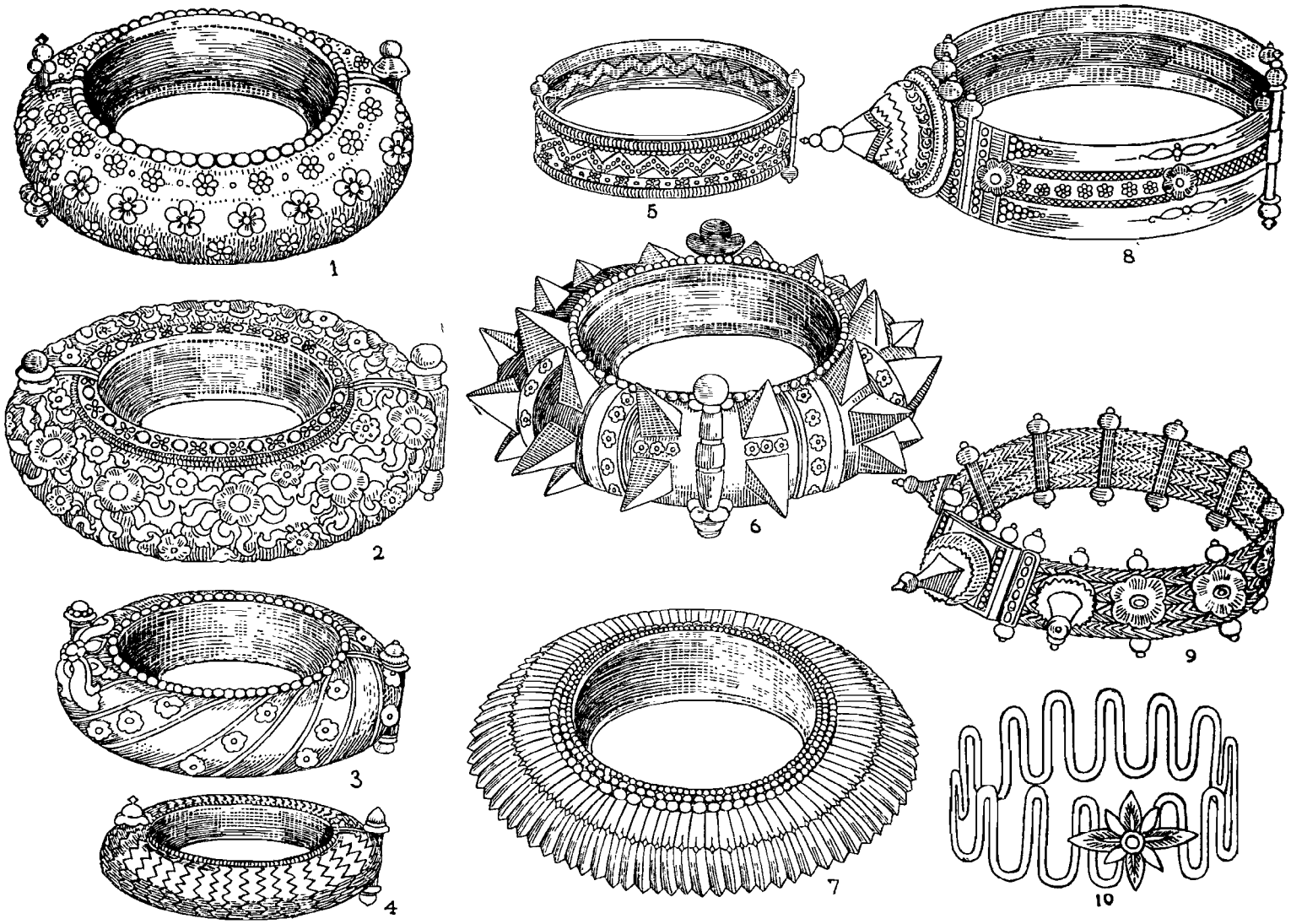


KHAGLA—a neck-wear

(10) ***Bandaria***—A good number of ornaments is worn on the hand. Just below the palm, a bangle with sharp pointed spike-like protrusions is worn. It is called *Bandaria*. It is made of hollow tubular metallic structure. The tube, at a section, has an oval curvature towards the outside and is slightly cambered towards inside. On the external surface of the tube, the protrusions could be made by striking the tube with appropriate tools. These are made at particular surface sections of the tube, being alternated by plain band-like stripes. A few lines are carved out in those stripes; shapes of flowers are also brought out. Two thin and narrow circular plates with beads carved on these are soldered on two sides along the two circular lines of curvature towards outside and inside. The protrusions, in a line over the surface, number twos and threes at a time. The circular ornament is cut into two semi-circular pieces and are joined by two slots and hooks on the two sides. The inside diameter of the circular ornament will be nearly 3½ inches, and the diameter of the outside circle will be nearly 7 inches. As a result, the girth of the tube has a diameter of nearly 1½ inches. The ornament weighs nearly 10 to 15 tolas each. *Bandaria* is of 3 types. In the *Sadha* or plain type, the intervening space between two rows of protrusions is kept plain. This space is carved with shapes of creepers and flowers, in *Lata* type. In *Barpalia* or *Sambalpuria* type of *Bandaria*, the protrusions do not have sharp points but are blunt. The sharp pointed protrusions are inconvenient and cumbersome to a woman at work. This ornament is largely falling into disuse.

(11) ***Kalari***—It is an improvement over *Bandaria*. This ornament is a bangle like *Bandaria*, but does not have the protrusions. Accordingly, the external surface of the tube is kept blank for any kind of carving or in-laying. According to the varying designs of in-laying on this external surface of the tube the *Kalari* takes its name. Various patterns, such as, *Phula Kalari*. *Jali Kalari*, *Patta Kalari* and *Panasa Kalari* are made. *Phula Kalari* is the one which has shapes of big and small flowers carved on the surface of the tube. Certain amount of uniformity will always be there about it. *Jali Kalari* is of the more intricate type and demands better workmanship. It takes such a name, as besides the shapes of flowers being carved on the surface, the intervening spaces are also carved with small petal-like shapes, which, as a result, give the appearance of a good network. The inner plate and the external hollow tube are joined, along with narrow circular thin plates soldered, on which are also carved small round beads. The artisan demands the highest rate of wage for this piece of work, that is, nearly 1 rupee per tola as making charges. *Patta Kalari* is the one in which several stripes are made on the external surface of the tube by drawing several parallel lines. In every alternate stripe, shapes of small flowers are also carved. *Panasa Kalari* is the simplest type. In this, the external surface of the tube is carved with small regular protrusions as in the surface of a jack fruit. A *Kalari* weighs between 10 to 15 tolas. The diameter of the inner circle is 3½ inches and that of the outer circle, along with the girth of the tube, is 6½ inches.

(12) ***Chudi***—Below the *Bandaria* or *Kalari* are worn other varieties of bangles called *Chudi*. These are of thin types. Three or four such bangles are joined together and slots and a hasp are supplied to it. When such bangles are left without any in-laying work, it is called *Sadha Chudi*, that is, the bangles of the plain type. The shapes of flowers are also carved on such joint bangles. In fact, such flower shapes are carved on separate thin narrow stripes of plates, which are then soldered on to the bangles. Such stripes have certain width, and in between two thin bangles, this is soldered. Each of the two bangles in the



WOMEN'S ORNAMENTS FOR THE HAND AND THE ARM

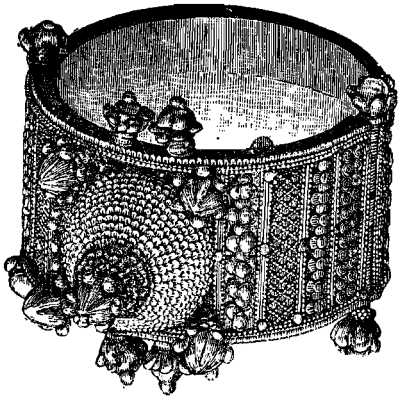
1. Phula Kalari. 2. Jali Kalari. 3. Patta Kalari. 4. Panasa Kalari. 5. Chudi. 6. Bandaria. 7. Kataria. 8. Tada. 9. Bahasuta. 10. Nagmuri

whole joint structure of this ornament is joined with small wire pieces being soldered to them. Small beads are also laid on the joints. On the whole, this ornament is a bit intricate type and brings good wages for the artisan.

(13) ***Kataria***—Next to *Chudis* on the other side of *Bandaria*, is worn the bigger ornament named *Kataria*. It is comparatively a lighter and simpler ornament. The technique of making it is essentially almost the same as in case of the previous ones. Here the outer surface of the tube is carved with a large number of lines at small spaces, with the result that very small protrusions are made at the edge of the curvature in the exterior middle. This ornament gives the impression of a disc weapon and is a bit sharp. It has also two varieties. The type just described is the plain type. If between the middle edge and the line of joint with the inner plate another line of small protrusions are made, it is called *Tihidi* type. The inner diameter of this ornament will be nearly 4 inches and the diameter of the outer circle about the edges with protrusions will be nearly 8 inches.

(14) ***Mudi*** (Hand-finger ring)—On the fingers are worn several finger rings called *Mudi*. These may be of simple types or may be a little intricate ones. A round solid band of some girth with a small plate or a small rhombus or a small metallic flower piece attached to a point, make a ring for the finger. On the small plates or on the rhombus, some carvings are generally made. Women wear these on all or some of the fingers of one or both hands.

(15) ***Tada***—On the right-hand arm, *Tada* is worn. It was once the most prominent and heaviest of the ornaments, weighing not less than 50 tolas each. But the weight has fallen down considerably, and now it will be nearly 10 to 12 tolas. In this case, no tube is used for the same purpose as in *Bandaria*. Small tubes of small girth are, of course, used. That is, two or three such circular tubes are made. These serve as the frame of the ornament. On these tubular frames, plates of some



Another type of Tada

thickness are soldered. On this plate, several pieces of workmanship are done. There are long stripes, flowers and beads, both in horizontal and perpendicular directions. These tubes and plates are cut at a place, where the slots and the hasp are supplied. At the just opposite point across the slots, there would be a big protrusion built in several layers. First a cup like hollow curved plate is placed on to the base plate. On this, another cubical structure is soldered, on the top of which again small balls of reduced sizes are put. It takes a conical shape and would be 1½ inches protruding outside from the base. The weight of the ornament varies according as the base tubular structure is made solid or hollow. The diameter of the circular ornament is between 3 to 4 inches.

(16) ***Bahasuta***—This is an ornament worn on the left hand arm. Unlike *Tada*, the base tubular structure is not there. It

is really a stripe of interwoven silver wires, held together by silver bands at regular intervals. On the outer surface, just above each band, several flower-shapes carved out on plates into appropriate sizes are soldered on to the band. The slots and the hasp are at one side. Near about it, there is the main protrusion similar to, but smaller in size than, that described in case of *Tada*. On two sides of the main protrusion, there are two other small pillar-like protrusions. The diameter of this circular ornament varies from 3 to 4 inches.

(17) ***Nagmuri***—Instead of *Bahasuta*, an ornament of very simple design, named *Nagmuri*, is also worn on the arm. It is a long silver wire, of some girth, inter-twined into shapes of 'U' s and inverse 'V' s alternately, made to a circular shape, being joined at the two ends. At the joint, a metallic flower is soldered to this structure. It normally weighs 5 to 7 tolas. This is an ornament made at Tarbha to cater to the demand in areas round Raipur in Madhya Pradesh.

(18) The hair-dress is, however, varied. Fashions and tastes change frequently. Sometime back, there was the broad silver comb to be fitted after carefully setting the hair. In its place, different varieties of brooches are now being used. Some contain designs of certain flowers. Some ear-rings and nose ornaments are also attempted to be made. However, these are not the ornaments widely produced in Tarbha. A few artisans, who are trying to make such ornaments, are largely imitating such designs from similar ornaments produced either at Cuttack or Agra. Some brooches made at Agra and Cuttack were found with the craftsman Shri Bidyadhar Sahu. The ornaments of the nose and the ears, and a few brooches for the hair seem to be a little finer varieties of work that these artisans are yet to master. However, some of them prepare broad betel leaf like ornaments to put on as brooches.

Utility and fancy wares

16. Besides ornaments, a few varieties of utensils and fancy wares are also made at Tarbha. A few sketches are given at page 163. A small silver plate meant for keeping betel pieces on it, called *Pandan* is very ornately designed. Its inner containing space is divided into several parallel running circular rings, each carved out with various fine art work. The outermost ring in the sketch contains shapes of flower buds ; the second ring, shapes of creepers with flowers ; the third ring, shapes of mango fruits and the innermost circle, a figure of a butterfly sucking honey from flowers. The edges are made of semi-circular curvatures with figures of the lean moon and a star on each of the protruding portions.

17. *Chandandan* is a small jug with a long neck and small hole-points at the mouth. It has a base too. This is richly carved out with figures of flowers, creepers and various other objects right from the base up to just below the neck. Rose water and water mixed with sandal wood paste are put into the jug by opening up at the base of the neck. The neck portion then being fitted into it in the process of screwing, the jug can be used as a sprinkler. Rich aristocratic people are used to make much use of it during summer. Similarly, there is the *Atardan*, that is, a container of scents. The sketch shows a plate richly carved with various fine art work of shapes of flowers, creepers and various other objects. On this, at the centre, is seated a statuette of a peacock with all its feathery loveliness. On its back, there is a flap fixed on to a hinge, covering up a small hole below it. Perfumes are kept in this hole and can be offered to a guest or a friend with finger tips. This is a piece, which was much in use in the courts in ex-princely states. These articles are



A woman labourer with her ornaments



A silver hair brooch on a woman's head



A GROUP OF FANCY WARES

1. Pandan. 2. Atardan. 3. Chandandan. 4. Karat.
(All exquisitely carved by the artisan Sri Satyananda Sahu)

made only when special orders are placed for their preparation. Other types of containers to keep betels in, snuff boxes are also made by the silversmiths, when ordered. A *Karat* is a small container of coins. It is made of two small bowls, one put over the other as lid. Several designs of creepers and lines are carved on its round outer surface. Working women particularly use this for tying with it knots at the ends of their *Sharis* while wearing. Plain utensils and those with shapes of creepers and flowers carved are also prepared here. Many other things, including articles of worship used in temples and on the statuettes of gods and goddesses, are also made. These are bugling cones, discs, clubs, lotus (the objects and weapons of the Bishnu's four hands), small canopies, crown, etc. Since these articles are prepared according to order, these have no specific usual designs and measurements. These are made as per the requirements of the customer. In the whole of Tarbha, there are only two to three artisans who can make such wares.

18. Colours are hardly used in making all these. Since these are made of silver, ornaments have a more or less white colour. When the product is of pure silver, its colour and glaze last for ever. Now a days, however, alloys are being mixed in high proportions. Accordingly, the glaze is usually not to be found there. On the other hand, such ornaments and other wares get darkened after a period, beginning right from a number of days up to a number of months. After first making, the wares, either of pure silver or of alloys present almost the same colour, and it is difficult for an ordinary customer to distinguish the pure from the alloys.

The Artisans belonging to all communities

19. ***Kansaris***, who were the traditional bell-metal workers, were the artisans, who first took to silversmithy, having learnt the art and the craft from the traditional silversmiths. The people of the community of weavers, known in these parts as *Meher*, soon followed the *Kansaris*. The people of other communities also undertook this craft later. As a result, people of all types of communities have been practising the craft. Thus the craft of silversmithy at Tarbha has neither a long tradition at the place nor the artisans, who are at work with it, are the traditional silversmiths. If social mobility in matter of profession and trade was very much restricted in the society, it is at least not true of Tarbha. It was, as if, there was a huge rush at a very profitable craft, learnt or improvised, and the people of all types of communities engaged in this. From this view point, it will perhaps not be very accurate to term all these people as belonging to artisan communities. However, people belonging to the following communities are found to be at work in this craft. 1. *Kansari*, 2. *Meher*, 3. *Paik*, 4. *Mali*, 5. *Teli*, 6. *Khadura*, 7. *Chasa*, 8. *Keuta*, 9. *Sundhi*, 10. *Brahmin*, 11. *Gauda*, 12. *Gudia*, 13. *Sunari*, 14. *Rajput*, 15. *Marwari*. Some other communities, such as, barbers and *Karans* were also working with this craft in the year 1962. They have now left it. Some belonging to the community of scavengers and sweepers are also engaged in processing a by-product of the craft. Thus, a conglomeration of people of all communities working in silversmithy form what may loosely be called the artisan community of Tarbha.

20. In the year 1962, 309 workshops called *Salas* belonging to 309 artisan families were functioning at Tarbha. In course of slightly more than a year, 68 of these families have either closed down or have shifted to other villages. That is, 241 workshops belonging to the same number of families, are now in the craft. Their communitywise distribution is indicated in the statement below.

ARTISAN COMMUNITIES ENGAGED IN THE CRAFT

Serial number	Communities	Position in 1962	Closed down in the meanwhile	Shifted to other villages	Present position (1964 May)
1	2	3	4	5	6
1.	Kansari ...	114	22	3	89
2.	Meher ...	72	10	2	60
3.	Chasa ...	11	4	...	7
4.	Khadura ...	13	...	...	13
5.	Mali ...	20	4	2	14
6.	Paik ...	31	2	...	29
7.	Keuta ...	9	1	...	8
8.	Mohanty ...	2	2	...	0
9.	Bhandari ...	1	1	...	0
10.	Marwari ...	1	...	...	1
11.	Teli ...	16	9	1	6
12.	Gauda ...	7	2	...	5
13.	Brahmin ...	4	1	...	3
14	Sundhi ...	5	2	...	3
15.	Gudia ...	1	...	...	1
16.	Sunari ...	1	...	...	1
17.	Rajput ...	1	...	...	1
	Total ...	309	60	8	241

It will be evident that the people of the *Kansari* community head in the craft with 89 workshops, closely followed by the *Meher*, who have 60 workshops. The *Paiks* occupy the third place with 29 workshops. Members of families other than the aforesaid 241 are also engaged in this craft in various capacities, either full-time or part-time. Female members of some Mohamedan, Barber and *Karan* families also find part-time work, knitting *Guinchis* with silver threads. Many other families of this village and nearby villages supply casual and permanent labourers and helpers for the craft. The aforesaid 241 families had 323 artisans engaged in the said craft all of whom were males. The females used to help their male members casually after doing their household chores. Some of them used to knit *Guinchis*, while some used to clean ornaments at the finishing stage. Very few female members were found to be solely engaged in this work. The cases of a few helpless women having taken to the cleansing work as sources of their livelihood were reported. It would, however, be difficult to class them with artisans proper. Nearly 400 persons were the helpers and apprentices engaged in the craft. Thus, nearly 723 workers

were found engaged full-time in this craft in 241 workshops, which works out to 3 workers in average in a workshop. The number of workers in a workshop varies from 1 to 8. But 2, 3 or 4 was the usual number found in most of the workshops. Helpers are drawn from all communities and particularly from the poor families. Very young persons, aged 12 or 13 years, were found engaged as helpers doing tit-bits at call of the artisan.

21. None of these artisan families are working under co-operation. Most of the artisans depend completely on this craft for their livelihood. Some of them have little or more land too. Being themselves poor, generally having no capital accumulation, these artisans have lost all enterprise. They always prefer to work for ready cash. On account of this, they are tied to the *Sahukars*, who are traders and money-lenders. The latter people monopolise the organization of the manufacture and trade of ornaments. They also supply the required raw materials to the artisans. The artisan mainly makes the ornament and delivers it to the trader, who in return, pays him his wages, that is, the making charges of the ornament. In this process, a few traders actually regulate the livelihood pattern of the artisans. The artisans also borrow money from the traders in times of need. Co-operation has not made any head-way among the artisans of Tarbha. The craft centres round the following few traders, who run their business on lines of individual enterprise. They are: 1. Sri Biramani Sahu, 2. Shri Kalakahnu Agarwal, 3. Shri Kshetri Meher, 4. Shri Arjun Moharana, 5. Shri Balamukund Sahu. The sixth trader is Shri Bidyadhar Sahu, who deals in ornaments of nickel alloys only.

22. These traders do not strictly occupy the positions of employers. The artisans, whom they supply raw materials and who deliver ornaments in return in lieu of making charges, are not strictly the wage-earners. They still retain their individual workshop and the most important component in the craft, that is, the skill. They have merely lost the initiative and enterprise in the craft. The traders have taken over this initiative and enterprise in addition to trading the wares. The position is a bit anomalous—the artisan is neither an enterprising craftsman nor a pure and simple wage-earner. Nor the trader has factory-sheds, where the artisans would merely work to his order in lieu of wages for the labour put in.

SECTION III

RAW MATERIALS, OTHER RESOURCES AND EQUIPMENTS

23. It may appear paradoxical but it is nonetheless a truth that silver is not the chief component of silver ornaments prepared at Tarbha.

Chief materials

24. Pure silver is very soft and not malleable. As such, it is very difficult to make ornaments with it. An amount of copper is required to be mixed to give to the admixture the required strength and durability, so that necessary figuration can be worked out on the frame of ornament. Hence, in old days, when the craft was trying to take its firm roots, only 4 tolas of copper was being added to 100 tolas of silver, and ornaments were being prepared with this alloy. Subsequently, the proportion of alloys in the metal used at Tarbha has increased even to such ridiculously low position that sometimes 534 tolas of copper and 66 tolas of zinc are added to 100 tolas of silver, thus yielding a compound of 700 tolas. Smiths are still adding further. In many cases, 890 tolas of copper and 110 tolas of zinc are compounded with 100 tolas of silver. High or low content of alloys, whatever it is, makes a silver alloy and the ornaments executed with this metal may be, to a degree, termed silver ornaments. But silver has been eliminated altogether in many cases. These smiths prepare so-called silver ornaments out of nickel alloys. This alloy goes with the misnomer of 'German silver', which is but an admixture of nickel, copper and zinc in the proportion of 1 : 2 : 1.

25. When the craft was in the height of prosperity, nearly 33 lakh tolas of metal was being processed annually at Tarbha. The craft, however, is at present having a decline. With 241 workshops and 723 artisans working therein, it is calculated that at present nearly 10,84,500 tolas of metal are being turned into ornaments and other utility goods. This is calculated at the average rate of 6 tolas of metal per artisan per day, for 723 workers, with 4 to 5 days' leisure or holidays in a month, working on the average 10 months in a year. The different proportions of admixture shall be indicated in a subsequent section. It was very difficult to obtain the accurate figures of admixture from traders and artisans. Moreover different traders and artisans work with different proportions of admixture. Silver-plating is already in large use in Tarbha. Most of the ornaments made by the smiths of Tarbha are getting darkened in colour in 7 to 15 days. A possible proportion of admixture that would tally with such conditions can be safely assumed. The proportion of 100 tolas of silver being added to 534 tolas of copper and 66 tolas of zinc is the one that is likely to give rise to such circumstances. Assuming this proportion of admixture, the annual quantity of metal turned out at Tarbha is resolved into 1,54,929 tolas of silver, 8,27,318 tolas of copper and 1,02,253 tolas of zinc.

26. All these materials are obtained by the traders from wholesale markets of Calcutta, and sometimes of Bombay. These traders procure silver, copper and zinc in large quantities and in suitable shapes. Almost all of them effect the admixture at their homes with the help of a few trusted artisans, and then deliver these metal to the artisans for making ornaments.

27. The nickel alloy, that is, the metal named 'German silver' is obtained from Agra in shapes of plates and threads.

Previously, small parts of ornaments, such as, flowers, beads, etc., of 'German silver' in ready-made shapes were being brought from Agra and then used in the ornaments prepared at Tarbha. For the last 4 to 5 years, however, a few more enterprising traders are found to make ornaments purely out of this nickel alloy. This alloy is white in colour but lacks in lustre and brightness of silver. For this, silver-plating is done on such ornaments. However, it was understood that 40 to 50 thousand tolas of 'German silver' was being annually turned out into ornaments in the village. This appears to be somewhat under-estimation of actual facts. A definite impression was had that almost all the artisans were preparing ornaments, more or less, of 'German silver'. The annual turn out of the alloy may accordingly be 75 to 80 thousand tolas approximately. Nevertheless, the amount of silver alloy worked upon is much more than the amount of nickel alloy in use there.

28. In view of this, copper, zinc and nickel have got to be regarded as the chief metals in the craft. Silver has been relegated to somewhat a subsidiary position, though it retains a crucial role all the same. Old ornaments are also made over to artisans for making new ones as per individual customer's orders. Some artisans try to keep up to a certain satisfactory level of quality. Some of these artisans were contacted and all of them were found to have good business.

Subsidiary materials

29. The other subsidiary materials used are charcoal, kerosene, ground-nut oil, borax, tamarind, common salt, soap-nut (nuts of sapindus saponaria), sulphuric acid, potassium cyanide. The articles like common salt, kerosene, borax and ground-nut oil are purchased in retail by the artisans themselves. Soap-nuts are collected from the nearby forests. Charcoal is also collected by the labourers from jungles. Artisans purchase it from them. The traders supply the acids. A rough estimate of the annual requirement of these subsidiary materials was made. In order to turn out 10,84,500 tolas of metal, the following subsidiary materials are required of the values noted against each of them.

Acids	...	Rs. 10,075/-
Charcoal	...	Rs. 3,100/-
Kerosene	...	Rs. 27,125/-
Borax	...	Rs. 6,200/-
Ground-nut oil	...	Rs. 775/-
Soap-nut and tamarind	...	Rs. 775/-

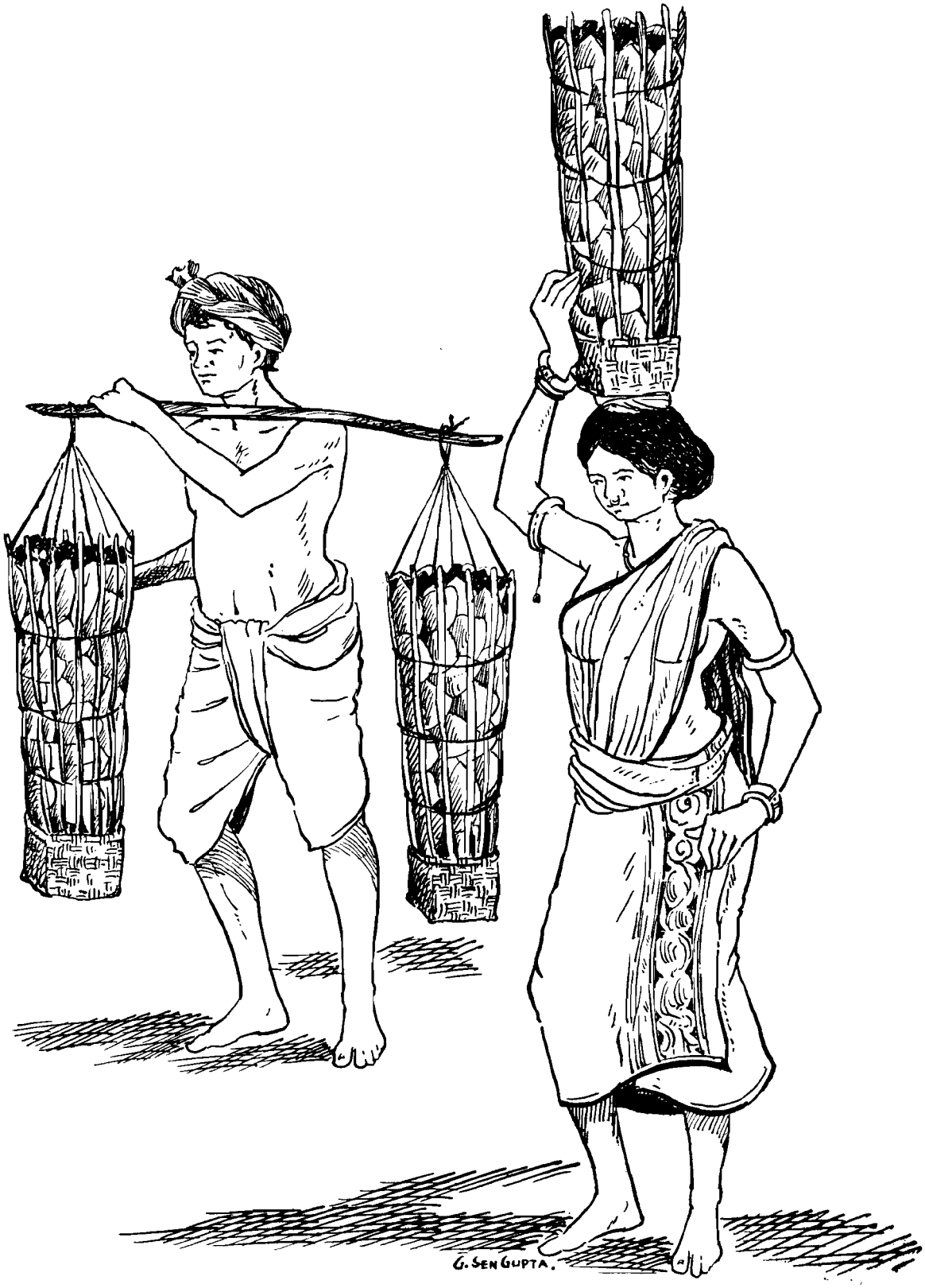
30. The above estimate is based on that of such materials required, as obtained from the old smiths of Tarbha for turning out 700 tolas of metal, that is, an admixture of 100 tolas of silver, 534 tolas of copper and 66 tolas of zinc.

Acids	...	Rs. 6.50	Paise
Charcoal—200 Kg.	...	Rs. 20.00	,,
Kerosene	...	Rs. 17.50	,,
Borax	...	Rs. 4.00	,,
Ground-nut oil	...	Rs. 0.50	,,
Soap-nut and tamarind	...	Rs. 0.50	,,

31. Besides, liquid tin, locally called *'Ranga'* is used to fill in tubes of silver plates while working on it. This is subsequently drained out. However, in the process, some of this metal is lost. The traders supply this metal.

Designs, colours and chemicals

32. The ornaments and other articles produced at Tarbha, comparatively bigger in size than elsewhere, are generally of coarse variety. The designs of art work



Labourers carrying charcoal from the jungle

made on them naturally come in that category. Not much progress has been made ever since the early days when the *Kansaris* learnt the craft from the traditional silversmiths. Whatever additions and improvements have been made are only by way of slow imagination of sluggish mind. The designs of art work used at Tarbha, accordingly, are largely the impressions of natural surroundings.

33. That is, many of the designs take the shape of creepers, flowers, leaves, birds, fruits, etc. The designs of creepers and flowers are worked out on ornaments, such as, *Kalari, Bandaria, Tada, Mudi, Khagla, Painri*, etc. Impressions of jackfruit are to be found on *Kalari*. All these designs, except a very few, are locally developed. However, the *Barpalia* and *Sambalpuria* type of *Bandarias* have designs which were originally made at Barpali and Sambalpur.

34. The artisans also copy out designs from the ornaments made at other places, such as, Cuttack and Agra. For example, in making brooches for hair dress, the artisans use specimens of filigree made at Cuttack and Agra for their guidance. Filigree, as a particular type and design of ornamentation, is not to be found in this place. Only recently a simple rudimentary beginning has been made. Various borders of *Saris* and catalogues of ornaments of other places also provide some clue to make new designs. Varieties of fish inspire the like designs also. The artisans work all these designs on various moulds of required sizes. A few artisans also prepare such moulds with new designs and sell them to other artisans as per latters' orders. It was, however, curious to note that such proficient artisans, who could make out new designs and sell them for others' uses, were rather sneered at. This was, perhaps, due to the fact that they made available to others the rare designs that they developed, though by way of sale, whereas a clever artisan would like to keep to himself such designs, if made. This was, therefore, perhaps taken as a departure from the unspecified code of conduct of the craft. As a result, the cleverer and more prosperous artisans looked down upon them. The moulds are made of brass and iron.

35. In fine silver ornaments made at Cuttack one would invariably mark a lot of filigree. In fact, it is the most intricate filigree at Cuttack that has earned it a name. Such filigree is not to be found in this village, but instead, enough of bead work are observed in all types of ornaments prepared here. There is hardly any ornament that does not carry a close cluster or a line of beads.

36. The ornaments made of silver or nickel alloys take the white colour. Whereas pure silver ornaments have their characteristic lustre, ornaments of nickel alloy do not have it. Silver plating is done to bring about such brightness. The technique of silver plating was learnt at Tarbha from an artisan brought from Nagpur by one of the enterprising Marwari traders. Besides this, no other colour is used. A tendency towards greater degrees of artistic work and sophistication in the choice of design was discernible. There is, however, no organization or caste guild to teach designs to new artisans. No deliberate attempt is made to improve skill or designs. These are merely learnt by the son from the father or the guardian, the skill being inherited in a traditional manner.

Tools and equipments

37. A large variety of tools and equipments are made use of in this craft. For a simple operation, a good number of small tools are required at different stages of it.

Some of the important tools and equipments are described below;

(1) ***Nehi***—It is an anvil, that is, a block of iron, on which smiths hammer metal into shape. The anvil has an upper surface 4" wide. It is roughly conical in shape, having square sides, gradually decreasing in girth towards the lower portion. Its total height is 7", of which 4" are above the surface, and the lower 3" are fixed on to a wooden slab under the ground. The wooden slab is 7 feet long, 2 feet wide and 1 foot thick. This is put under the earth in order to serve as the fixed base for the *Nehi*. When the metal is hammered on the upper surface of the *Nehi*, it is this underground wooden slab that really absorbs the force and weight of the stroke. The wooden slab is fixed underground in the workshop, known as *Sala Ghara*. It has the required small depression or hole on to which the lower end of the *Nehi* is fixed. *Nehi* can also be taken out when not required, in order to be fitted again later. The top surface of *Nehi* may have either a regular lateral shape or an irregular one.

(2) ***Nehini***—It is but an anvil smaller in size than *Nehi*. Smaller bits of work are hammered on this. It is not fixed on to any underground wooden slab, but is fixed on to a separate small wooden slab kept on the surface, which can be moved to various spots.

Both *Nehi* and *Nehini* are factory-made and are purchased by the smiths for use.

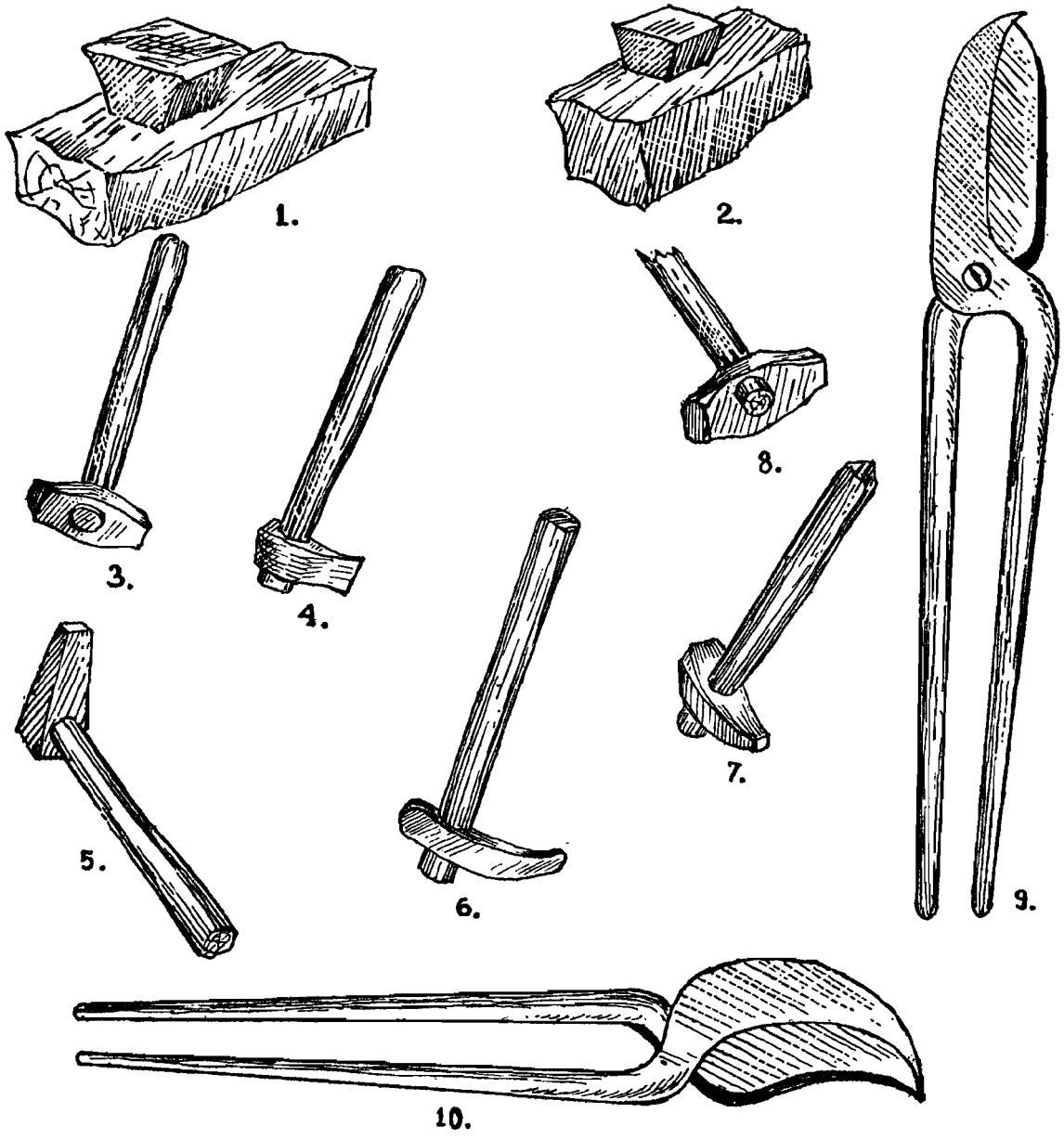
(3) ***Hatuda***—It is a hammer of comparatively bigger size, and weighs 100 to 120 tolas. Bigger lumps of silver are hammered with this on *Nehi*. This is also factory-made and is purchased from outside.

(4) ***Chuta***—This is a much smaller type of hammer and weighs only about 7 tolas. Small bits of silver pieces are slowly hammered with this on *Nehini* in order to bring out the required shapes and designs.

There are various kinds of *Chutas* weighing 3, 4 or 5 tolas each. Some of these are called *Thesa Chuta*, *Chaddha Chuta*, *Khala Chuta*, etc. *Thesa Chuta* is the one, which is used to hammer small dice on silver plates to bring out necessary designs; *Chaddha Chuta* is so made that hammering with this will bring out a round curved shape on a silver plate.

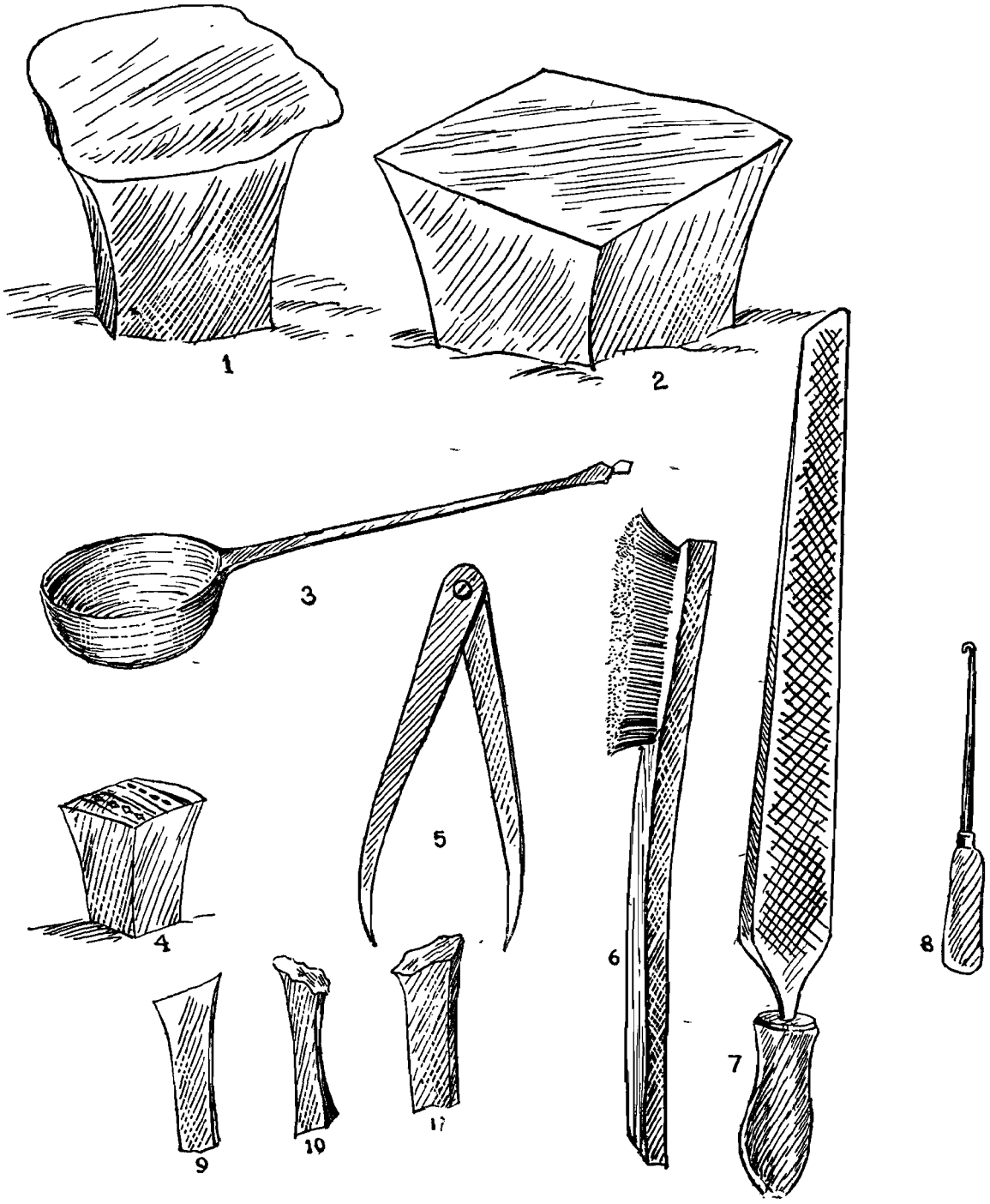
(5) ***Dahana***—This is but a tongs, that is a gripping and lifting instrument consisting of two legs joined by a pivot. Its lips are straight. The two legs would be nearly 18" long. The smith holds on to a piece of hot silver with this, and keeping the latter on an anvil hammers with *Hatuda* or *Chuta*. *Dahana* is prepared by the village ironsmith.

Two other varieties of this are found. The tongs which have curved lips are called *Banka Dahana*. The smith uses this to catch hold of the crucible from the fireplace with hot liquid metal in it and to bring it out to pour the liquid on various moulds to make sillver rods, plates or wires. It is the curvature of the lips that helps in handling hot metal by conveniently tilting the crucible full of liquid. The tongs with straight lips would not be suitable for this purpose as the boiling heat would, in that case, come straight up to the hand while pouring the liquid into various forms. The other variety of the tongs is called *Jumboo*. It is a fork. Instead of two legs it has got two hands and by means of spring action at the back a thing is held on at the tip of the hands or loosened. The smith forcibly holds on to a silver plate with these tongs and twists it as required. The legs of the tongs, either *Banka Dahana* or *Jumboo*, would be of similar length as those of *Dahana*. Both of



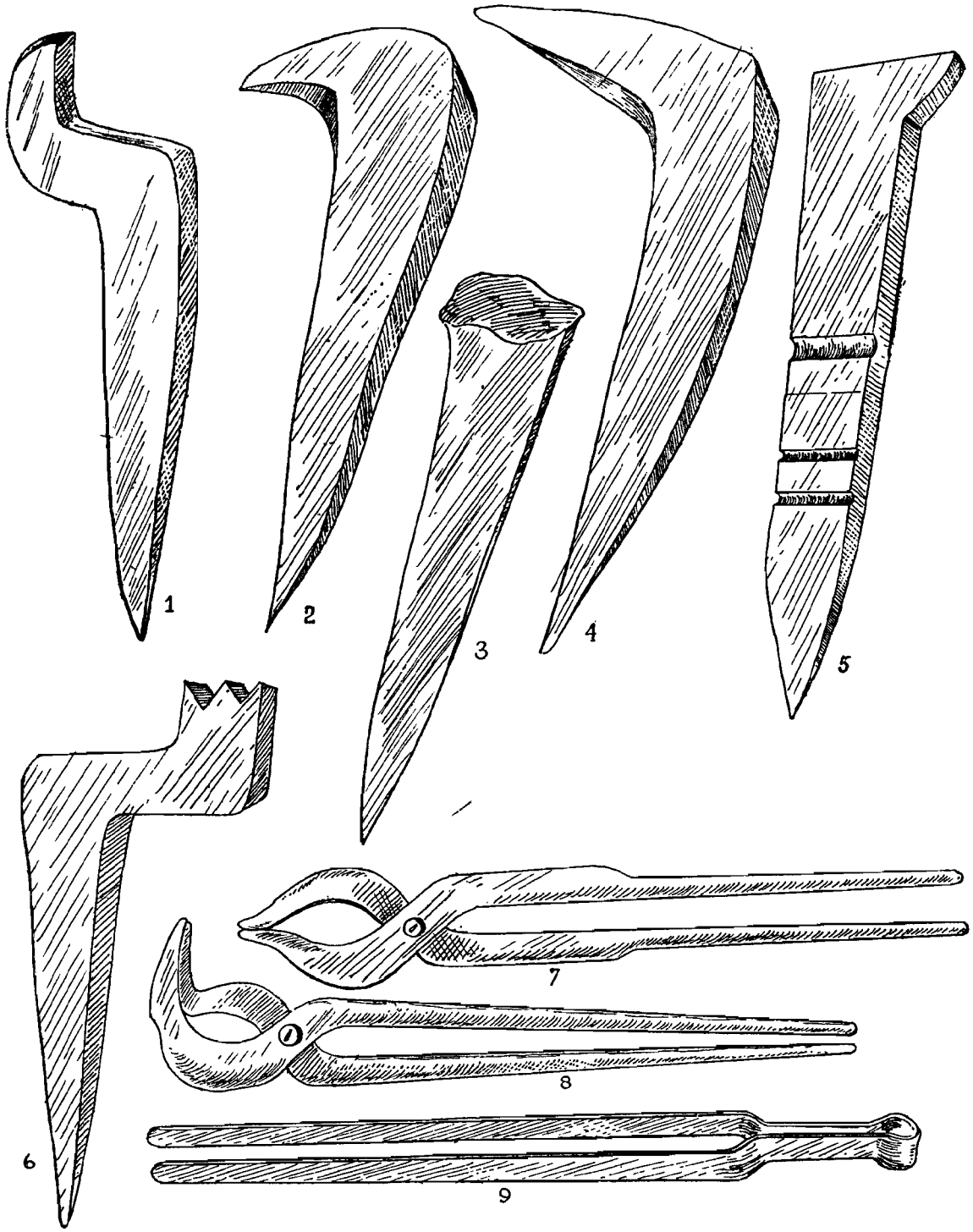
A GROUP OF SMALL IMPLEMENTS

1 & 2. Nehini. 3, 4, 5, 6, 7 & 8. A group of small hammers called 'Chuta'. 9. Kainchi—scissors with straight blades. 10. Banka Kainchi—scissors with curved blades



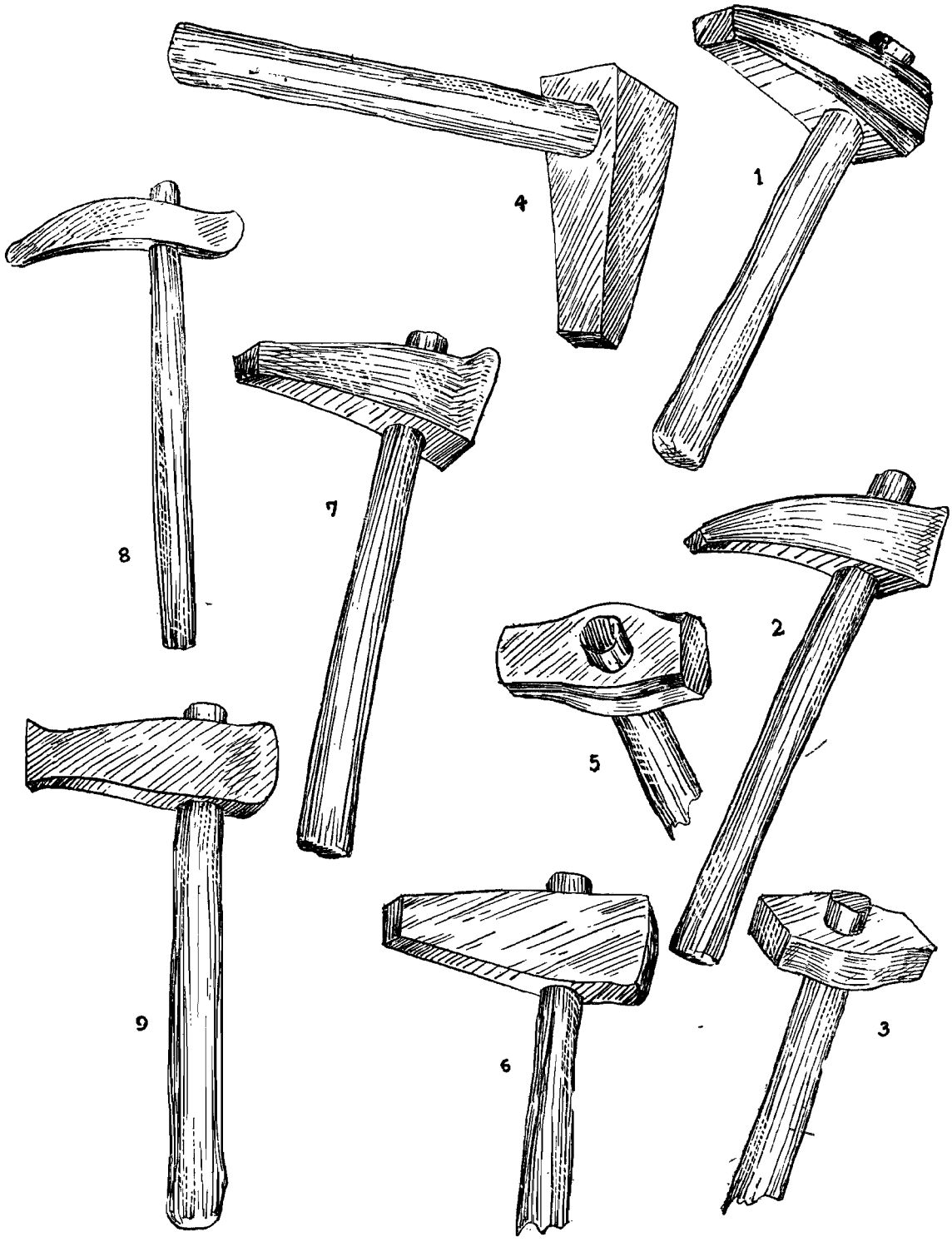
ANOTHER GROUP OF IMPLEMENTS

1 & 2. Nehis fixed to wooden slabs underground. 3. Anaka. 4. Jira Thasa. 5. Iron compass. 6. Brush. 7. File. 8. Needle for knitting Guinchi. 9. Chheni—a sharp chisel for cutting. 10 & 11. Puadas—chisels to bring out various shapes



A FEW MORE IMPLEMENTS

1, 2, 3, 4 & 5. A group of Sábilis to shape, mould, mend or polish metal plates. 6. Ghoda Sabili—to bring out protrusions. 7. Luipita Dahana—tongs. 8. Banka Dahana—tongs with curved lips. 9. Jumboo—a plain iron fork.



A group of hammers called 'Hatudas' used at various stages and on various metal forms

these are also prepared by the local iron-smith.

(6) ***Katha Janta***—This is really an improvised pulling machine used for making silver wires of various girths. It is composed of different parts as detailed below:

(a) ***Kala Gachha***—This is a log of hard wood, 6 feet long, 6 inches wide and 6 inches high.

(b) ***Kala Badi***—This is a stick of wood, round in girth, 2½ feet long and 2 inches in diameter at a section.

(c) ***Kala Munda***—This is a piece of wood, 6 inches long, 6 inches wide and 1½ inches high. Two crosswise grooves, one inch wide each, are cut on the upper part of the wooden piece.



A worker making wires on Katha Janta

(d) ***Bala Siadi***—This is a strong two-legged pivoted tongs with an iron girdle round the two legs. The lips are very strong, made of thick iron rods, and have got several carved lines on them which help ultimately in holding on to the wire.

(e) ***Janta***—This is a piece of hard steel, one foot long and two inches wide of some thickness. Small holes of various girths would be there on this iron piece. Silver wires could be put through these holes.

The mechanism works as follows:

The *Kala Munda* is securely fixed at one end on to the *Kala Gachha*, that is, the low lying hard timber. Below the *Kala Munda*, there are several small step-like holes on the *Kala Gachha* at regular intervals. The *Janta* is to be put into the *Kala Munda* breadthwise. The silver wire of a particular girth is made into smaller girth at one end by hammering on the anvil. This portion is put into the hole of the required smaller girth. The other end falls towards back of the *Kala Munda*. The little protruding portion of the wire peeps outside towards the other side of the *Kala Munda*. This end of the wire could be caught hold of strongly by the *Bala Siadi*, that is, by the strong tongs. The girdle round the legs of the tongs could be fixed on to a hook on the *Kala Badi*. The worker sits towards the trunk of *Kala Gachha* with the *Kala Badi*. By fixing the tongs to the little end of the wire, he forcibly pulls the *Kala Badi* at its upper end by putting the lower end to the successive step-like holes on the *Kala Gachha*. By this process of pulling, the wire of a bigger girth is converted into that of a smaller girth. By successive pulling through smaller holes, the wire can be brought into required reduced girth.

This mechanism costs nearly Rs. 20/-. The village carpenter and the ironsmith together make it. This is, however, a very laborious and crude method of preparing

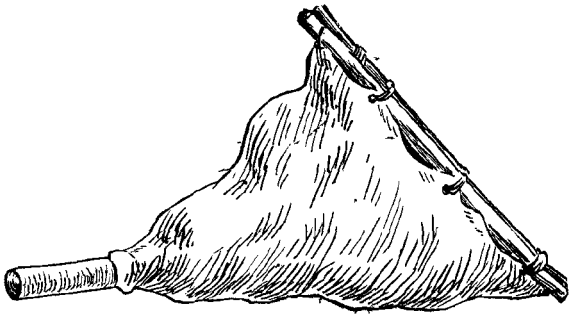
wires. After the installation of press machines in the village under factory sheds, wires are being prepared there. For this reason *Katha Janta* is hardly made use of now-a-days. However, when the machines in the factory would not be working or when there would be any instant need by the artisan, he can prepare wires with *Katha Janta*. That is why one *Katha Janta* is always kept handy in each workshop. The hired labourers or apprentices usually handle this mechanism and make wires.

(7) ***Sabili***—It is an iron bar pointed at one end, while the other end has different shapes. The pointed end is put on to the surface of the earth and the *Sabili* is securely fixed. According as the upper end takes various shapes, it serves various purposes, and is also named variously, that is, *Gadi Matha Sabili, Nali Matha Sabili, Peti Matha Sabili*, etc. In *Peti Matha Sabili,* the upper end of the bar is curved and pointed to a side being gradually conical in shape. With this, the inner plate of such ornaments as *Kalari* and *Kataria* are brought into semi-round shape, being polished in the process. In the *Gadi Matha Sabili,* the upper curved end of the bar is abruptly more pointed and is more curved. With this pointed end, the two flaps of the outer covering plate of *Kataria* are opened. *Nali Matha Sabili* is one, the upper end of which takes two curvatures presenting the shape of an armless chair in a section. The upper end is not pointed but is blunt and round. Around this, the tube of *Bandaria* is brought into shape and is polished. *Ghoda Sabili* is similar to *Nali Matha Sabili* with the only difference that at the top of the upper end, there are small teeth like protruding shapes in order to bring out similar protrusions in *Kataria*. There are several such variations of such *Sabilis*. Different *Sabilis* are required at different stages of preparing ornaments. Most of them are 8 to 10 inches high, being 1" to 1½" in girth in the middle portion.

(8) ***Kainchi or Katuri***—This is but a pair of scissors and is required in cutting thin silver plates. When the two flaps are straight, it is called *Sadha Kainchi,* and when the two flaps take a curved shape, it is called *Banka Kainchi*. Whereas *Sadha Kainchi* can be put to any ordinary use, *Banka Kainchi* is specially used for cutting round shapes in difficult positions, such as, cutting the irregular inner sides in the round shape of metal flaps, while making *Kataria*.

(9) A hard iron file is also used to polish the sharp edges of various metallic tools.

(10) ***Chamada Bhati***—It is a leather bellows. One whole piece of hide of a cow or a buffalo is used for this. It is stitched at many points and gum is used at other points. Ultimately it is given the shape of various layers of one big bag. There is an opening to a side of the bottom layer. Into this nozzle, a hollow bamboo



Chamada Bhati—a countrymade leather bellows

tube is fixed. At the backside of the bag, there is a linear opening. The two sides of the opening are joined with two bamboo sticks, which serve as handles. When the handles are raised, the opening naturally lets in fresh air into the bag, and when pressed with the hand, it gets closed and currents of air are blown through the bamboo tube into the hearth.

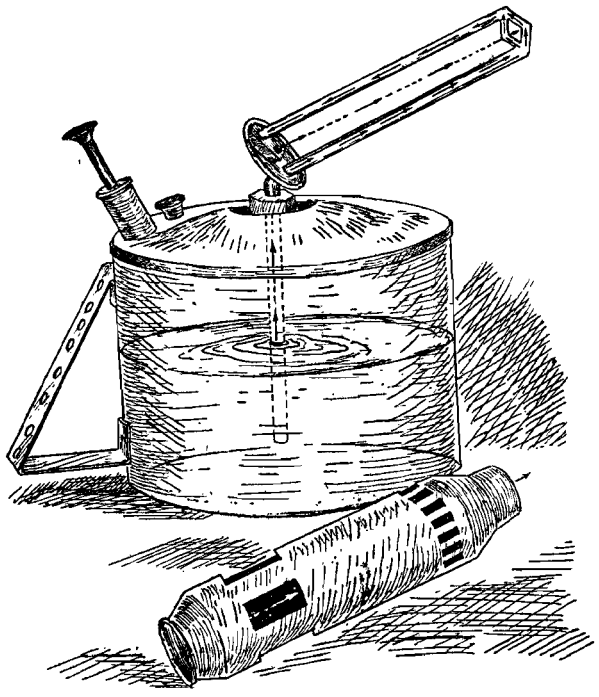
(11) ***Rotary Blower***—The leather bellows was, after all, a crude equipment. It costs Rs. 10/- and used to last for a year

only. On the other hand a rotary blower made of iron costs nearly Rs. 33/- and usually lasts for about 20 years. Hence the latter type of blower has come into wide use lately. The sketch of a rotary blower of iron can be seen below.



Rotary blower fitted to the forge

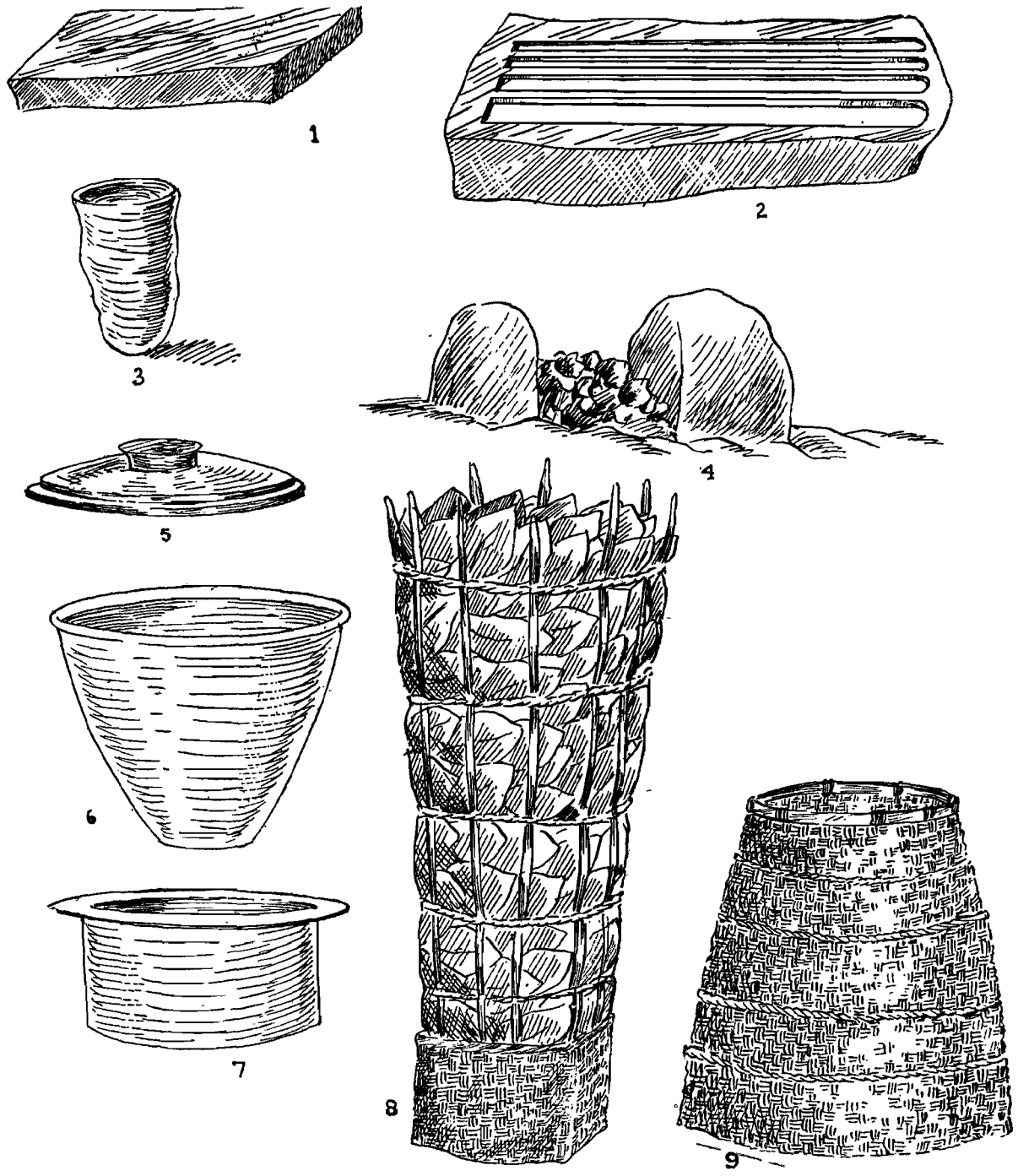
(12) *Blow lamp*—This is used only for soldering the joints. It is similar in structure and mechanism to that of a kerosene pressure stove. With the help of blow lamp continuous flow of flame at high temperature is maintained which, when supplied at a particular metallic point, would very much heat it, melt it and by the process would lend it to be soldered. Several openings and joints in various ornaments are soldered in this way by putting in small bits of thin silver plate and borax.



Diagramatic sketch of a blow lamp

(13) A few small cups of copper are required to keep acid inside. These cost nearly Rs. 9/- each. Similarly brass pots are required to keep borax inside it and to heat therewith. A small such pot costs nearly Rs. 2/-.

(14) *Koi*—It is a crucible shaped like a small tumbler in which silver metal is melted. It is prepared by the village potter out of a special kind of clay prepared by mixing powdered charcoal with dusts of dried black sticky soil. The crucible so prepared is then burnt in fire before use. Such type of crucible, however, gets melted after it is used only once. Now-a-days, however, crucibles made of fire-clay are available in the market. It can melt 80 tolas of silver at a time and costs



A FEW EQUIPMENTS AND MATERIALS

1. A piece of whetstone for sharpening the tools. 2. Achhrú. 3. Koi—a crucible. 4. Poda sala—a forge. 5. Patarchapa. 6. A bowl for keeping fire-clay in. 7. A copper pot to keep acid in. 8. A leafy container improvised on a small bamboo basket to carry charcoal from the jungle. 9. A bamboo basket to keep charcoal in by the forge and the furnace.

only 56 Paise. Almost all the artisans now use this type of crucible.

(15) ***Achhu***—It is but a mould with grooves of various sizes. The molten liquid metal is poured into the grooves, and it naturally takes the shape of the grooves. *Achhu* can be made both of earth and of iron.

The earthen *Achhu* is prepared in the following process. The village potter brings sticky soil, dries it and churns it into dust ; fine sand is then mixed into it and both are further churned. The compound is then strained through a closely knit net, so that the fine particles are separated from the coarse. Water is added to it and the clay is prepared. With this clay, the moulds of required shape and size can be prepared. For making wires, long metal pieces of small girth are suitable. These are made from moulds with narrow grooves. For metal pieces of higher girth or size, moulds with similar grooves would be necessary. *Achhu* can be made also of iron, and such ready-made ones are available in the market.

A little variant of this type of mould is what is called *Patara Chapa*. This is used for making thin silver plates. It has two flaps. On the surface of the lower flap, the molten liquid metal is poured and the upper lid is heavily pressed on to it, so that the liquid spreads throughout and takes the shape of thin round plates. Small bits of thin plates required for soldering are prepared with this *Patara Chapa*.

(16) Various kinds and types of dices are also used. These are locally called *Thasa*. A *Thasa* is but a small cube of iron or brass, on the upper surface of which outlines and designs of art work are carved. The silver plates may be put on these and suitably hammered with, so as to automatically bring out the designs on it. However, all the required art-pieces for all kinds of ornaments, which are of various shapes and curvatures, cannot be had by putting silver plates to dices and then hammering it. For this, dices of inverse positions are required. These are really small iron sticks of some girth, on the lower surface of which several designs are worked. This can be put on to the surface of the frame of an ornament and then slowly hammered on in order to bring out necessary shapes and lines. These are called *Puada*. Nearly 50 to 60 types of *Puadas* were noticed. Roughly, they were all of a similar type, but each of them had very important distinguishing features. One would have a slightly different edge from another, and this would bring about a lot of difference while in use on an ornament frame. One would have a curved lower surface. Another may have an oblique surface. One may have sharp edges, whereas another may not have so sharp an edge. These are very necessary for making such ornaments as *Kataria, Bandaria* and *Kalari*. Artisans purchase iron rods of required girth and make it to pieces. At one end of such a small piece they would carve out a necessary design or shape, which would be useful in making one or another kind of ornament. For example, in making *Bandaria*, various kinds of *Puadas* are necessary, namely, those for drawing lines, for raising protrusions, for polishing them, for mending the intervening spaces between two protrusions, for drawing lines on them, for drawing cross shapes and semi-circular half moon shapes and also for carving out flowers. For a *Kalari, Puadas* with carvings of half moon shapes and round shapes are very necessary. *Kataria* requires *Puadas* with sharp edges for raising small protrusions and for polishing them.

(17) ***Anaka***—This is a big spoon with a large handle, made for pouring molten liquid metal into silver tubes as in case of making *Bandaria*.

(18) Besides the above tools, a small saw, a box of drawing instruments, a right-

angle scale, a weighing balance and weighing measures are also required.

There are also a large number of other small tools. In the workshop of one established artisan, namely, Shri Satyanand Sahu, 120 pieces of tools and implements were found, many of which were, of course, variations of the few above types described.

38. Several of the aforesaid tools and implements have come into use at Tarbha in recent times. For example, blow lamp and rotary blower were not in use 8 to 10 years before, when the people were used to leather bellows, and soldering was being done by putting the ornaments on to the fire-pots and by blowing air into it, in order to create sufficient heat for melting, through a brass or an iron pipe blown at one end with mouth. The artisans have already taken advantage of electricity, though its full possibilities are yet to be exploited for the craft. The following types of machines can be pressed into service and can be operated with electricity:

(*a*) a grinder—for polishing the surface;

(*b*) a driller—for making holes;

(*c*) an electrical welding machine;

(*d*) a press machine; and

(e) an electric motor to work these machines.

A sketch of the workshop of one artisan is given at page 182.

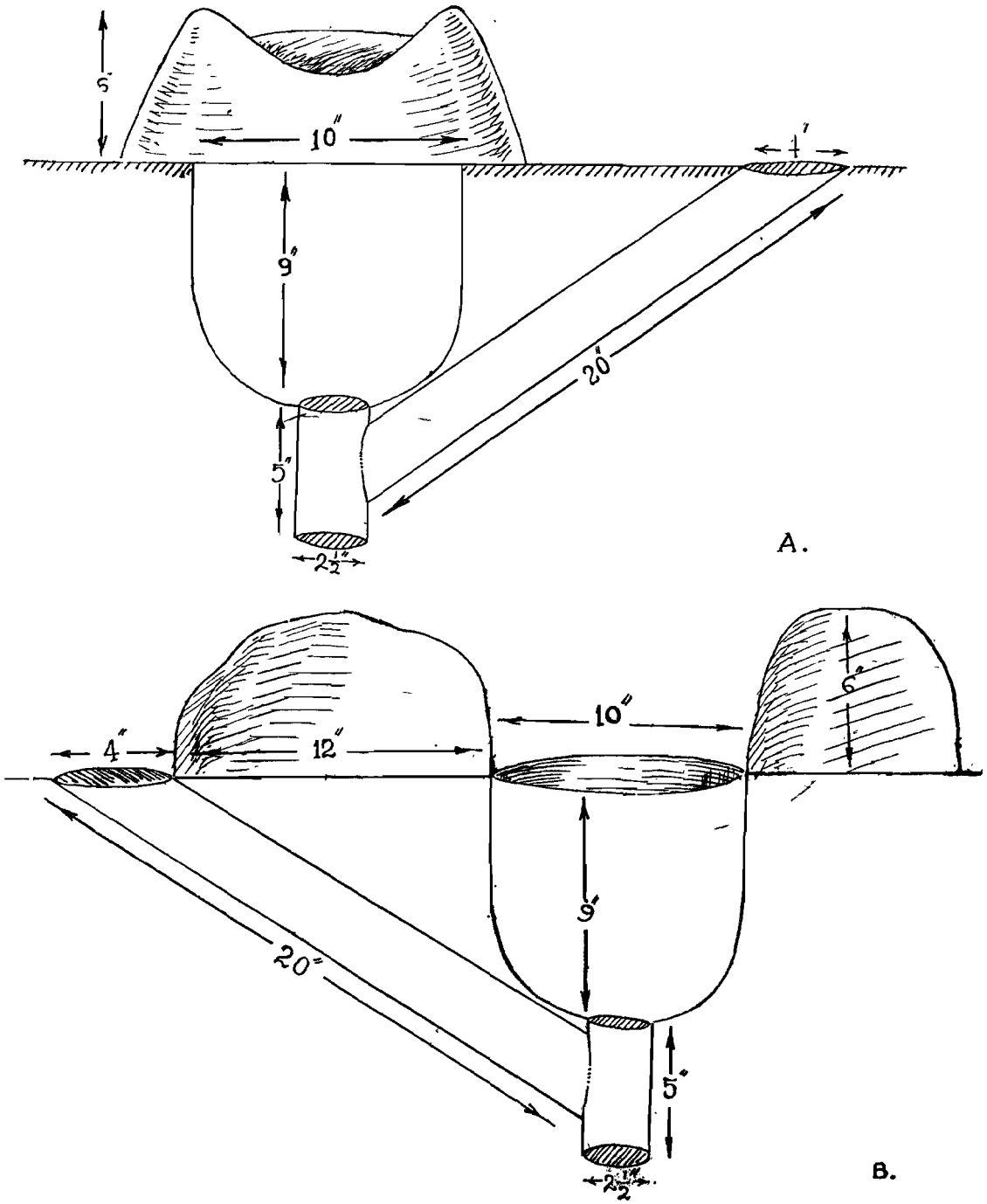
A workshop

39. The workshop is located in a part of the artisan's house. The portion usually occupied for the workshop measures $12\frac{1}{3}' \times 12\frac{1}{3}'$. The house is of a rickety structure, with mud walls and the roof composed of bamboos, timbers and nurriah tiles. To a side towards a corner, the furnace and the forge, known by the names *Auta Sala* and *Poda Sala* are built. The underground logs of wood are laid at two places with mechanism for fitting *Nehi* on it. At one side of *Auta Sala* and on the other of *Poda Sala*, are the two base-stands for rotary blower. Separate places are set apart for keeping bowls of water and acids. Small tools and implements, put inside a wooden box, are kept to a side. There is an overhanging iron wire, to which hang several iron tongs.

40. The important part of a workshop or *Sala* is the *Auta Sala*, that is, the furnace for melting. Its structure and design are indicated in the sketch at page 183. First a round pit 10" in diameter is dug up to a depth of 9". After this, the diameter of the pit is reduced to $2\frac{1}{2}$". The depth of this second pit is 5". The total depth of both the pits, therefore, is 14". In order to make a durable pit, a whole pit of 14" depth is first dug in the ground. After 9", a round piece of timber, $2\frac{1}{2}$" in diameter and 5" in length, is put in the middle of the pit, and thereafter soaked clay is put round it, so that the lower pit acquires sufficient durability at the walls. The circular opening of $2\frac{1}{2}$" diameter at the mouth of the lower pit is netted by putting slips of tiles in it, so that there would be opening to pass in air to the upper pit, and also through which the reduced ashes would fall down to the lower pit. From one side of the lower pit, i.e., just below the foot of the upper pit there is another tubular hole extending up to the surface of the ground at some distance from the rim of the upper pit. The length of the latter hole of tubular shape is 20" and it has a diameter of 4". In fact, the whole portion between the upper pit and this hole is dug out. Thereafter, the tubular hole, 20" long, is made by means of putting semi-circular tiles, one fitting the other, and in that way, being stretched on to the ground surface. Clay is put round the tiles and the external space is filled up. It is, through this 20" long round hole or tube that air is blown into the



Equipments and accessories in a workshop



A. A diagram of *Auta Sala*—a smelting furnace on the floor
B. A diagram of *Poda Sala*—a forge on the floor

furnace. The blower usually is kept 6" from the mouth of the tubular hole. The nozzle of the tube of the blower is put into this latter tubular hole for 6". By rotating the fan in the blower, air is blown into the furnace through the lower pit. In the upper pit, first a layer of charcoal is put. With the blowing of air into the pit and by lighting fire to it the whole charcoal can be set on burning. The crucible with the metal inside it is then put on the burning charcoal. The whole upper pit is then filled with charcoal. After continuous blowing for about 1 to 1½ hours, the hard metal inside the crucible gets melted. With tongs of curved lips the crucible can be taken out and molten liquid metal can be poured into the appropriate mould. Above the ground surface around the upper pit, a small wall nearly 6" high and 4" wide is put. This round wall helps to preserve and sustain the heat generated in the furnace. In fact, the height of the upper pit is increased by 6" for the wall.

41. The forge is called *Poda Sala*. This is used for heating and reheating the metal pieces before hammerings on the anvil in the process of making an ornament. The structure and outline of a forge are exactly the same as in case of a furnace, with the difference as follows:

Instead of a circular wall around the pit as in a furnace, only two lines of earth nearly one foot long and 8" to 12" in girth and 6" high are put on to the two sides of it. At one side, there would be the blower and the other side will be closed. Since heating and re-heating do not require as much temperature as melting, no need has been felt to preserve the generated heat in the upper pit by putting around a circular wall on the surface. The artisan sits opposite the opening between the two small walls and puts in metal rods and takes these out to hammer on the anvil kept at hand to a side.

42. One blower would be sufficient for working both the furnace and the forge, as the two are not worked simultaneously. After some metal is melted in the furnace, it is brought to a shape on the mould, which then is treated by heating and re-heating in the forge, and by hammering, is got into required shapes.

43. The photograph of the workshop of Sri Satyananda Sahu showing the artisan busy at work along with his elderly sons is given at page 187.

44. The shed of a workshop of average space costs nearly Rs. 800/-. The tools and equipments and other accessories cost between Rs. 400/- to Rs. 800/-, depending on whether only one or more than one, say five or six ornaments are made. This rough estimate, of course, excludes the cost of land on which the workshop is built. If the owner takes the help of his family members, he can manage with a small running capital of Rs. 100/-. Otherwise little more amount is required towards hiring of labourers. The artisan, of course, cannot independently buy silver and other raw materials with this small running capital. He has to depend on the traders for supply of raw materials.

Manpower—skilled and unskilled

45. Of the whole artisan-population engaged in silversmithy at Tarbha, the 241 artisans have their own workshops. They are by far the more proficient ones than the others. Besides them 82 others belonging to their families also come in that category. The nearly 400 other people, directly engaged in the craft, are either labourers or helpers who belong to Tarbha or the neighbouring villages.

46. Amongst the hired manpower in the craft, small boys about 13 to 14 years old get as wages nearly Rs. 15/- per month. Adult male workers, on the other hand, get Rs. 30/- to Rs. 40/- per month.

47. The teenagers are not only paid very small wages, but also are made often to work long extra hours for which no extra payment is made. They are given simple light refreshements consisting of fried rice and water, the value of which would be nearly 12 to 25 Paise a time for the extra hours of work. The only element that keeps these youngsters going on is the hope of learning the trade and of eventually becoming artisans in future and establishing workshops of their own with the help of their master artisans. In fact, many such youngsters, in due course, turn out to be artisans. At the time of leaving their employment, the employing artisans also give in gratis a few more or less important tools and equipments.

48. Of the adults, only the males are hired. Their rate of payment varies according to their proficiency in helping the artisan. All these hired labourers are employed on long term basis. This is advantageous both to the employee, who is thus assured of his daily bread, and to the employer, who is also saved of the otherwise sure case of paying more highly to the casual labourer. Payment is made weekly. The conditions of semi-skilled and unskilled labourers are very deplorable. They are very poor and have to live from hand to mouth. Thus they cannot afford to remain absent from their work even for a day.

49. Skilled labourers are, however, a little better off. They are paid nearly Rs. 40/- to Rs. 60/- in a month. Their number would be nearly 100. This is the stage when an apprentice, having learnt the techniques of silversmithy, is about to embark on his own independent artisanship. The services of these people are very much in demand. All skilled labourers do not work on the basis of fixed wages. They agree to work on the basis of getting a share in the making charges. For example, if a skilled labourer, who is engaged in making an ornament, say *Bandaria* and who works along with the owning artisan, earns together with the latter Rs. 25/- as making charges of 100 tolas of ornaments; he gets a share of Rs. 12.50 Paise, leaving the other half to the owning artisan. The latter has, of course, to meet the expenses of making the ornaments, as those for charcoal, borax, acids, tools and equipments, etc. In order to meet this part of expenses the owning artisan adopts an unfair course. The wholesale trader, who supplies raw materials for ornament also supplies a quantity of pure silver for purposes of soldering and silver-plating. The owning artisan takes away a part of this pure silver and adds more alloys to the whole quantity of raw materials.

50. In some cases, the skilled labourers work in other artisans' workshops on the basis of securing the whole amount of making charges, leaving only an agreed sum to the owner. Thus in the above instance, the skilled labourer may get Rs. 25/- from the wholesale trader as making charges of 100 tolas of ornaments, out of which he may hand over to the owner only Rs. 5/- appropriating the rest. In this case also the owner meets the incidental expenses of the working and making, finding the amount in the same aforesaid usurious process. In this case, however, the owning artisan does not work along with the skilled labourer on the particular ornaments.

51. The aforesaid systems of engaging skilled labourers are heavily weighted in favour of the latter. This indicates the relative scarcity of skill to be had on the basis of hire. It also points out to the other direction, that is, to the fast rate at which the skilled labourers are turning out to be owning artisans themselves.

52. Artisans specialize in making different ornaments. Some make only *Bandaria* and have spent their life-time in this one ornament. Similarly, some others

make only *Kalari* or *Kataria* or something else. Only very few artisans can make most of the ornaments and such artisans number only 5 or 6 in the village.

Capital and management

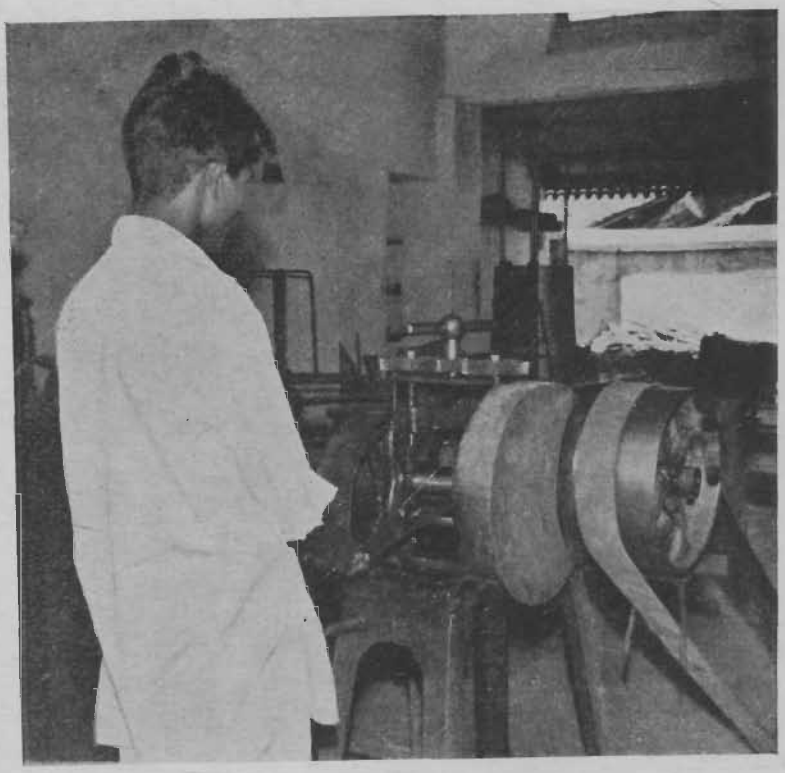
53. In the craft under study, the artisan provides only the skill and some amount of capital towards establishment of workshops and purchase of tools and equipments. It, however, requires a large quantum of working capital to provide all sorts of raw materials, to have the marketing organization and for storing. The necessary capital for this and the requisite management enterprise for running the whole show rest with the traders.



A master artisan with his elderly sons busy in his workshop



An artisan pouring molten metal into the mould



A worker making thin silver plates in a press machine



A young housewife busy in knitting Guinchi

SECTION IV

PRODUCTION AND ITS TECHNIQUES

Different Alloys

54. Ornaments at Tarbha are made mostly of silver alloys and partly of nickel alloys. Silver is a soft metal and as such, pure silver is not suitable for making ornaments. Adding of little quantity of copper makes the metal durable and strong without loss of any degree of lustre of a pure silver. Admixture of higher proportion of copper, however, takes away the glazing brightness and whiteness of silver. To obviate this, quantities of zinc are mixed with the compound containing higher proportion of copper. The following statement shows the sixteen kinds of silver alloys used by the smiths of Tarbha.

DIFFERENT KINDS OF SILVER ALLOYS USED

Serial Number of Alloys	Proportion of mixtures		
	Silver (in tolas)	Copper (in tolas)	Zinc (in tolas)
1	2	3	4
1.	100	4	Nil
2.	100	8½	½
3.	100	15	1
4.	100	28	2
5.	100	45½	4½
6.	100	55	5
7.	100	69	6
8.	100	89	11
9.	100	108	12
10.	100	126	14
11.	100	178	22
12.	100	222	28
13.	100	267	33
14.	100	356	44
15.	100	534	66
16.	100	890	110

55. Alloy No. 1 is not much different from pure silver. The metallic value of the new and the old ornaments made of this alloy remains the same. No acid or chemical is required to cleanse it after a new ornament is prepared with this alloy. This proportion of admixture was in use in good old days. The ornaments made of alloys Nos. 2 to 7 require cleansing with acids and chemicals. Such ornaments, however, do not take any darkened hue or shaded appearance. Ornaments made of alloys Nos. 8 to 10 get darkened and present copperish hue after use for about two months. Those made of alloys Nos. 11 to 14 present darkened colour in 15 to 30 days time. Ornaments made of alloy No. 15 gets tarnished only after 7 days. Ornaments made with the highest proportion of alloys with silver, that is, No. 16 cannot be used without silver-plating.

56. The *Sahukars*, i.e., traders, who supply the raw materials to the artisans themselves get the admixture done, and alloys prepared before issuing to the artisans. It cannot be denied that the artisans do make no further additions of alloys. In fact, 8 tolas of pure silver for each 100 tolas of alloy is issued to the artisan for purposes of silver-plating and for in-laying work. The artisan steals a portion of it and in its place, adds further alloys. On the whole, the artisan has a tendency to make further addition of alloys as long as the trader cannot detect his action.

Various stages of production

57. Each of the ornaments made pass through several stages or processes of production. All the processes are not the same or similar in case of all ornaments.

That is, the processes differ according to design, structure, composition and in-laying work of various ornaments. However, all these can be grouped under several broad categories as follows:

58. The metal may be in the shape of large or small blocks or in shape of old ornaments. These are converted into convenient metallic shapes in order to be made into plates or wires. The metal is put into the crucible and melted in the furnace. Some quantity of borax is added for quick melting. Addition of borax also helps in thoroughly melting the alloy and leaves no bits of semi-molten metal. The required mould, duly cleansed in ground-nut oil, is kept at hand. Cleaning with oil helps in easy removal of the metal from the mould. Once the metal is thoroughly melted in the furnace, the crucible is brought out with the tongs with curved lips and the metal is poured into the mould. For obtaining silver plates the molten metal is poured into a wide and not-so-deep mould; for preparing wires the molten metal is poured into a mould containing long narrow furrows. If very thin plates are required, the liquid is poured over the lower flap of *Patar Chapa* and the upper flap is pressed over it with force. When the molten matter is inside the mould, dusts of borax are sprinkled over it in order to bring out necessary glaze. Cold water is then sprinkled over the mould. The liquid gets solidified, though still very hot. The forms of solidified metal are then taken out of the mould. This is what is called *Lui*. These semi-hot metal bars are immediately hammered on the anvil. The processes of heating, hammering and re-heating goes on till the metal turns into the required shapes. If wires are required, the long thin metal forms called *Lui* are hammered to a degree, and then put into *Katha Janta* which turns out the required wires. The process of making silver plates or wires is the most laborious of all, and hardly requires any skill. This is accordingly performed by unskilled and semi-skilled labourers. The artisans are not resorting to this laborious process at present. Press machines and squeezing machines have been installed in two factories in this village for the last two years. With these machines, plates and threads are made in no time. It also helps in maintaining uniformity in thickness and girth of the plates and wires. The cost of making plates and wires with these machines is also low, being only Rs. 2/- for 100 tolas of *Lui*, i.e., metal bars. With installation of these machines two years back, nearly 300 workers previously engaged in similar work by manual processes, were released. Installation of the said machines was facilitated with supply of electricity to Tarbha. A machine at work in a factory in the village is shown at page 188.

59. The very thin plates required for soldering the joints and edges of the ornaments are made of an alloy of silver, brass, zinc and aluminium. For working with silver alloys Nos. 1 and 2, the soldering plates are made in the proportion of one tola of silver and $\frac{1}{16}$th tola of brass. For alloys Nos. 3 to 10, the soldering plates are made of alloys in the proportion of one tola of silver, $\frac{3}{4}$th tola of brass and $\frac{5}{16}$th tola of zinc. For alloys Nos. 11 to 15, the soldering plates are with the proportion of one tola of silver, $\frac{1}{2}$ tola of brass and $\frac{1}{2}$ tola of zinc. For working with the alloy No. 16, the proportion of zinc is further increased in relation to silver and brass in the soldering alloy. Small quantities of aluminium are mixed to the soldering alloys. This would be only $\frac{1}{16}$th of a tola for 5 tolas of such soldering metal. For preparing soldering plates, *Patar Chapa* is necessary.

60. With plates and wires made, the first stage of the work is over. The next complicated stage of making out the shapes of ornaments soon begins. For some ornaments, the plates are made into tubes; in some cases, the plates are curved and folded, while in some other cases, the wires are put into various shapes, either

by knitting or by just laying out as per designs. In the few cases of making brooches for the hair dress, some amount of filigree is also done. In many cases, intricate shapes of flowers, birds, etc., are carved on the plates. All kinds of tools and equipments are brought into use at this stage. The ultimate shape that the ornament would take very much depends on the dexterity of hand and general proficiency of the artisan displayed at this stage. On this also depends the amount of making charges. The minute details of making two of the more important ornaments, namely, *Bandaria* and *Kataria* has been described later which may give an insight into the working processes of the silversmiths.

61. After the ornament is made it is cleansed. When the ornaments were being made of pure silver or of small proportioned silver alloys, the cleansing was being done with simple tamarind water and foams of soap-nuts. As, in recent times, proportion of alloys has very badly increased, cleansing is being done with diluted sulphuric acid and then with soap-nuts.

Silver plating

62. With ornaments made of nickel alloys or high proportioned silver alloys, which would otherwise take copperish hue in no time, silver-plating is required. A solution of sodium chloride (common salt), silver nitrate and cream of tartar is prepared, and is just coated on the ornament to be silver-plated. A more astute chemical process is now in vogue for the said silver-plating. Nearly 7 to 8 years back, a trader of Tarbha, namely, Kalakahnu Agarwal, brought a chemical worker from Nagpur. The latter knew the chemical process of silver-plating. He was secretly engaged by the said trader to silver-plate the finished products of 'German silver' and silver with high copper content. While the said worker continued secretly working in the residential house of said trader, none knew. Soon the trader did not like to entertain so costly a worker from such a distant place as Nagpur. Therefore he selected a confidant of his, who learnt the technique from the earlier worker. A few other artisans gradually came to learn the process. It is learnt that sums of money were transacted in the process of learning the secret. As a result, quite a number of artisans and traders are now doing silver-plating in this process. For this, silver nitrate is prepared by putting in thin, small bits of silver plates in nitric acid. By pouring out the acid, the reduced silver ashes, namely, silver nitrate, is recovered. Water and potassium cyanide are diluted in a proportion in a glazed pot. To this, silver nitrate is added and the solution becomes ready for use in silver-plating. This solution is kept in tact in air tight bottle with a securely fixed cork. The finished product of an ornament is first cleansed in diluted sulphuric acid and dried. In a glazed pot, clean water with a small tin plate inside it is kept. To this is added the aforesaid solution of silver nitrate, potassium cyanide and water. The product is put in this diluted solution and left there for about 5 minutes. It is then brought out with the help of copper tongs. By now, the product would have gathered a coat of silver round it. It is then cleansed successively in three pots containing clean water. No brush is used at the time. The purpose is to wash all the poisonous elements of potassium cyanide. It is then dried either in the sun or with heat near a fire-place. The product is thereafter cleansed with brush in a pot containing foams of soap nut, which adds glaze to it.

63. The ornament is then sold to a customer or delivered to *Sahukar* as the case may be. The *Sahukar* puts the ornament delivered to test in order to determine whether the proportion of alloys has not been stepped up by the smith. He rubs the ornament on a hard stone plate; some

dusts are obviously left, which are collected; to this a drop of nitric acid is added. It makes a solution, to which a few drops of solution of sodium chloride is added. It makes a silver compound and copper remains as a solution. The proportion of copper therein is roughly determined. The trader compares this proportion with the proportion of alloys already issued by him and detects further addition of alloys, if any. The ornament treated in the previous chemical process with silver nitrate and potassium cyanide, however, withstands this test. As a result, but for the good faith existing between the trader and the artisan, it would be difficult to detect the fraud of the artisans. To obviate this, some traders were found having ordered the artisans to deliver back to them the finished products without final washing and finishing. One such trader, who dealt in only ornaments of 'German silver' was found to be silver-plating the finished products in his own house with help of a few trusted workers. The cost of silver-plating comes to nearly Rs. 6/- for 100 tolas of work of normal size.

Techniques in making a pair of *Bandaria*

64. A pair of *Bandaria* is made in the following process. For a certain weight of the ornament, the metal of equal weight is taken. The small additional weight of metal, that is later on added to the ornament in shape of soldering bits compensates the weight of the metal that is lost in the process of making. The metal is melted in the furnace and brought into suitable form called *Lui* with the help of press machines. This *Lui* can be brought into the shape of silver plates of a suitable size. For a pair of *Bandaria* of normal size nearly of 20 tolas, the silver plate thus prepared would be 18" long and 2½" broad. This again will be cut into two pieces, each 9" long. The pair of *Bandaria* is made of this pair of silver plates.

65. An iron rod of ¾" diametre and of some length is taken. A silver plate is made into a tube round it. The plate is then put over the rod lengthwise across the breadth and rounded off to the shape of a tube. A small plank of wood is made use of to bring it into proper shape. The two edges having met, the tubular shape is taken out and the meeting edges, soldered, by putting on to it bits of soldering plates and borax. It is again put on to the rod. With the same old wooden plank, its surface is made even, and the whole thing is a tube 9" long, and 2½" in circumference at a section.

66. A kilogram of water mixed with half a tola of sulphuric acid is heated in an earthen or copper plate. The silver tube is put into this hot water and thereby cleansed. There would be at hand a potful of semi-liquid fire-clay, known in the locality as *Chhuimati*, and the tube is dipped into it. Fire-clay is heat-resistant. Being dipped into it, such clay forms a coat on the tube, both inside and outside. The portion of the coat over the joint helps preserve it when the tube is next heated and dried in the fire. A quantity of molten tin is then poured into the tube in order to make it a solid one for the time being, so that it can be brought into a shape and also that necessary carvings can be made on the surface without deforming the round tube. For this, a piece of iron rod is pierced on the ground to serve as a support. One end opening of the tube is closed with a flap of card-board tied round it with a string from outside. The tube is then tied to the upright iron support, with the one open end of it upwards. Molten tin, locally called *Ranga*, is poured into the tube, which soon solidifies. The tube is then untied and the fire-clay in the outer surface of it is cleansed in water.

67. A wooden plank of some thickness is now brought into use. A semi-circular ditch depthwise would be there on this plank. This is locally called *Moda Gata Gachha*. The tube is then put into this ditch with the lengthwise joint line up-

wards. With help of *Moda Sabili*, an iron bar with curved upper end, the tube is gradually pushed into the semi-circular ditch. With slow and steady processing, the tube lies across the lower lines of the ditch, thereby forming the semi-circular shape. It is then taken out and put round the upper end of *Nali Matha Sabili*. With slow beatings with a wooden plank over the tube round the end of the *Sabili*, the semi-circular shape is brought into a full circular shape, while the two ends meet. The line of joint thus falls inwards of the circular frame of the tube. Another wooden plank with a low semi-circular ditch, locally called *Thara Pata Gachha*, is now made use of. The circular frame of the tube is made to stand on it. It is also clutched with foot fingers. With the help of a small hammer and a *Puada* with pointed edges, twelve parallel stripes round the tubular shape breadthwise are carved. On these stripes of spaces, 12 groups of protrusions are made. A group may contain two or three protrusions. Such stripes, on which protrusions are made, are some spaces apart from each other. In these vacant spaces, shapes of flowers and cumin seeds are carved. Such shapes are also carved at the *gullies* of the pairs of protrusions. The sharp protrusions are made out with help of a small hammer, namely, *Chuta* and the particular type of *Puada* with a sharp sloping edge. When strokes are made on the tube with this, the protrusions appear, by way of the area to the sharper edge ebbing down and the area to the not-so-sharper edge bulging out. The protrusions are not round in girth, but have flat sides with a sort of pyramidal structure. The proficiency of the artisan is gauged from the accomplishment with which these protrusions are made out. Varieties of *Puadas* are thereafter brought into play in shaping these pointed forms. Some are used to polish it; some are used to mend the narrow breaches in between and around these pointed forms; some are used to sharpen the points; some are meant to blunt it, as required in case of *Barpalia* type of *Bandaria*, and so on. A particular variety of *Puada* is there, on the surface slope of which are carved the shapes of cumin seeds. This *Puada* is used to bring out these shapes at appropriate places.

68. After this, the circular frame is cut into two, at the point across the meeting place of the two ends. The two semi-circular frames are again dipped into semi-liquid fire-clay pot so as to give a heat protective cover to the in-lying joints. The two pieces of tubes are then put in a pan on the forge and are heated. The metal tin inside the tube gets melted in no time and is drained out, and the frame is cooled off. These may be slowly struck with hammer, so that any left over metal inside may fall off. The coat of fire-clay over the tubes are then brushed off in cool water. In case some tin metal is left over inside the tube, the latter can be soaked in kerosene oil and put on fire. As a result, the inside left-over tin gets burnt. By getting the tube outside and slowly striking it, the burnt out matter would easily fall off. The tubes are then brushed again in hot diluted sulphuric acid. The two ends of each semi-circular frame are then mended. Slots and a hasp are then to be fitted to these. Slots are separately kept ready, and with help of blow lamp, these are soldered on to the two ends. The separate hasp of silver alloy is fitted into the slots. Beforehand, small stripes of silver plates with shapes of cumin seeds carved on it in the appropriate dice are kept ready. Four such stripes are required for two semi-circular frames, on two sides of each, for one pair of *Bandaria*. These stripes are brought into semi-circular shapes by slow striking, having put them round a wooden bar of round girth, which are locally called *Jiragolakunda*. These semi-circular narrow stripes are soldered on to the edges of the semi-circular frames of *Bandaria*. The stripes are put in position and are tied to the frames with narrow tin strings. By

putting in soldering bits of metal plates and borax, the stripes are soldered with blow lamp.

69. The ornament is now ready but for cleansing. This is done with diluted sulphuric acid with a brush. As it happens in many cases, that the ornament is made of nickel alloys or silver alloys with high copper content, silver-plating is done with the solution of silver nitrate and potassium cyanide. In such a case, a course of further cleansing is undertaken.

70. The ornament is then ready either for the direct customer or for the trader.

Techniques in making a pair of *Kataria*

71. As in case of *Bandaria*, so in case of *Kataria* a silver plate of an appropriate size has to be made from *Lui* with machines or by simple hammering on the anvil. The plate will have some thickness and would be 1" or more than an inch in width.

72. This plate is first made into a circular shape lengthwise to look like a broad ring. The ends are soldered with bits of thin plate and borax by means of blow lamp. This ring with broad wall like sides are then put on its sides on a plank of wood, which has narrow grooves of slightly curved depression. With a small hammer of somewhat sharp edges, strokes are dealt with at the middle line across the sides of the walls of the ring. A line of depression would then appear in the middle of the walls, in keeping with the line of depression on the wooden plank below. The sides of the ring would naturally appear like two flaps about the said line of depression. Taking it on to the anvil and then pressing over it, the flaps are put one above the other. As a result, it appears like two concentric circles, the width between the two circumferences being the width of the flap. A little fire-clay is then coated around the line of joint. The circular ring-like double flaps are then heated on the forge, hammered on the anvil, reheated and hammered again. This operation is repeated three or four times. During these, the double flaps of the ring get widened and the ring itself becomes bigger. However, during these processes, the two edges, simply meeting at the inner circumference, get uneven. A compass may be brought into use in outlining the complete round circle at the inner circumference of the ring. The portions bulging outside the circular line have then to be cut off with scissors with curved blades.

73. The two flaps are now to be opened. The particular type of iron bar, namely, *Gadimatha Sabili* and the hammer are brought into play. The curved upper end of the bar is slowly pushed in between the two flaps, being also slowly hammered on for thrust. The flaps then open around. It appears like a circular ditch, with only two sides meeting together at the bottom. The frame is then once more baked in fire in the forge. At this stage, the surface of the flaps has to be mended again for evenness, and it is heated again. Once the frame is made ready, the small teeth-like protrusions have to be made at the common meeting edge of the flaps. *Ghoda Sabili* is the iron bar, at the upper end of which protrusions would be there. This bar is put inside the hollow frame, and its teeth-like protrusions are made to be along the line of the edge of the two flaps. Small strokes then have to be dealt with on the external surface of the edge line with a hammer. Points like tooth marks soon would be found in the said exterior. *Suar Puada* is a small iron stick with the carving of a similar protrusion in inverse position at an end. This can be put on each of the small protruding marks and slowly hammered on its head. As a result, the two sides of a protrusion get further depressed and the protrusion extends in proper shape. Because of these hammer-

ings and pressure, the two exterior surfaces get rough and uneven. *Gadimatha Sabili* can again be put inside the two flaps, and with slow hammerings with a small plank of wood, the exterior surface of the flaps excluding the portion of protrusions gets smoothened and polished. In order to make further sharpening of the protrusions and to bring them to uniform sizes, and also to make further carving work on the exterior of the flaps, liquid tin has to be put inside the open frame to give it a solidity. For this, a piece of cloth is covered on a small heap of sand. The frame of the ornament is placed on it with one flap to the ground. It would then be pressed from above. As a result, the sand under the cover of the cloth would get bulged in the vacant space inside the round frame of *Kataria*. It remains in such a position that any molten matter, if poured in at any point of the inner lower edge of the frame, would get inside the hollow space and fill it up. It is exactly at these points, molten tin is poured into the hollow frame. On cooling down, the solidified frame is taken up.

A variety of *Puadas*, namely, *Paja Puada, Chheda Puada* and *Patamara Puada* are brought into use in sharpening, further cutting and polishing the protrusions at the edge, which then take the final shape. Exterior surface is further mended in order to be polished. Then, with *Chheda Puada*, two circular lines on two flaps are laid. Along these lines on two sides, very small protruding marks are to be made dexterously with *Chheda Puada*. These are called *Tihidis* and *Kataria* with them is called *Tihidi* variety of *Kataria* and, that without these, plain variety of *Kataria*. Small lines again shall have to be drawn from the protruding edge down towards the centre. These would cross the circular line of *Tihidis*. It would appear like spokes of a wheel. Along these lines, shall be carved out the shapes of cumin seeds, locally called *Jira* with the appropriate *Jira Puada*. The molten tin inside can now be drained off by heating the frame in a pan kept on the forge. The frame can also be soaked in kerosene, and fire set to it, so that the left-over metal inside falls off with slight strokes. An inner plate of necessary width so as to fit in the vacant circular space of the frame has to be prepared with help of *Petimatha Sabili*. The stripe of the plate takes slightly curved shape at the two edges across the breadth. The stripe is also made round to a circle. This stripe is put inside in proper position fitting to the edges of the two flaps of the frame. The soldering is to be done along the two circular joint lines on two sides. Earlier, three narrow round stripes of plates are prepared. Put on the dice with designs of cumin seeds, the narrow stripes are carved with such shapes. Forced round the *Jiragolakunda* these stripes take circular shapes. Three such circular shapes to a side, that is, six such in all, are made. The size of cumin seeds would be from small to big in all the three stripes. The circular stripe with the smallest shapes on is put at the joint-line between the inner stripe and the edge of one flap. The circular stripe with middle-sized shapes of cumin seeds and that with big-sized shapes are then put at regular small distances from the inside edge and soldered. Six such stripes are soldered on the exterior sides of the two flaps. Soldering is done with small bits of thin plates and borax put below the stripes heated with blow lamp. Threads of tin metal are tied round the frame having put the circular cumin seed stripes on. This is only meant to keep these in position while soldering.

74. The ornament is now ready. It is then cleansed with diluted sulphuric acid. If the ornament is made with nickel alloys or with silver alloys of high copper content, silver-plating is also done with the solution of silver nitrate and potassium cyanide. *Kataria* is thus made ready for use and is delivered direct to a customer as per order or to a trader.

Working hours

75. An artisan with his labourers works usually for 8 hours a day. The working hour generally consists of 2 shifts, one extending from 7 a.m. to 12 O'clock noon and the second 3 P.M. to 7 P.M. A fully engaged artisan gets nearly 24 to 25 days' work in a month, and in that manner for 10 months in a year. During the months of marriage and festivity, the artisans get heavier order for work and during those days, they are found working straight up to midnight. A fully proficient artisan can work 6 to 10 tolas of metal in a day.

Extracting silver from refuse

76. It may not be out of place to describe how the scavengers have also taken to making silver from the dusts and refuse of silversmiths' workshops. They, of course, take it as part-time business. The artisans do not throw away the dusts and refuse gathered from their workshops. They make weekly, fortnightly and monthly accumulations of such refuse and sell it. The scavengers often buy such accumulations for prices ranging from Rs. 2/- to Rs. 10/-. Sometimes monthly accumulations are sold for as high a price as Rs. 100/-. This dust contains silver particles alongwith particles of other metals. They take these in broken earthen pots to the ponds with still water and dexterously wash the refuse off, retaining only the heavy and metal-like substances. These are brought home and put in crucibles made of burnt cow-bone dust, sand and some clay. It is then put on a simple improvised fire-pot. The fire is blown red hot through a hollow pipe into which air is pumped from mouth. Zinc is added to the matter inside the crucible from time to time. It eats away with itself all non-silver contents. Silver is thus left off in the pot, which is gathered and sold by the scavengers to supplement their meagre income otherwise earned.

SECTION V

ECONOMIC ASPECTS

77. The works of art like goldsmithy or silversmithy form a sphere of predominance by the artisans. The imagination, display of it on the objects of art and craft and the proficiency in such display are the real foundations of any such trade. This is, however, not true of the craft of silversmithy at Tarbha.

Qualities of art not emphasized

78. The wares produced are really not so much objects of art as mere commonplace traditional pieces of ornament meant to satisfy a coarse taste of ornamentation. The general social and cultural outlook of the people around using these perhaps do not demand any higher artistic work. The designs, proportions, lay-outs and colour scheme are generally of a very low order. A few months' training or a year's apprenticeship can enable a clever trainee to take up production of, at least, some simple varieties of ornaments. It is exactly for these reasons of low orders of craftsmanship generally required that when a few years back the craft was in a considerable height of prosperity, people from all sorts of communities, notably from non-artisan communities, flocked to the craft in order to share in the spoil. Many of them have since left and many are leaving.

79. This is all but to point out that the artistic skill and proficient craftsmanship do not count as the most important element in silversmithy of Tarbha, as it should in a craft like this. Accordingly, the artisans here have not ever had a predominance in the craft. This is, however, not to equate the silversmiths of this place to any ordinary skilled worker in a factory. In other words, while the work of a skilled worker in a modern factory can be subjected to a time and motion study, the work of the artisan at Tarbha cannot be so subjected. That is, the artisan still retains some degrees of creative mind, which is strictly his own, and without which the craft would not thrive. The artisan still owns his workshop, though poorly equipped. He has some amount of choice when, how, where and with whom he has to work. Thus some amount of enterprise is still left to him.

Initiative and enterprise largely with the traders

80. The initiative and enterprise in commercial aspects of the craft has passed on to other people, that is, a few traders. What kind of stakes the latter have in the economy of the craft ? The trader usually invests a large sum of capital. The required raw materials, namely, silver, copper, zinc, chemicals and acids are purchased by the trader at wholesale rates and supplied to the artisans. When the artisan makes and delivers back the wares, the trader has to take up marketing of these. The problem of storage and possible deterioration in appearance of ornaments is there. The trader either himself organizes the sale or promotes such sale through agents. He has also to make arrangements for their transports. Besides, the trader also undertakes certain risks. While he delivers silver and other raw materials to the artisan mostly on good faith, there is the underlying risk of the artisan not turning up at all and committing fraud. The artisan may, as well, stop dealing with the particular trader and may start dealing with another. This risk, however, is minimized by the fact of existence

of a kind unwritten agreement among the traders by which one trader does not accommodate an artisan, who might have defrauded another trader. Thus, rarely an artisan commits such a fraud except at the risk of losing his daily bread. The trader also undertakes a similar risk in respect of sub-traders or agents to whom he delivers only on good faith wares worth several thousands of rupees at a time. Under similar circumstances as aforesaid, an agent rarely commits fraud with a trader except on the risk of losing his own business. Though in this way, it is reduced to the minimum, risk-taking by the traders is a fact of economy of silversmithy craft at Tarbha.

Trader's stakes in the craft, poor

81. The stakes of the trader vis-a-vis the artisan in the economy of the craft, however, are not of such a proportion that the net gains of the trade should be so very disproportionately distributed between the traders on the one hand and the artisans on the other. There is also a third side of the matter. That is, the customers or consumers have also a stake in the craft. An Indian family really does not 'spend' on ornaments; it 'invests' in ornaments. The latter are really a stand by for rainy days. Are the interests of consumer sufficiently guarded in the economics of silversmithy at Tarbha? To take the last question first, the interest of the consumer is what is discounted the most in the said craft. The alloys in the ornaments there are so much that the metallic value of an ornament would really make a paltry sum in relation to the purchase price of it. It is in this process that black fraud has been, and still is being, to a greater degree, committed in this craft here. It is really a consideration of this kind that has led to disrepute and decline of the craft. When the customer under some economic strain came to sell back his or her ornament to the trader as old silver, the latter refused to buy it as such. Thus started the disbelief, non-reliance, disrepute and consequently, the decline. On the other hand, disharmony did crop up in the relationship between the trader and the artisan. Considering their economic stakes in the craft, the trader has taken a lion's share in the profits leaving only a subsistence-wage for the artisan.

Cost-analysis and incomes

82. The following is the cost-structure of making ornaments. Let us take the alloy No. 10 quoted earlier. If a pair of *Bandaria* weighing 20 tolas are made with the silver alloy of this quality, the cost of production will be as detailed below:

(1)	Silver alloy 20 tolas (8 tolas of silver, 11 tolas of copper and 1 tola of zinc) at the wholesale rates ...	Rs. 20.00		
(2)	Soldering plates of pure silver one tola ...	Rs. 2.40	Paise	
(3)	Charges for making plates in press machines ...	Rs. 0.40	Paise	
(4)	Tin metal-wastage ...	Rs. 0.20	Paise	
(5)	Charcoal ...	Rs. 1.00		
(6)	Kerosene oil ...	Rs. 0.06	Paise	
(7)	Groundnut oil ...	Rs. 0.03	Paise	
(8)	Borax ...	Rs. 0.16	Paise	
(9)	Acids and cleansing ...	Rs. 0.37	Paise	
	Total ...	Rs. 24.62	Paise	
(10)	Making charges (Wage of the artisan at the rate of 25 Paise per tola) ...	Rs. 5.00	Paise	
	Grand Total ...	Rs. 29.62	Paise	

83. Thus Rs. 29.62 Paise is spent in making 20 tolas *Bandaria*. The metal used is 21 tolas, of which one tola gets burnt in the process. The trader bears the cost of first two items, that is, Rs. 22.40 Paise for supplying materials. He further bears the cost of paying the artisan his wages, that is, Rs. 5/-. Thus it costs Rs. 27.40 Paise to the trader to get a pair of *Bandaria* weighing 20 tolas. Out of making charges of Rs. 5/-

the artisan has to spend on the items Nos. 3 to 9, that is, Rs. 2.22 Paise. These are the incidental expenses in making the ornaments. Would the artisan honestly meet these incidental expenses from the wages he gets, he would be left with only Rs. 2.78 Paise for a work of 20 tolas that would have taken of him not less than 2 days. A very poor return indeed. To help himself out of this difficulty, the artisan obviously steals a portion of the metal by adding further alloys.

84. Ornaments of pure silver of average workmanship sells at the rate of Rs. 3.38 Paise per tola. Ornaments of the lowest quality silver alloy No. 16 are sold at the rate of Rs. 1.38 Paise per tola. Ordinarily an ornament of the metallic quality in which a *Bandaria* is made would sell nearly at Rs. 2.25 Paise per tola. The *Bandaria* weighing 20 tolas would thus fetch to the seller Rs. 45/-. Deducting the cost of production chargeable to the trader, that is, Rs. 27.40 Paise, the gross profit works out to be Rs. 17.60 Paise. The sub-trader or agent may be left with a margin of profit of Rs. 5/-. The trader gets Rs. 12.60 Paise as profit. In other words, the trader gets a profit of nearly Rs. 0.63 Paise per tola. For 10 lakhs tolas of metal handled in a year at Tarbha, the 5 to 6 traders get a profit of Rs. 6,30,000/- a year. On the other hand, the owner-artisans of 241 workshops get only Rs. 2,50,000/- a year, at the rate of Rs. 5/- for 20 tolas with out-turn of 10 lakh tolas in a year. This itself indicates the degrees of disparity in income and concentration of wealth in the village. Obviously, the few traders control production, supply and distribution of the wares in the craft. In a way, they control and guide the economic life and livelihood pattern of the artisans at the place and around. If the ornament is prepared with silver alloy No. 16, that is, the alloy in proportion of 100 tolas silver to 890 tolas of copper and 110 tolas of zinc, the aforesaid 20 tolas of metal would consist of 2 tolas of silver, 16 tolas of copper and 2 tolas of zinc, the cost of which would be only Rs. 5.75 Paise. In that case, the cost on this count could be reduced by Rs. 14.25 Paise, whereas the cost of silver-plating would rise to be nearly Rs. 1.25 Paise at the rate of $\frac{1}{16}$th rupee per tola. In the net result, the cost would be reduced by Rs. 13/- nearly. If the ornament sells at a slightly lower price, still the profit would rise by another Rs. 8/-.

85. If the ornament is made of nickel alloys, the cost of metal alone would be only Rs. 3.75 Paise instead of Rs. 20/- in the previous calculation. Taking into account the cost of full silver-plating in this case, and the likely low sale price for the ornament, the profit for the trader would rise considerably to be nearly Rs. 20/- for 20 tolas. In as much as the trade in nickel alloys is so vastly profitable, though always risky, quite a number of artisans have taken to it.

86. It may not be out of place to mention here the clever strategy adopted by a few traders, who openly declare their trade in nickel alloys. But nobody, not even of themselves as stated by them, is sure if the actual customers in the field get to buy these nickel alloys as such. On the other hand, there may be one or two intermediaries, that is, agents, who would be selling the said ornaments as pure silver to innocent customers. In this case, the fraud is very intelligently committed, while the trader parades his innocence, and while it would be well neigh impossible to catch the retail trader in the field. The only advantage of this open declaration is that the customer, who knows and who chooses to deal straight with the trader has not much to lose. He knows that he is about to buy a low quality metal with a low price only for sake of the value of ornaments that would be in it, and that after a year or so, when the metal gets blackened, he can get it silver-plated again. This straightforward dealing is certainly better than the hideous fraud committed with silver alloys.

87. The ornaments are meant, largely to cater to the relatively coarse tastes of unsophisticated people of such districts as Bolangir, Kalahandi, Baudh-Khondmals and a part of Sambalpur. People of nearby areas of Madhya Pradesh also use it. Many people of these localities go to serve at Tatanagar, Jamshedpur and tea gardens of Assam. Orders are accordingly received from those areas.

88. Besides entrusting to the sub-traders or agents, the traders also organize direct sale. They have several jeep vehicles at their disposal. They send salesmen in these transports with large quantities of ornaments to many weekly and bi-weekly markets in this district and nearby districts. They also send in such transports ornaments for ready sale in big villages, where a good number of marriages would take place.

Standardization, labelling and advertisement not feasible

89. Standardization is generally not possible in works of art, being products of handicrafts. No standardization has ever been attempted at Tarbha, though certain amount of it is feasible particularly in such processes as making plates and wares, carving art objects on thin silver plates, preparing screws, slots and hasps, etc. The scope, however, is very limited.

90. Only when the producers sport the quality of their products and seek to retain monopoly in them, do they take to properly labelling their products. No artisan or trader of Tarbha would think of it. A few artisans like Sri Satyananda Sahu, who try to maintain quality of their products rather by serving to the orders of customers direct than by working for the traders, started labelling their products by inscribing their names at the lower portion of the ornaments, but they have also meanwhile left it. Exactly for similar reasons, advertisement is not being organized, for nobody would undertake to guarantee the quality of his product. This is one of the reasons why very few people outside Bolangir and a few nearby districts know of Tarbha and its ornaments. The overall picture of economics of Tarbha silversmithy appears to be very gloomy.

SECTION VI

CONCLUSION AND SUGGESTIONS

91. The prosperity of the craft at Tarbha is very much in the decline. It has suffered badly since last two years. Quite a number of workshops have closed down. Many artisans have shifted to other places, where they might manage to establish certain amount of reliability and to continue with their craft. Some artisans, and many engaged in the craft mostly as semi-skilled and unskilled workers, have left this profession. Some of the traders have gradually taken up other lucrative occupations, namely, money-lending and groceries. Many artisans did not have work as the traders did not issue silver regularly. Almost all the artisans are capital-hungry. On the whole, the craft is very badly sinking.

92. Only a few artisans were found to have retained some amount of prosperity. These were the few, who continued to work independently. Customers have flocked to such artisans as they have found a degree of reliability with the latter.

93. The plausible remedy out of such a situation would appear to be that of giving in some way independent and commercially self-contained status to the real working artisans. For this, a good co-operative concern with strong Government backing may be of immense help. This co-operative would need good capital investment from the Government. The short term, and later long term loans may be advanced to the working artisans, who would be bound by bye-laws to be made, to deal directly with customers, but not with traders. The co-operative should also, step by step, enter into the field relating to supply of raw materials and undertaking trade in the finished wares. If the co-operative venture succeeds, definite steps may be taken in due course for establishing a craft institute in the village or nearby. Assistance can be availed of the Central Handicrafts Development Centre, which has been established a few years back in the country with the object of studying the tools and technique employed in different handicrafts and evolving suitable improvements. Improved designs for the craft may be obtained from the Regional Development Centre established at Calcutta during the Second Plan period. All these steps for the handicarfts are envisaged in the national Third Five Year Plan. If the artisans of Tarbha do really take a positive decision to improve their lot, facilities would perhaps not be lacking.

94. A Government-run factory or a Panchayat-run production-*cum*-training centre may also help serve the purpose. It would naturally depend on the men who work it than on the system organized.

LIST OF AGENTS FOR THE SALE OF GOVERNMENT OF INDIA PUBLICATIONS

(As on 17th February, 1964)

AGARTALA—Laxmi Bhandar Books & Scientific Sales (Rest.)

AGRA—

1. National Book House, Jeoni Mandi ... (Reg.)
2. Wadhawa & Co., 45, Civil Lines .. (Reg.)
3. Banwari Lal Jain, Publishers, Moti Katra ... (Rest.)
4. English Book Depot, Sadar Bazar, Agra Cantt. .. (Rest.)

AHMADNAGAR—V. T. Jorakar, Prop. Rama General Stores, Navi Path ... (Rest.)

AHMEDABAD—

1. Balgovind Kuber Dass & Co., Gandhi Road ... (Reg.)
2. Chandra Kant Chiman Lal Vora, Gandhi Road ... (Reg.)
3. New Order Book Co., Ellis Bridge ... (Reg.)
4. Mahajan Bros., Opp. Khadia Police Gate ... (Rest.)
5. Sastu Kitab Ghar, Near Relief Talkies, Patthar Kuva, Relief Road .. (Reg.)

AJMER—

1. Book Land, 663, Madar Gate .. (Reg.)
2. Rajputana Book House, Station Road ... (Reg.)
3. Law Book House, 271, Hathi Bhata ... (Reg.)
4. Vijay Bros., Kutchery Road ... (Rest.)
5. Krishna Bros., Kutchery Road ... (Rest.)

ALIGARH—Friends' Book House. Muslim University Market ... (Reg.)

ALLAHABAD—

1. Superintendent, Printing & Stationery, U.P.
2. Kitabistan, 17-A, Kamla Nehru Road ... (Reg.)
3. Law Book Co., Sardar Patel Marg., P. Box 4 .. (Reg.)
4. Ram Narain Lal Beni Madho, 2-A, Katra Road ... (Reg.)
5. Universal Book Co., 20, M. G. Road ... (Reg.)
6. The University Book Agency (of Lahore), Elgin Road ... (Reg.)
7. Wadhwa & Co., 23, M. G. Marg ... (Rest.)
8. Bharat Law House., 15, Mahatma Gandhi Marg ... (Rest.)
9. Ram Narain Lal Beni Prasad, 2-A, Katra Road (Rest.)

AMBALA—

1. English Book Depot, Ambala Cantt. .. (Reg.)
2. Seth Law House, 8719, Railway Road, Ambala Cantt. ... (Rest.)

AMRITSAR—

1. The Law Book Agency, G. T. Road, Putligarh ... (Reg.)
2. S. Gupta, Agent, Govt. Publications, Near P. O. Majith Mandi ... (Reg.)
3. Amar Nath & Sons, Near P. O Majith Mandi .. (Reg.)

ANAND—

1. Vijaya Stores, Station Road .. (Rest.)
2. Charto Book Stall, Tulsi Sadan, Stn. Road ... (Rest.)

ASANSOL—D. N. Roy & R. K. Roy, Booksellers, Atwal Building ... (Rest.)

BANGALORE—

1. The Bangalore Legal Practitioner Co-op. Society Ltd., Bar Association Building ... (Reg.)
2. S. S. Book Emporium, 118, Mount Joy Road ... (Reg.)
3. The Bangalore Press, Lake View, Mysore Road, P. O. Box 507 ... (Reg.)
4. The Standard Book Depot, Avenue Road ... (Reg.)
5. Vichara Sahitya Private Ltd., Balepet ... (Reg.)
6. Makkala Pustaka Press, Balamandira, Gandhinagar (Reg.)
7. Maruthi Book Depot, Avenue Road ... (Rest.)
8. International Book House P. Ltd., 4-F., Mahatma Gandhi Road .. (Reg.)
9. Navakarnataka Pubns. Private Ltd., Majestic Circle (Rest.)

BAREILLY—Agarwal Brothers, Barra Bazar ... (Reg.)

BARODA—

1. Shri Chandrakant Mohan Lal Shah, Raopura ... (Rest.)
2. Good Companions Booksellers, Publishers & Sub-Agent ... (Rest.)
3. New Medical Book House, 540, Madan Zampa Road ... (Rest.)

BEAWAR—The Secretary, S, D. College, Co-operative Stores Ltd. ... (Rest.)

BELGHARIA—Granthlok, Antiquarian Booksellers & Publishers (24-Parganas), 5/1, Amlica Mukherjee Road ... (Reg.)

BHAGALPUR—Paper Stationery Stores, D. N. Singh Road ... (Reg.)

BHOPAL—

1. Superintendent, State Government Press
2. Lyall Book Depot. Mohd. Din Bldg. Sultania Road (Reg.)
3. Delite Books, Opp. Bhopal Talkies ... (Rest.)

BHUBANESWAR—Ekamra Bidyabhaban, Eastern Tower, Room No. 3 ... (Rest.)

BIJAPUR—Shri D. V. Deshpande, Recognised Law Booksellers, Prop. Vinod Book Depot, Near Shiralsheti Chowk ... (Rest.)

BIKANER—Bhandani Bros. ... (Rest.)

BILASPUR—Sharma Book Stall, Sadar Bazar ... (Rest.)

BOMBAY—

1. Supdt. Printing and Stationery, Queens Road
2. Charles Lambert and Co., 101, Mahatma Gandhi Road .. (Reg.)
3. Co-operators' Book Depot, 5/32, Ahmed Sailor Bldg., Dadar ... (Reg.)
4. Current Book House, Maruti Lane, Raghunath Dadaji St. ... (Reg.)
5. Current Technical Literature Co. P. Ltd., India House, 1st Floor ... (Reg.)
6. International Book House Ltd., 9, Ash Lane, M. G. Road ... (Reg.)
7. Lakkani Book Depot, Girgaum ... (Reg.)
8. Elpees Agencies, 24, Bhangwadi, Kalbadevi ... (Reg.)
9. P. P. H. Book Stall, 190-B, Khetwadi Main Road ... (Reg.)
10. New Book Co., 188-190, Dr. Dadabhai Naoroji Road ... (Reg.)
11. Popular Book Depot, Lamington Road ... (Reg.)
12. Sunder Das Gian Chand, 601, Girgaum Road, Near Princess Street ... (Reg.)
13. D. B. Taraporewala Sons and Co. (P) Ltd., 210, Dr. Dadabhai Naoroji Road .. (Reg.)
14. Thacker and Co., Rampart Row ... (Reg.)
15. N. M. Tripathi Private Ltd., Princess Street ... (Reg.)
16. The Kothari Book Depot, King Edward Road ... (Reg.)
17. P. H. Rama Krishna and Sons, 147, Rajaram Bhavan, Shivaji Park Road, No. 5 ... (Rest.)
18. C. Jamnadas and Co., Booksellers, 146-C, Princess Street ... (Reg.)
19. Indo Nath and Co., A-6, Daulat Nagar, Voriuli ... (Reg.)
20. Minerva Book Shop, Shop No. 1/80, N. Subhas Road ... (Reg.)
21. Academic Book Co., Association Building, Girgaum Road ... (Rest.)
22. Dominion Publishers, 23, Bell Building, Sir P. M. Road ... (Rest.)
23. Bombay National History Society, 91. Walkeshwar Road ... (Rest.)
24. Dowmadeo and Co., 16, Naziria Building, Ballard Estate ... (Rest.)
25. Asian Trading Co., 310, The Miraball, P. B. 1505 ... (Rest.)

CALCUTTA—

1. Chatterjee and Co., 3/1, Bacharam Chatterjee Lane (Reg.)
2. Dass Gupta and Co. Ltd., 54/3, College Street ... (Reg.)
3. Hindu Library, 69A, Balaram De Street ... (Reg.)
4. S. K. Lahiri and Co. Private Ltd., College Street (Reg.)
5. M. C. Sarkar and Sons Private Ltd., 14, Bankim Chatterjee Street ... (Reg.)
6. W. Newman and Co. Ltd , 3, Old Court House Street ... (Reg.)
7. Oxford Book and Stationery Co., 17, Park Street (Reg.)
8. R. Chambray and Co. Ltd., Kent House, P. 33, Mission Row Extension ... (Reg.)
9. S. C. Sarkar and Sons Private Ltd., 1-C, College Square ... (Reg.)
10. Thacker, Spink and Co. (1933) P. Ltd., 3, Esplanade East ... (Reg.)
11. Firma K. L. Mukhopadhya, 6/1A, Bancha Ram Akrur Lane (Reg).

12. K. K. Roy, P. Box No. 10210, Calcutta-19 ... (Rest.)
13. Sm. P. D. Upadhya, 77, Muktaram Babu Street . (Rest.)
14. Universal Book Dist., 8/2, Hastings Street (Rest.)
15. Modern Book Depot, 9, Chowringhee Centre (Rest.)
16. Soor and Co., 125, Canning Street . (Reg.)
17. S. Bhattacharjee, 49, Dharamtala Street .. (Rest.)
18. Mukherjee Library, 10, Sarba Khan Road . (Reg.)
19. Current Literature Co., 208, Mahatma Gandhi Road . (Reg.)
20. The Book Depository, 4/1, Madan Street (1st Floor) (Rest.)
21. Scientific Book Agency, Netaji Subhas Road (Rest.)
22. Reliance Trading Co., 17/1, Banku Bihari Ghose Lane, District Howrah (Rest.)
23. Indian Book Dist Co., 65/2 Mahatma Gandhi Road (Rest.)

CALICUT—Touring Book Stall ... (Rest.)

CHANDIGARH—
1. Supdt. Govt. Printing and Stationery, Punjab
2. Jain Law Agency, Flat No. 8, Sector No. 22 . (Reg.)
3. Rama News Agency, Booksellers, Sector No. 22 .. (Reg.)
4. Universal Book Store, Booth 25, Sector 22-D . (Reg.)
5. English Book Shop, 34, Sector 22-D ... (Rest.)
6. Mehta Bros., 15-Z, Sector 22-B (Rest.)
7. Tandan Book Depot, Shopping Centre, Sector 16 . (Rest.)
8. Kailash Law Publishers, Sector 22-B . (Rest.)

CHHINDWARA—The Verma Book Depot .. (Rest.)

COCHIN—Sareswat Corporation Ltd., Palliarakav Road .. (Reg.)

CUTTACK—
1. Press Officer, Orissa Sectt.
2. Cuttack Law Times ... (Reg.)
3. Prabhat K. Mahapatra, Mangalabag, P. B. 35 .. (Reg.)
4. D. P. Sur & Sons, Mangalabag .. (Rest.)
5. Utkal Stores, Balu Bazar .. (Rest.)

DEHRADUN—
1. Jugal Kishore & Co., Rajpur Road ... (Reg.)
2. National News Agency, Paltan Bazar .. (Reg.)
3. Bishan Singh and Mahendra Pal Singh, 318, Chukhuwala .. (Reg.)
4. Utam Pustak Bhandar, Paltan Bazar . (Rest.)

DELHI—
1. J. M. Jaina & Brothers, Mori Gate ... (Reg.)
2. Atma Ram & Sons, Kashmere Gate (Reg.)
3. Federal Law Book Depot, Kashmere Gate . (Reg.)
4. Bahri Bros., 188, Lajpat Rai Market .. (Reg.)
5. Bawa Harkishan Dass Bedi (Vijaya General Agencies) P. B. 2027, Ahata Kedara, Chamalian Road ... (Reg.)
6. Book-Well, 4, Sant Narankari Colony, P. B. 1565 .. (Reg.)
7. Imperial Publishing Co., 3, Faiz Bazar, Daryaganj (Reg.)
8. Metropolitan Book Co., 1, Faiz Bazar ... (Reg.)
9. Publication Centre, Subjimandi ... (Reg.)
10. Youngman & Co., Nai Sarak ... (Reg.)
11. Indian Army Book Depot, 3, Daryaganj ... (Reg.)
12. All India Educational Supply Co., Shri Ram Buildings, Jawahar Nagar ... (Rest.)
13. Dhanwant Medical & Law Book House, 1522, Lajpat Rai Market ... (Rest.)
14. University Book House, 15, U. B. Bangalore Road, Jawahar Nagar (Rest.)
15. Law Literature House, 2646, Balimaran ... (Rest.)
16. Summer Brothers, P. O. Birla Lines .. (Rest.)
17. Universal Book & Stationery Co., 16, Netaji Subhas Marg ... (Reg.)
18. B. Nath & Bros., 3808, Charkhawalan (Chowri Bazar) ... (Rest.)
19. Rajkamal Prakashan P. Ltd., 3, Faiz Bazar ... (Reg.)
20. Premier Book Co., Printers, Publishers &. Booksellers, Nai Sarak .. (Rest.)
21. Universal Book Traders, 80, Gokhale Market .. (Reg.)
22. Tech. & Commercial Book Coy., 75, Gokhale Market ... (Rest.)
23. Saini Law Publishing Co., 1416, Chabiganj, Kashmere Gate ... (Rest.)
24. G. M. Ahuja, Booksellers & Stationers, 309, Nehru Bazar ... (Rest.)
25. Sat Narain & Sons, 3141, Mohd. Ali Bazar, Mori Gate ... (Reg.)
26. Kitab Mahal (Wholesale Div.) P. Ltd., 28, Faiz Bazar ... (Reg.)
27. Hindu Sahitya Sansar, Nai Sarak ... (Rest.)
28. Munshi Ram Manohar Lal, Oriental Booksellers & Publishers, P. B. 1165, Nai Sarak (Rest.)
29. K. L. Seth, Suppliers of Law, Commercial Tech. Books, Shanti Nagar, Ganeshpura .. (Rest.)
30. Adarsh Publishing Service, 5A/10, Ansari Road . (Rest.)

DHANBAD—
1. Ismag Co-operative Stores Ltd., P. O. Indian School of Mines . (Reg.)
2. New Sketch Press, Post Box 26 .. (Rest.)

DHARWAR—
1. The Agricultural College Consumers Co-op. Society (Rest.)
2. Rameshraya Book Depot, Subhas Road . (Rest.)
3. Karnatakaya Sahitya Mandira of Publishers and Booksellers .. (Rest.)

ERNAKULAM—
1. Pai & Co., Cloth Bazar Road ... (Rest.)
2. South India Traders, c/o. Constitutional Journal (Reg.)

FEROZEPUR—English Book Depot, 78, Jhoke Road (Reg.)

GAUHATI—Mokshada Pustakalaya (Reg.)

GAYA—Sahitya Sadan, Gautam Buddha Marg ... (Reg.)

GHAZIABAD—Jayana Book Agency ... (Rest.)

GORAKHPUR—Vishwa Vidyalaya Prakashan, Nakhes Road .. (Reg.)

GUDUR—The General Manager, The N. D. C. Publishing & Printing Society Ltd. ... (Rest.)

GUNTUR—Book Lovers Private Ltd., Kadriguda, Chowrasta ... (Reg.)

GWALIOR—
1. Supdt. Printing & Stationery, M. B.
2. Loyal Book Depot, Patankar Bazar, Laskhar (Reg.)
3. M. C. Daftari, Prop. M. B. Jain & Bros., Booksellers, Sarafa, Lashkar (Rest.)

HUBLI—Pervaje's Book House, Koppikar Road .. (Reg.)

HYDERABAD—
1. Director, Govt. Press
2. The Swaraj Book Depot, Lakdikapul ... (Reg.)
3. Book Lovers Private Ltd. (Rest.)
4. Labour Law Publications, 873, Sultan Bazar (Rest.)

IMPHAL—Tikendra and Sons, Booksellers ... (Rest.)

INDORE—
1. Wadhawa and Co., 56, M. G. Road (Reg.)
2. Swarup Brothers, Khajuri Bazar ... (Rest.)
3. Madhya Pradesh Book Centre, 41, Ahilya Pura ... (Rest.)
4. Modern Book House, Shiv Vilas Palace (Rest.)
5. Navyug Sahitya Sadan, Publishers and Booksellers, 10, Khajuri Bazar . (Rest.)

JABALPUR—
1. Modern Book House, 286, Jawaharganj . (Reg.)
2. National Book House, 135, Jai Prakash Narain Marg (Rest.)

JAIPUR—
1. Government Printing and Stationery Department, Rajasthan
2. Bharat Law House, Booksellers and Publishers, Opp. Prem Prakash Cinema . (Reg.)
3. Garg Book Co., Tripolia Bazar . (Reg.)
4. Vani Mandir, Sawai Mansingh Highway .. (Reg.)
5. Kalyan Mal and Sons, Tripolia Bazar ... (Rest.)
6. Popular Book Depot, Chaura Rasta ... (Reg.)
7. Krishna Book Depot, Chaura Rasta ... (Rest.)
8. Dominion Law Depot, Shah Building, P. B. No. 23 (Rest.)

JAMNAGAR—Swedeshi Vastu Bhandar ... (Reg.)

JAMSHEDPUR—
1. Amar Kitab Ghar, Diagonal Road, P. B. 78 .. (Reg.)
2. Gupta Stores, Dhatkidih ... (Reg.)
3. Sanyal Bros., Booksellers and News Agents, Bistupur Market ... (Rest.)

JAWALAPUR—Sahayog Book Depot ... (Rest.)

JHUNJHUNU—
1. Shashi Kumar Sarat Chand ... (Rest.)
2. Kapram Prakashan Prasaran, 1/90, Namdha Niwas, Azad Marg ... (R.)

JODHPUR—
1. Dwaraka Das Rathi, Wholesale Books and News Agents ... (Reg.)
2. Kitab-Ghar, Sojati Gate ... (Reg.)
3. Choppra Brothers, Tripolia Bazar ... (Reg.)

JULLUNDUR—
1. Hazooria Bros., Mai Hiran Gate .. (Rest.)
2. Jain General House, Bazar Bansanwala ... (Reg.)
3. University Publishers, Railway Road ... (Rest.)

KANPUR—
1. Advani and Co., P. Box 100, The Mall ... (Reg.)
2. Sahitya Niketan, Shradhanand Park ... (Reg.)
3. The Universal Book Stall, The Mall ... (Reg.)
4. Raj Corporation, Raj House, P. B. 200, Chowk ... (Rest.)

KARUR—Shri V. Nagaraja Rao, 26, Srinivasapuram ... (Rest.)

KODARMA—The Bhagwati Press, P. O. Jhumri Tilaiya, District Hazaribagh ... (Reg.)

KOLHAPUR—Maharashtra Granth Bhandar, Mahadwar Road ... (Rest.)

KOTA—Kota Book Depot ... (Rest.)

KUMTA—S. V. Kamat, Booksellers and Stationers, (N. Kanara) ... (Reg.)

LUCKNOW—
1. Soochna Sahitya Depot (State Book Depot)
2. Balkrishna Book Co. Ltd., Hazratganj ... (Reg.)
3. British Book Depot, 84, Hazratganj . (Reg.)
4. Ram Advani, Hazratganj, P. B. 154 ... (Reg.)
5. Universal Publishers (P) Ltd., Hazratganj (Reg.)
6. Eastern Book Co., Lalbagh Road .. (Reg.)
7. Civil and Military Educational Stores, 106/B, Sadar Bazar ... (Rest.)
8. Acquarium Supply Co., 213, Faizabad Road .. (Rest.)
9. Law Book Mart, Amin-Ud-Daula Park .. (Rest.)

LUDHIANA—
1. Lyall Book Depot, Chaura Bazar . (Reg.)
2. Mohindra Brothers, Katcheri Road (Rest.)
3. Nanda Stationery Bhandar, Pustak Bazar ... (Rest.)
4. The Pharmacy News, Pindi Street .. (Rest.)

MADRAS—
1. Superintendent, Government Press, Mount Road
2. Account Test Institute, P. O. 760, Egmore . (Reg.)
3. C. Subbiah Chetty and Co., Triplicane ... (Reg.)
4. K. Krishnamurty, Post Box 384 ... (Reg.)
5. Presidency Book Supplies, 8, Pycrofts Road, Triplicane .. (Reg.)
6. P. Vardhachary and Co., 8, Linghi Chetty Street (Reg.)
7. Palani Parchuram, 3, Pycrofts Road, Triplicane ... (Reg.)
8. NCBH Private Ltd., 199, Mount Road ... (Rest.)
9. V. Sadanand, The Personal Bookshop, 10, Congress Building 111, Mount Road .. (Rest.)

MADURAI—
1. Oriental Book House, 258, West Masi Street ... (Reg.)
2. Vivekananda Press, 48, West Masi Street .. (Reg.)

MANDYA SUGAR TOWN—K. N. Narimhe Gowda and Sons .. (Rest.)

MANGALORE—U. R. Shenoye Sons, Car Street, P. Box 128 (Rest.)

MANJESHWAR—Mukenda Krishna Nayak ... (Rest.)

MATHURA—Rath & Co., Tilohi Building, Bengali Ghat (Rest.)

MEERUT—
1. Prakash Educational Stores, Subhas Bazar ... (Reg.)
2. Hindi Chitra Press, West Kutchery Road ... (Reg.)
3. Loyal Book Depot, Chhippi Tank .. (Reg.)
4. Bhart Educational Stores, Chhippi Tank .. (Rest.)
5. Universal Book Depot, Booksellers and News Agents (Rest.)

MONGHYR—Anusandhan, Minerva Press Building ... (Rest.)

MUSSOORIE—
1. Cambridge Book Depot, The Mall ... (Rest.)
2. Hind Traders .. (Rest.)

MUZAFFARNAGAR—
1. Mittal and Co., 85-C, New Mandi ...(Rest.)
2. B. S. Jain and Co., 71, Abupura ... (Rest.)

MUZAFFARPUR—
1. Scientific and Educational Supply Syndicate (Reg.)
2. Legal Corner, Tikmanio House, Amgola Road ... (Rest.)
3. Tirhut Book Depot ... (Rest.)

MYSORE—
1. H. Venkataramiah and Sons, New Statue Circle ... (Reg.)
2. Peoples Book House, Opp. Jagan Mohan Palace ... (Reg.)
3. Geeta Book House, Booksellers and Publishers, Krishnamurthipuram ... (Rest.)
4. News Paper House, Lansdowne Building ... (Rest.)
5. Indian Mercantile Corporation, Toy Palace, Ramvilas ... (Rest.)

NADIAD—R. S. Dessay, Station Road ... (Rest.)

NAGPUR—
1. Superintendent, Government Press & Book Depot
2. Western Book Depot, Residency Road ... (Reg.)
3. The Asst. Secretary, Mineral Industry Association, Mineral House ... (Rest.)

NAINITAL—Coural Book Depot, Bara Bazar ... (Rest.)

NANDED—
1. Book Centre, College, Law, General Books, Station Road ... (Rest.)
2. Hindustan General Stores, Paper and Stationery Merchants, P. B. No. 51 ... (Rest.)
3. Sanjoy Book Agency, Vazirabad ... (Rest.)

NEW DELHI—
1. Amrit Book Co., Connaught Circus .. (Reg.)
2. Bhawani and Sons, 8F, Connaught Place ... (Reg.)
3. Central News Agency, 23/90, Connaught Circus .. (Reg.)
4. Empire Book Depot, 278, Aliganj ... (Reg.)
5. English Book Stores, 7-L, Connaught Circus, P. O. B. 328 ... (Reg.)
6. Faquir Chand and Sons, 15-A, Khan Market ... (Reg.)
7. Jain Book Agency, C-9, Prem House, Connaught Place ... (Reg.)
8. Oxford Book and Stationery Co., Scindia House (Reg.)
9. Ram Krishna and Sons (of Lahore) 16/B, Connaught Place ... (Reg.)
10. Sikh Publishing House, 7-C, Connaught Place ... (Reg.)
11. Suneja Book Centre, 24/90, Connaught Circus ... (Reg.)
12. United Book Agency, 31, Municipal Market, Connaught Circus ... (Reg.)
13. Jayana Book Depot, Chhaparwala Kuan, Karol Bagh ... (Reg.)
14. Navayug Traders, Desh Bandhu Gupta Road, Dev Nagar ... (Reg.)
15. Saraswati Book Depot, 15, Lady Harding Road ... (Reg.)
16 The Secretary, Indian Met. Society, Lodi Road ... (Reg.)
17. New Book Depot, Latest Books, Periodicals, Stationery and Novelles, P. B. 96, Connaught Place ... (Reg.)
18. Mehra Brothers, 50-G, Kalkaji ... (Reg.)
19. Laxmi Book Stores, 42, Janpath .. (Rest.)
20. Hindi Book House, 82, Janpath ... (Reg.)
21. People Publishing House (P) Ltd., Rani Jhansi Road ... (Reg.)
22. R. K. Publishers, 23, Beadon Pura, Karol Bagh .. (Rest.)
23. Sharma Bros, 17, New Market, Moti Nagar ... (Reg.)
24. Aapki Dukan, 5/5777, Deb Nagar .. (Rest.)
25. Sarvodaya Service, 66A-1, Rohtak Road, P. B. 2521 (Rest.)
26. H. Chandson, P. B. No. 3034 ... (Rest.)
27. The Secretary, Federation of Association of Small Industry of India, 23-B/2, Rohtak Road (Rest.)
28. Standard Booksellers and Stationers, Palam Enclave ... (Rest.)
29. Lakshmi Book Depot, 57, Regarpura ... (Rest.)
30. Sant Ram Booksellers, 16, New Municipal Market, Lody Colony ... (Rest.)

PANJIM—
1. Singhals Book House, P. O. B. 70 Near the Church (Rest.)
2. Sagoon Gaydev Dhoud, Booksellers, 5-7 Rua, 3. Ide Jameria ... (Rest.)

PATHANKOT—The Krishna Book Dept, Main Bazar ... (Rest.)

PATIALA—
1. Superintendent, Bhupendra State Press
2. Jain and Co., 17, Shah Nashin Bazar .. (Reg.)

PATNA—
1. Superintendent, Government Printing, Bihar
2. J. N. P. Agarwal and Co., Padri-Ki-Haveli, Raghunath Bhaban ... (Reg.)
3. Luxmi Trading Co., Padri-Ki-Haveli ... (Reg.)
4. Moti Lal Banarasi Dass, Bankipore ... (Reg.)
5. Bengal Law House, Chowhatta ... (Rest.)

PITHORAGARH—Maniram Punetha and Sons ... (Rest.)

NEW DEL-11.

PONDICHERRY—M/S. Honesty Book House, 9 Rue Dupleix (R.)

POONA—
1. Deccan Book Stall, Deccan Gymkhana ... (Reg.)
2. Imperial Book Depot, 266, M. G. Road ... (Reg.)
3. International Book Service, Deccan Gymkhana .. (Reg.)
4. Raka Book Agency, Opp. Natu's Chawl, Near Appa Balwant Chowk ... (Reg.)
5. Utility Book Depot, 1339, Shivaji Nagar (Rest.)

PUDUKOTTAI—Shri P. N. Swaminathan Sivam and Co., East Main Road ... (Rest.)

RAJKOT—Mohan Lal Dossabhai Shah, Booksellers and Sub-Agents ... (Reg.)

RANCHI—
1. Crown Book Depot, Upper Bazar .. (Reg.)
2. Pustak Mahal, Upper Bazar ... (Rest.)

REWA—Superintendent, Government State Emporium V.P.

ROURKELA—The Rourkela Review .. (Rest.)

SAHARANPUR—Chandra Bharata Pustak Bhandar, Court Road .. (Rest.)

SECUNDERABAD—Hindustan Diary Publishers, Market Street ... (Reg.)

SILCHAR—Shri Nishitto sen Nazirpati ... (Rest.)

SIMLA—
1. Supdt., Himachal Pradesh Govt.
2. Minerva Book Shop, The Mall .. (Reg.)
3. The New Book Depot, 79, The Mall ... (Reg.)

SINNAR—Shri N. N. Jakhadi, Agent, Times of India, Sinnar (Nasik) .. (Rest.)

SHILLONG—
1. The Officer-in-Charge, Assam Govt. B. D.
2. Chapla Bookstall, P. B. No. 1 ... (Rest.)

SONEPAT—United Book Agency (Reg.)

SRINAGAR—The Kashmir Book Shop, Residency Road ... (Reg.)

SURAT—Shri Gajanan Pustakalaya, Tower Road ... (Reg.)

TIRUCHIRAPALLI—
1. Kalpana Publishers, Wosiur ... (Reg.)
2. S. Krishnaswami & Co., 35, Subhash Chander Bose Road ... (Reg.)
3. Palaniappa Bros. . (Rest.)

TRIVANDRUM—
1. International Book Depot, Main Road ... (Reg.)
2. Reddear Press & Book Depot, P. B. No. 4 .. (Rest.)

TUTICORIN—Shri K. Thiagarajan, 10-C, French Chapal Road ... (Rest.)

UDAIPUR—
1. Jagdish & Co., Inside Surajapole ... (Rest.)
2. Book Centre, Maharana Bhopal Consumers' Co-op. Society Ltd. ... (Rest.)

UJJAIN—Manak Chand Book Depot, Sati Gate . (Rest.)

VARANASI—
1. Students Friends & Co., Lanka ... (Rest.)
2. Chowkhamba Sanskrit Series Office, Gopal Mandir Road P. B. 8 ... (Reg.)
3. Globe Book Centre ... (Rest.)
4. Kohinoor Stores, University Road, Lanka ... (Reg.)
5. B. H. U. Book Depot .. (Rest.)

VELLORE—A. Venkatasubhan, Law Booksellers (Reg.)

VIJAYAWADA—The Book and Review Centre, Eluru Road, Governpet (Rest.)

VISAKHAPATNAM—
1. Gupta Brothers, Vizia Building ... (Reg.)
2. Book Centre, 11/97, Main Road ... (Reg.)
3. The Secy. Andhra University, General Co-op. Stores Ltd. ... (Rest.)

VIZIANAGRAM—Sarda and Co. (Rest.)

WARDHA—Swarajaya Bhandar, Bhorji Market ... (Reg.)

For local sale

1. Govt. of India Kitab Mahal, Janpath Opp. India Coffee House, New Delhi
2. Govt. of India Book Depot, 8 Hastings Street, Calcutta
3. High Commissioner for India in London, India House, London W. C. 2

Railway Bookstall holders

1. S/s. A. H. Wheeler & Co., 15, Elgin Road, Allahabad
2. Gahlot Bros., K. E. M. Road, Bikaner
3. Higgenbothams & Co. Ltd., Mount Road, Madras
4. M. Gulab Singh & Sons Private Ltd., Mathura Road, New Delhi

Foreign

1. S/s. Education Enterprise Private Ltd., Kathmandu (Nepal)
2. S/s. Aktie Bologat, C. E. Fritzes Kungl, Hovobokhandel, Fredsgation-2 Box 1656, Stockholm-16 (Sweden)
3. Reise-und Verkehrsverlag Stuttgart, Post 730 Gutenbergs-tra, 21, Stuttgart No. 11245, Stuttgart den (Germany West)
4. Shri Iswar Subramanyam 452, Reversite Driv Apt. 6, New York, 27 NWY
5. The Proprietor, Book Centre, Lakshmi Mansions, 49, The Mall, Lahore (Pakistan)

On S. and R. Basis

1. Head Clerk, Govt. Book Depot, Ahmedabad
2. The Assistant Director, Extension Centre, Kapileswar Road, Belgaum
3. The Employment Officer, Employment Exchange, Dhar
4. The Asst. Director, Footwear Extension Centre, Polo Ground No. 1 Jodhpur
5. The O. I/C, Extension Centre, Club Road, Muzaffarpur
6. The Director, Indian Bureau of Mines, Government of India, Ministry of Mines and Fuel, Nagpur
7. The Asst. Director, Industrial Extension Centre, Nadiad (Gujarat)
8. The Head Clerk, Photozincographic Press, 5, Finance Road, Poona
9. Government Printing and Stationery, Rajkot
10. The O. I/C, Extension Centre, Industrial Estate, Kokar, Ranchi
11. The Director, S. I. S. I. Industrial Extension Centre, Udhna, Surat
12. The Registrar of Companies, Narayani Building, 27, Brabourne Road, Calcutta-1
13. The Registrar of Companies, Kerala, 50 Feet Road, Ernakulam
14. The Registrar of Companies, H. No. 3-5-83, Hyderguda, Hyderabad
15. Registrar of Companies, Assam, Manipur and Tripura, Shillong
16. Registrar of Companies, Sunlight Insurance Building, Ajmeri Gate Extension, New Delhi
17. Registrar of Companies, Punjab and Himachal Pradesh Link Road, Jullundur City
18. Registrar of Companies, Bihar, Jamal Road, Patna-1
19. Registrar of Companies, Raj. & Ajmer, Shri Kamta Prasad House, 1st Floor, 'C' Scheme, Ashok Marg, Jaipur
20. The Registrar of Companies, Andhra Bank Building, 6 Linghi Chetty Street P. B. 1530, Madras
21. The Registrar of Companies, Mahatma Gandhi Road, West Cott. Bldg., P. B. 334 Kanpur
22. The Registrar of Companies, Everest 100, Marine Drive, Bombay
23. The Registrar of Companies, 102, Brigade Road, Bangalore
24. The Registrar of Companies, Gwalior
25. Asst. Director Extension Centre, Bhuli Road, Dhanbad
26. Registrar of Companies, Orissa, Cuttack Chandi, Cuttack
27. The Registrar of Companies, Gujarat State, Gujarat Samachar Building, Ahmedabad
28. Publication Division Sale Depot, North Block, New Delhi
29. The Development Commissioner, Small Scale Industries, New Delhi
30. The O. I/C, University Employment Bureau, Lucknow
31. O. I/C, S. I. S. I. Extension Centre, Malda
32. O. I/C, S. I. S. I. Extension Centre, Habra, Tabaluria, 24-Parganas
33. O. I/C, S. I. S. I. Model Carpentry Workshop, Piyali Nagar, P. O. Burnipur.
34. O. I/C, S. I. S. I. Chrontanning Extension Centre, Tangra, 33, North Topsia Road, Calcutta-46
35. O. I/C, S. I. S. I. Extension Centre (Footwear), Calcutta
36. Asst. Director, Extension Centre, Hyderabad
37. Asst. Director, Extension Centre, Krishna Distt. (A. P.)
38. Employment Officer, Employment Exchange, Jhabua
39. Dy. Director Incharge, S. I. S. I., C/o. Chief Civil Admn., Goa, Panjim
40. The Registrar of Trade Unions, Kanpur
41. The Employment Officer, Employment Exchange, Gopal Bhavan, Mornia
42. The O. I/C, State Information Centre, Hyderabad
43. The Registrar of Companies, Pondicherry
44. The Asst. Director of Publicity and Information, Vidhana Sabha P. B. 271, Bangalore