THE IMPORTANCE OF THROWING ON A KICKWHEEL AS A POTTERY MAKING TECHNIQUE IN NIGERIAN SECONDARY SCHOOLS.

A THESIS

Presented in partial fulfilment of the
requirements for the award of
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Ahmadu Bello University, Zaria

by

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To

Chief Daniel 'Mosanya Aina (the late Olugbon of Odogbolu), and Samuel Olatunji Aina,

And those who strife to make pottery teaching a reality in this country.

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Isaac Olusegun Aina
A.B.U., Zaria.

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CHAPTER I

INTRODUCTION: and Background History to the Problem:

Following the embargo placed on imported materials during the state of emergency in Nigeria, the Richware Pottery Industries in Ilupeju, Lagos was forced to embark on the use of local pottery raw materials i.e. Lisabi clay, feldspar, quartz from Abeokuta and its environs.* It became imperative then, that experiments had to be started on these local raw materials, so that these could be substituted for the previously imported ones, to keep the Pottery Industries going. Up till that time in 1970, the bulk of materials used were imported.

In 1973, the Principal of a Lagos Secondary School, Ahmadiya Grammar School, Surulere, felt that students should be given opportunity to experience as many different areas of Fine Arts as possible. To this end, he added pottery to the list of host of other Fine Art subjects being offered in his college. He sought the assistance of the Art Section of the Federal Ministry of Education which supplied him with the list of items to order.** Except in Colleges where the principals are broadminded enough, the vote for Art is either too small or completely diverted to other uses. But in this case, some amount of money was made available for the introduction of pottery, but because of the relatively high cost of some of these materials, it was far too small to cover the basic items needed to start it off. The need then arose to supplement with, and improvise from local materials. For instance, instead of importing modelling sticks, good ones could be fashioned cheaply out of the chewing sticks, such as those sold at

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* This fact was revealed by the manager of the Industries in June 1971, during a course in Industrial Production of Pottery attended in the industries by the researcher.

** The researcher was a member of staff of the Art Section of the Federal Ministry of Education then, and he supplied the list of the required items.

Shagamu or Calabar, or even out of scraps of wood.

It is a common knowledge that it takes such a long time to get consignment ordered from foreign manufacturers of educational materials, especially Art materials. And sometimes these are very expensive. Feeling this pinch in 1973, the Assistant Adviser on Education (Art) for the Federal Government requested the researcher to compile a list of materials and equipments that could be got locally to teach pottery.

In an interview with Chief Agiobu-Kemmer, the Principal of King's College, Lagos in 1973, he expressed the feeling that there are a number of students - though may be few - who preferred and derived more pleasure in doing the three-dimensional art, especially pottery.* This assertion was proved right at Queen's College Yaba, where the researcher taught for a brief period. Students - even the allegedly troublesome ones in other subjects - showed some remarkable interest in pottery and produced some excellent pots by using coiling and pinching methods. It is an inconstestable fact that people express themselves differently. Some do better through verbal expression, some written, some in two-dimensional art while some do in three-dimensional art. It is also a fact that where there is no outlet for releasing a bottled up emotion in a child, this could lead to an imbalanced growth of the child and make a nuisance of him or her. It is therefore believed by the researcher that by adding another avenue of self-expression into schools, some students whose superabundance of energy and internal tension have been a nuisance, could find a legitimate outlet for their bottled up emotion in pottery making.

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* This assertion was made during a series of interviews held with the Principal on setting up pottery studio for King's College in 1973.

It is generally acknowledged that traditional pottery is a wide-spread craft in Nigeria. In the traditional societies, pottery met the various needs as cooking utensils, water storage, oil lamps, and the implements of ritual and worship.

Going through the collection of pots at the Pottery Gallery of Jos Museum, it can be easily seen that these traditional wares are of excellent shapes and craftsmanship.

> Though "wrought out of rough textured clays, these pots are the result of acquired traditions developed by generations of master potters working in their own way* in designs, and patterns disciplined to simplicity by the limitations of the materials used"[3]

STATEMENT OF PROBLEM:

How Nigeria is going to meet the challenge of modern technology, especially in ceramics, is a question still to be answered.

> The appellation China to most traditional ceramics is a tribute to the technical and artistic skill of the Chinese who produced beautiful ceramics hundreds of years before the advent of modern technology.[4]

In September, 1976, most children of school age will be sent to school, no matter where they are in the country. This is because of the introduction of the Free Universal Primary Education - which has recently become a house-hold word throughout the country. Those

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* The traditional societies have locally set patterns identified with the locality and passed from generation to generation.

3. D.K. & R.D. Wren, "Pottery making" p. xii.

4. Terry Agbelemoge, Ed. "Role of Artist in Modern Technology" Daily Times Wed. Nov. 26, 1975 pp. 16-17.

children, who have hitherto been the apprentices to the master craftsmen, who are, in most cases their parents, will now move to schools. This is no doubt, a noble plan to eradicate illiteracy, but the questions here are, who are to understudy these master craftsmen who would eventually pass away, who will be the progenitor of this craft to the future, how are the children, the future custodian of our heritage, to be made aware of their cultural heritage in this direction?

Art teaching at this particular level will cater for those students who would have missed the apprenticeship training in the traditional pottery workshop setting (including those who would not have had the opportunity)and will then be afforded better opportunity to express themselves.[5]

As if to answer these questions too, the former Federal Commissioner for Education, Chief A.Y. Eke in a speech said:

> ... If she (Nigeria) is to secure the best advantage from the UPE scheme commencing next year, she will have to introduce the other half of general education not later than Sept. 1982. And it should embrace not only the existing types of secondary education but also a comprehensive net-work of training...[6]

And quite recently on the same note, another commissioner for Education called on all curriculum planners throughout the Federation and asked them -

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5. In traditional craft, the pattern is set, and followed according to the norms of the society without much room for individual expression e.g. the Ibeji figures in Yoruba-land, or the traditional Abuja Pottery.

6. Eke, Chief A.Y., Former Commissioner for Education. "Counting the Pluses of UPE". Daily Times Monday October 20, 1975, Extract from an address given at King's College, Friday October 17th, 1975.

> ... not to neglect artistic education in the attempts to accord traditional curriculum its rightful place ..., such artistic education he went further, ... would develop and offer scope for self expression, creativity and preservation of our culture.[7]

Also pertinent is the call made by an educationist, he contended that:

> ... varied cultural activities including frequent visit to Museums, art centres, as well as teaching of music, art, and indegenous languages should be integrated into the schools' curriculum fron the earliest possible moment ...[8]

Because of the pattern of education inherited from the colonial past, it has been difficult for Nigerians to break away from the "white collar job" concept of vocation and to fully recognise the importance of craft in our cultural development. It is a general belief that crafts are meant for the illiterates and the uneducated. When people are mass educated beginning with the UPE, and with this misconception carried along, this mentality will surely lead to total abandoning of this craft if no substitute is made for it in the schools.

The luke-warm attitude of the Federal Government to this craft has left so much to be desired.

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7. Ajayi, Adeyiga, "Call for Artistic Education" Daily Times Monday December 22, 1975, p.3. He is a Commissioner for Education Lagos State.

8. Balogun, Dr. Ola, "New Role to Revive Culture". A paper presented to Department of Education Cultural Class, A.B.U. Zaria November 1, 1974.

> In 1951, the Government decided to start a pottery Training Centre, where new and more advance technical methods, especially glazing, could be taught. The centre was intended to serve the whole of the (then) Northern region...[9]
> In 1954, there was a government legislation to develop pottery in the country[10]

Three centres were established namely at Abuja, Okigwi and Ado Ekiti. It is one thing to pass a legislation and another thing to implement it; it is another to encourage and support it. According to my source of information the pottery centre at Ado Ekiti has closed down; and the one at Okigwi was affected by the civil war, but still functioning well is the Abuja Pottery Training Centre. Though, quite recently there was a pronouncement by some States government to revitalize the craft; it is felt by the researcher that this is not enough to compensate for the great threat and consequent loss to the youth; rather, it should be encouraged in Colleges among the youths who are going to be the future builders of Nigerian culture.

Though pottery raw materials are abundant in the country, there is acute scarcity of the processed materials. Pottery raw materials processing industries and locally made equipment are desirable and urgently needed in this country.

Schools hardly offer pottery as a subject though it is included in the School Certificate and General Certificate of Education syllabus.

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9. Frank Heath, "A chronicle of Abuja" p. 42.

10. Michael O'Brien, (Former Pottery Officer, Abuja) An unpublished Lecture delivered on Pottery, in the Department of Fine Art, A.B.U. Zaria, December, 1975.

Those who could teach the craft in colleges are very few, and where they are engaged in teaching, lack of materials and equipment impair the introduction of the craft. It is therefore the student's observation:

1. That the future of Pottery craft, an otherwise virile part of Nigerian culture, is at stake if nothing is done to rescue it.
2. That there is abundant raw materials in the country that could be used in propagating this craft to educational, economic and cultural advantage.
3. That stepping up the teaching of this craft in Secondary Schools will eventually lead to educational, economic and cultural growth of this country.
4. That the craft will afford opportunity for personal expression and fulfilment of students, in our educational system.
5. That, apart from the aesthetic and educational satisfaction that could be derived from this craft, it could also provide a means of lifelihood to some people if pursued beyond school level.
6. That to achieve the above goals, the development of pottery raw materials and designing, construction, and maintenance of pottery equipment locally is imperative.

The Significanance of the Study.

The abundance of processed pottery materials and equipment will facilitate easy introduction of the craft into many more schools. One of the significances in the introduction of the Craft is to teach the students to make pots, acquire skill, control over material and to be able to translate a concept into material object. Thus one of the

prime reasons why ceramics is such a profitable art for the schools is that it creates a sense of understanding and a relationship between the students and the craft. So that a student who would not have given a second look to a pot either in the museum or anywhere, will appreciate it, having experienced the techniques and materials used, and probably the difficulties involved.

It is possible that some of these students may become the future potters, but it is much more important that -

> "whilst they were young and impressionable a sense of material and process, and of form and pattern, is borne in upon them through the experience of their own hands with clay, glaze, fire; they will be enriched for life"[13]. Thus it may lead to a "... development of artistic appreciation and a sound critical faculty in art to recognise form and decor. Finding pleasure in beauty, as it is claimed, is a precious human quality".[14]

It is also possible that stepping up this craft in colleges will be laying a foundation for future production of ceramic scientists and researchers, and artist potters, which will eventually lead to establishment of wide and varied ceramic industries in the country. This might lead to a synthesis of modern and traditional culture in pottery.

SCOPE AND DELIMITATION OF STUDY

This study will not delve into highly technical techniques of industrial production and kiln construction.

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12. Philip Rawson, "Ceramics - the appreciation of the Arts/6" p.6.
13. Dorothy Kemp, op.cit., pp. 11 & 12. said by Bernard Leach.
14. Ibid. p. 14.

It will deal extensively with an equipment for throwing - the KICKWHEEL. It will consider other wheels but no electric wheels. The study will not go into extensive experiment on glaze.

The whole exercise, it is felt, will consequently lead to improvement in pottery teaching with some local materials and equipments built locally. It is further hoped that this will be laying a good foundation for better appreciation and future development of unlimited possibilities of ceramics in Nigeria.

DEFINITION OF TERMS

It is commonly agreed upon by ceramic - authorities that the word "ceramics" comes from a Greek word "Keramos" for pottery. This is further defined by Singer and Singer as "products made from inorganic materials which are first shaped and subsequently hardened by heat".[16] In like manner, J.P. Roberts, (a reader in ceramics) defines it as "crystalline inorganic non-mentallic solids of high melting point".[17]

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16. Singer and Singer, "Industrial Ceramics" p. 196.

17. J.P. Roberts, "Ceramics" The New Universal Library Vol. 15 p.215.

CHAPTER II

THE SUITABILITY OF A KICK-WHEEL AS AN EQUIPMENT FOR THROWING IN NIGERIAN SCHOOLS:

Historical Development

The development of the wheel technique has not been precisely dated. The basic simple wheel has been used in Egypt, Greece, China, Japan and quite recently in Nigeria.*

> It is believed that the first potter's wheel was a crude balanced stone, which was rotated by hand. With human ingenuity, however, various types of potter's wheels have evolved in different lands, each varying slightly but using simply mechanical principles.[1]

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* See pages 66 - 75 for wheels built in the Department of Fine Art, A.B.U., Zaria; and appendix .A. for wheels of other countries.

1. Geza de Vegh & Alber Mandi, "The Craft of Ceramics" p. 86.

As already enumerated clearly in the introduction the rationale for producing kickwheels locally includes the following:

The necessity to be self-reliant

Some few years back the Nigerian Government launched "Made in Nigeria" policy, and a strong publicity campaign was mounted. Designing and construction of kickwheels for local need therefore, is in tune with the policy and aspiration of the government and people of Nigeria as a whole. In the foregoing passages, it has been conclusively asserted that Nigeria needs to be self-reliant in this direction.

Despite the fact that some kick-wheels have been constructed locally at Okigwi and Abuja for studio production, and some at A.B.U. in the Department of Fine Art for students of higher institution, there is still the need to encourage the craft in and construct Kickwheels for Secondary Schools in Nigeria.

Abundance of Local Raw Materials.

Secondly, it has been previously stated that ceramic raw materials are in abundance in the country, so also are the materials for kickwheel construction, which is principally wood. To allay a wrong impression that may be aroused by local scarcity of wood in any part of the country a research report by Lawrence Okigbo shows that:

> Nigeria is one of the world's most important producers of tropical timbers. Her timber production and exports have steadily grown since the beginning of the century.

He claimed further that:

> There are more than one hundred usable timber species in Nigeria, and that she has a very wide range of timber species for all purposes. There are, for example, timbers as light as Balsawood. (Hildegardia); some extremely heavy - Ekki; some as white as sycamore - Funtumia; some as black as soot- Ebony; some as silky as Polar Birchceltis; some as durable as iron - Erun, Ekki, some crimson red - camwood; some with very fragrant smell - scented Guarea and others with a rather pungent smell Cylicodiscus.[2]

There are many Sawmills everywhere in the country. In another brochure A guide to building timbers in Nigeria, he dealt with the availability and characteristics of the species - see appendix B. See appendix C also for the distribution of the Sawmills in Nigeria and appendix D for further enquiries regarding sources of supply of those species.

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2. Lawrence Okigbo. "Some Nigerian woods" p. 3.

Also, the kickwheel can be constructed easily in the different schools. The researcher has endeavoured to design the wheel in such a way that a skillful local carpenter or cabinet maker could easily make it. So also, the Trade Centres and Technical Colleges all over the country may easily construct the kickwheel.

The kickwheel is also easily adaptable and portable. Because of its complete manual manipulation, it could be used in the remotest village college in the country, whether there is electricity there or not; or regardless of whether the electricity supply is regular or not.

The kickwheel if constructed locally, will be cheap and easy to maintain. Considering the large number of colleges there are, and many more to develop in the nearest future, the wheel therefore, must be made to be cheap and simple so that it could be easily maintained. In Kyoto; Japan, majority of potters use electric wheels at present, but as H.H. Sanders[3] has observed it is very difficult to find craftsmen who can repair them.

Basic Principles in the design of a kickwheel

> There are three important technical elements in any wheel. Firstly, the circular wheel itself, which rotates lying flat; secondly, the bearing or bearings on which it rotates. The simplest of which is a cup and spike bearing, with the wheel balanced on the tip of the spike.

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3. H.H. Sanders, "The world of Japanese Ceramics". p. 61.

Thirdly, the means of spinning the wheel.[4]

Apart from these technical elements, some human elements also have to be considered. From the field of psychology;

> a resume of human desires and their relation to furniture design - functionalism, human needs and beauty.[5]

should also be looked into.

The efficiency of the wheel is best determined by the relationship between the size of the wheel, that is, the height of the shaft, the weight of the fly-wheel on one hand and the age group of children for whom it is being designed; the estimated weight or volume of clay to be thrown on it on the other hand - these can be termed the elements of functionalism.

The Aspects of Human Needs:

The human need for comfort, rest, and hospitality should also be put into consideration. For instance a confortable furniture or equipment will attract many more users than an ill-designed or ill-fitting one. A practical example of this can be seen in the Kashim Ibrahim Library where a few number of chairs are cushioned and the majority having hard plywood tops. Most of the times, the first group of chairs to be occupied are the cushioned ones; and so it is in other public places; one would look round for the most confortable of the available things.

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4. Philip Rawson, "CERAMICS: the appreciation of the Arts/6"

5. W.H. Vernum, "Creative Design in Furniture". p.8.

Desire for "play" is another factor to be considered when designing, especially, for school children. It is still a debatable concept of education as to whether the child learns better by being allowed a freedom to develop at her own pace (child centred philosophy) or be forced or subjected to meticulous craming and reproduction of facts and rules (subject centred philosophy). A secondary school student, especially in the lower class, it is believed, could still learn better when allowed to "play" with art to some extent at this level of education, sculpture and ceramics inclusive. Often times when students visit the Ceramic Studio of this Department, the desire to play is usually manifested by students, playfully kicking some of the wheels. It is here observed that students may learn and enjoy such wheels more than an uncomfortably rigid and business - like type of wheels.

Desire to escape - This is another common element that should be put into consideration when designing a class-room, i.e. easy access and movement of the students in the class-room. This property of the classroom should also be embedded in each unit of the room. Therefore, a wheel should be designed in such a way that the students can get on or off it easily. Not only this, the wheels and other furniture and equipment in the classroom should be arranged with this point in view. This consequently leads to the necessity for group planning, provision for individual student's requirements and group requirements - that is something that will be used by all the students at different times. Space could be gained from orderly arrangements

of individual units, if for example arranged parallel to the walls.

Desire for economy is another important human propensity: economy of space, economy of materials, economy of money etc. etc. In buying or constructing a wheel this has to be considered, but

> because of their somewhat limited production, good potter's wheels are rather expensive.[6]

On the other hand,

> it is clear that Nigeria has almost unlimited reserves of all the major raw materials necessary for ceramics and some of these are of excellent quality....[7]

To satisfy this desire for economy therefore, the readily available materials should be used in constructing our kickwheels. While designing for construction -

> the machine must be considered not as a vehicle of production, but as a means of mass creative production... making the user the master of machine, not its slave.[8]

The last of the human desires to be considered is the natural attitude and human desire of the designer. This is best explained by the assertion of William H. Vernum when he says:

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6. G. Nelson, "Ceramics a potter's hand book", p.293.
7. M. Cardew, "Pioneer Pottery at Abuja" Nigeria Magazine p.49, No. 52. 1956.
8. Vernum. op.cit., p.80.

> for the craftsman, there is a very real pleasure in selecting wood or other materials and, with the tools of his crafts, creating original designs in responsive and attractive materials. This process of constructive creation brings its own sense of completeness, of competence, of satisfaction almost unrivalled in its emotional result.[9]

Pre-construction and preservative measures:

Since the major part of this kickwheel is going to be in wood, and planks are easier treated while still in bits than after construction, it is advisable therefore, to touch briefly on preservation of wood.

> Wood may be attacked by any of these destroying pests ... decaying fungi, termites (white ants) and boring bettles.[10]

But adequate and appropriate treatment renders these perishable woods resistant, safe, and economic for use, thus increasing their service life.

> Decay fungi decompose the wood tissues, thereby destroying the strength of the wood and finally reducing it to crumbling mass.[11]

For this fungi attach to occur, it requires certain favourable conditions -

> moisture, air, suitable temperature and adequate food.[12]

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9. Ibid. pp. 15 - 16
10. Lawrence Okigbo, "A guide to building timbers in Nigeria". p.9.
11. Ibid., p. 9.
12. Ibid. p.9.

Possible Preservatives:

1. By seasoning - this could be by artificial seasoning or air-seasoning.

> Seasoning is a partial drying of wood aimed at reducing water content to a level at which it is at balance with the surrounding atmosphere.[13]

Dry wood it is claimed

> shrinks less, warps less, deflects less and it's less susceptible to decay and stain.[14]

2. By application of fungicide and insecticide chemicals:

These chemicals are -

i. Tar oils: The most commonly used and most well-known type is creosote. It is highly poisonous to fungi and insects and easy to apply.

ii. Chemical soluble in water:
These are salts of zinc, copper, arsenic, boron, mercury and sodium which are dissolved in water to give toxic solution.

Because of its solubility, it can be easily washed away, so, it is better if painted upon when dried.

> Available on the market are - Mixol 20, Santobrite, Dowicide, Grammexane, Tanalith, Celcure, Atlas A, and Wolmanit.

iii. Chemical soluble in organic solvent:
These category contain chlorophenol or chlorinated naphthalenes, dissolved in suitable solvent usually volatile.[15]

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13. Ibid., p. 15
14. Ibid., p. 11
15. Ibid., p. 15.

These groups combine the advantages of the first two and in addition penetrate deepper into the wood.

Simple Methods of Treatment:

Brushing: This simply means painting the wood to be used for the construction with brush and chemical. This is the easiest of all, as an unprofessional or small-scale treatment.

Spraying: Insecticide spraying-guns could be bought cheaply in the market, ranging from the house-hold spraying gun to the more expensive ones used by the farmers in spraying their trees.

Dipping: The cut woods are immersed into a bath, trough, or container of chemical. The longer the wood is kept in the chemical, the better the penetration into its core; it is a more complete method than the first two.

Hot and Cold tank Process:

This method consists of submergingthe wood in a bath of hot preservative chemical and allowing it to cool inside it.

> While the preservative is hot, moisture and air are driven out of the wood, and as it cools, the preservative is drawn into the wood.[16]

The boiling could be done for 4 - 6 hours and the cooling for 16 - 18 hours about 24 hours in all, as asserted by Okigbo in his brochure "A Guide to Building Timbers in Nigeria".

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16. Ibid., p. 16.

A recut or redressed surface after treatment must be treated again to avoid attack through the freshly exposed surface.

Maintenance:

Apart from the pre-construction treatment of the woods to be used, the only area that is usually exposed and affected by the constant use of hard-tools on the kickwheel is the wheel-head. This usually wears out near the centre. This should be changed as soon as that occurs.

Occasional oiling of the bearings will aid the smooth running of the fly-wheel and the wheel-head, thus giving easier and more rotations per kick.

Where bolts and screws are used, occasional checking and re-tightening would do a lot of good to retain the stability of the wheel.

CHAPTER III

FIRST WHEEL CONSTRUCTION FROM DISCARDED MACHINE JUNKS

Materials used

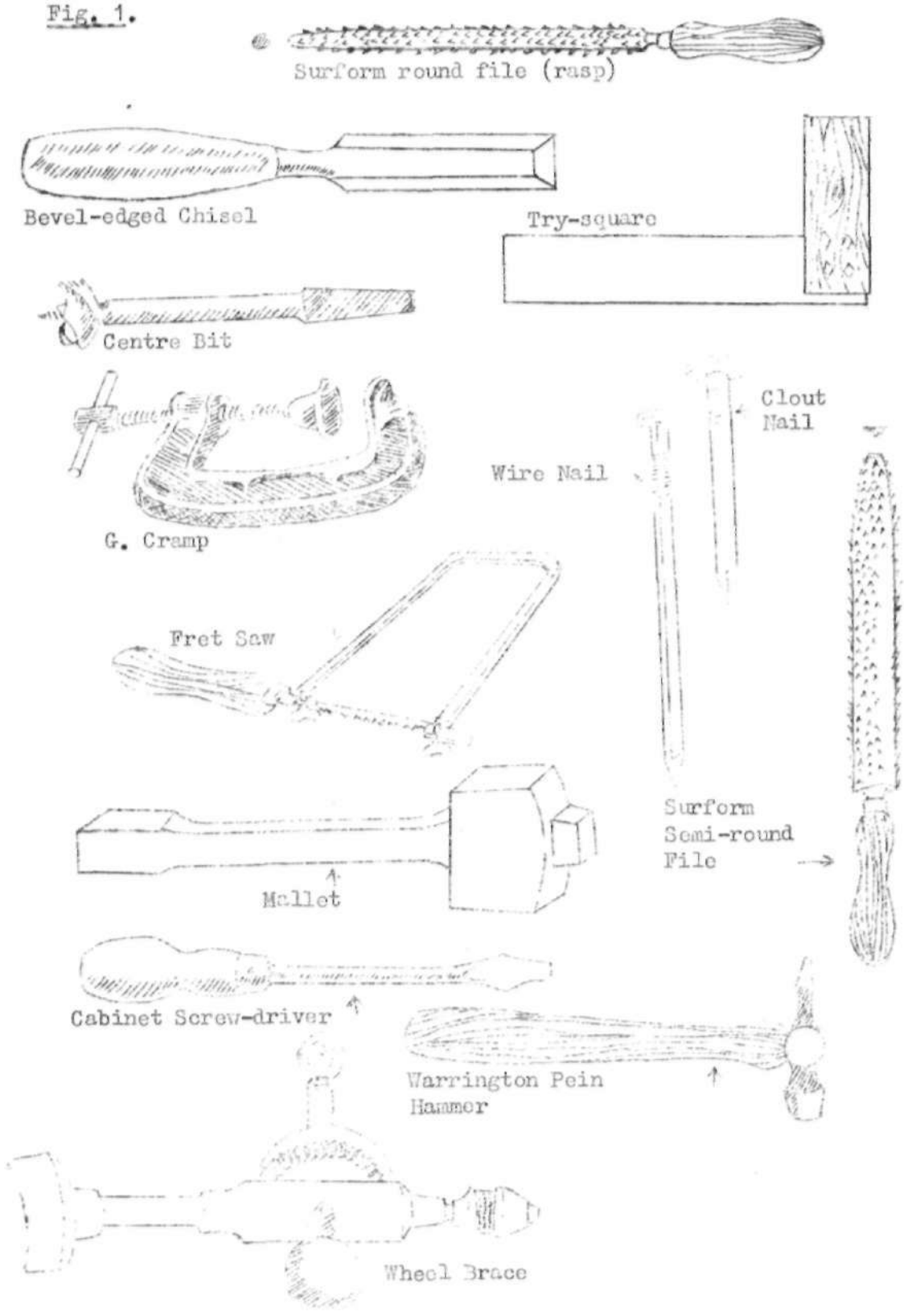
Materials used in the first construction included four 5 x 11 x [illegible] cm. planks for the frame; three 2.5 x 24 cm. diameter plywood sheets for the wheel-head; plywood for fly-wheel base and work-table; a 82 cm. x 2.5 cm. diameter rod for the shaft; some cement, gravels, sand and 1.25 cm. diameter M/S rods, two bearings (bigger one with 2.5 cm. hole, and smaller one with 1.6 cm. hole); screws - countersunk head screws, 2.5 cm. posidrive screws, slim bolt and nuts, 5 cm. and 7.5 cm. round-wire nails, clout nails; cardboard, string and Premier-Grip drawing pins.

Tools used

Tools used in construction included Wheel-Brace drill and Centre-Bit; cabinet screwdriver; Warrington Pein hammer; two G-Cramps; Mallet; Fret-saw; Surform round file and surform semi-round file (Rasps); Bevel-Edged chisels, a panel saw; and Try-square.

TOOLS

Fig. 1.


Surform round file (rasp)
Bevel-edged Chisel
Try-square
Centre Bit
Clout Nail
Wire Nail
G. Cramp
Fret Saw
Surform Semi-round File
Mallet
Cabinet Screw-driver
Warrington Pein Hammer
Wheel Brace

1. Planks for the construction were recovered from a roughly built frame for another type of kickwheel. Four pieces of 5 x 11 x 44 cm., 5 x 11 x 70 cm., 5 x 11 x 72 cm., and 5 x 11 x 100 cm. were cut out of the previous pieces. They were unplaned, unseasoned, and have been attacked by termites in some places; they have also warped a bit. A frame for an old display shelves was collected at the sculpture junks. These planks have to be used because of shortage of planks at that particular time.

2. Bearings - Going through the junks by the sculpture studio, a discarded machine was inspected and found to contain six bearings. Three of the bearings were extracted easily after breaking the cast-iron case of the machine. Bearings of this type "SKEFKO 5 SFB" or machine could be bought cheaply and easily from machine or motor spare-parts dealers.

3. Shaft - A straight rod was again recovered from the junks. It has about 2.5 cm. diameter and 82 cm. long. At one end is a small turned-tip of about 1.6 cm. diameter. This small tip fits perfectly into the smaller bearing, while the other end fits well into the bigger bearing. Any straight water pipe or 2.5 cm. M/S rod from Hardware or Building materials store will serve the same purpose.

4. Fly-Wheel - For the fly-wheel, three materials were to be used; a 70 cm. diameter plywood, reduced from a previously prepared 76.5 dia. (30" dia) fly-wheel. Cement was collected from ceramic's store and 1.25 cm. M/S iron rods from sculpture junks; string, drawing pins and cardboard from the Department Store.

5. Wheel-Head - The Wheel-Head was made out of the 30.5 cm. diameter plywood, , each 2 cm. thick, already cut to shape. A cerated unit of the dismantled machine was also used for the wheel-head-cup.

ii. Construction Processes

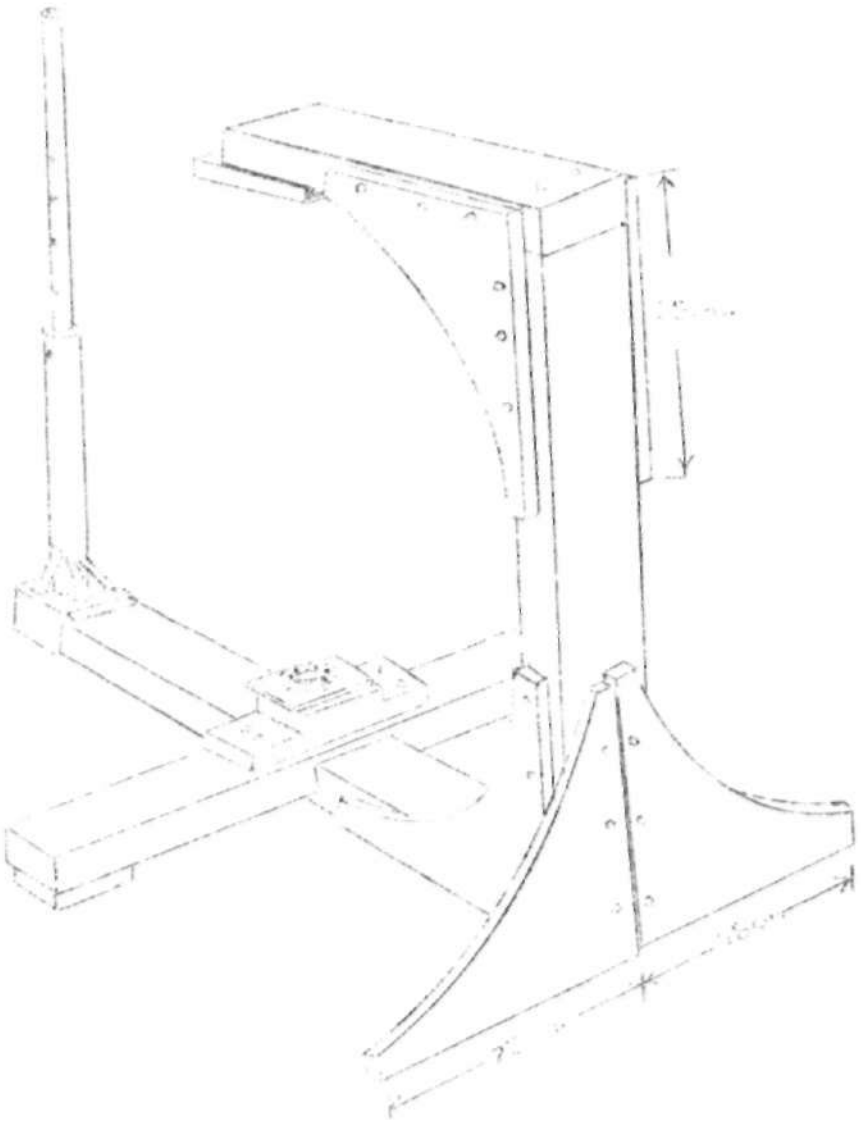
The frame was put together as in Figure 2 The main frame was triangulated at the joints with off-cut ply-wood. For the joints, they were drilled in some places, screwed or nailed together.

The Fly-Wheel was constructed as follows: A 70 cm. diameter plywood was used as a base for concrete top. On the plywood were 5 and 7.5cm nails tacked in places as in Figure 3. These nails are meant to hold down the cement concrete on top and to raise from the top of the plywood, the iron-rod reinforcement. At the centre of the ply-wood is a 7.5 cm. nail. On this nail was fixed a slightly truncated pyramid clay shape, turned up-side down as in Fig. 3b It measures 6 cm. high, the height of the concrete part of the fly-wheel. Card-boards were cut into "a" 6 x 220 cm. and "b" 9 x 221 cm. pieces. Cardboard "b" is for the external circumfrence of the circular plywood while cardboard,"a" is for the internal circumfrence of cardboard "b". These were used in casting the concrete top of the fly-wheel and the 6 cm. height of the internal cardboard is the height of the concrete. Drawing pins were used in tacking the board to the plywood and strings used in tying it at the rim and base to reinforce it when wet.

1.25 M/S Iron-Rods were used for reinforcement. Four straight ones of 60 cm. long, two circular ones of 30 cm. and 50 cm. diameter each

Fig.2.

THE FRAME OF THE KICKWHEEL



respectively were prepared. Two straight rods out of the four were laid on a table 14 cm. apart. The two circular ones were placed on them, the smaller one inside the bigger one. The remaining two straight rods were placed on the circular ones, this time, at right angle to those straight ones below. They were carefully tied at the junctions with iron-wire (Fig. 3^{a}). The base of the iron-rod - reinforcement was placed, raised on some nails, so that the top of the last two rods was about 5 cm. off the top of the plywood base. The 1 cm. allowance at the top is for cement, so that the iron rods are properly concealed for safety.

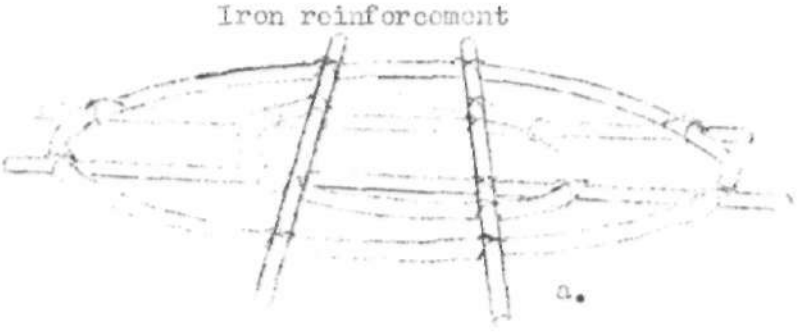
Concrete Mixture-

The first casting was not successful for the following reasons -

1. The cement was already weak; it had set before use. The lumps in it were broken and ground into powder before use.
2. There was no gravel added to the mixture and
3. There was no reinforcement.

The second mixture which was successful was made up of one part cement to two parts gravels to three parts sand (all by volume). This composition was mixed with water, poured into the cardboard frame and plywood base. It was left to set for two days. Water was occasionally poured on it to keep it wet. After the second day, it was plastered with a mixture of fine sand and cement. After plastering, it was left to set after which it was kept wet by being sprinkled with water as many times as possible. The clay pyramid was removed, so also was

Figure 3. THE FLYWHEEL





b. Clay for centre.



Circular plywood base with nails tacked on it.



the nail at the centre. The point left by the nail was used as a centre for a circle of 2.5 cm. in diameter; this fits exactly on to the shaft - resting on the fly-wheel support.

The Wheel-Head - was constructed from three plywood discs 25 cm. diameter, each 2 cm. thick (Fig. 5). Disc "a" was marked at the centre. Disc "b" was marked at the centre, and a circle, the circumference of the cerated-edge unit, marked on it. The marking was carved half-way to fit the top of "d". This was fairly easy because it is a plywood and in sheets. Disc "c" was marked at the centre, drilled and rasped to fit two sections of unit "d" i.e. the lower half of the cerated - edges and the circular part of base "x".

The three discs were glued and screwed together; first, "a" and "b" screwed from "b" side. Short screws were used and fairly near the edges. Then "c" was glued and screwed to the first two, with the top part of "d" embedded in the carved space between "b" and "c" Fig. e. On the neck of "d" is an alen's screw. This is used in tightening the wheel-head to the shaft.

In place of unit "d", a pipe accurately cut and welded to an iron-sheet could serve the same purpose as in Figure 4.

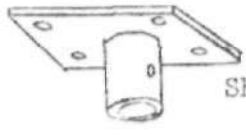


Figure 4. SHAFT-CUP

PARTS OF THE WHEEL HEAD

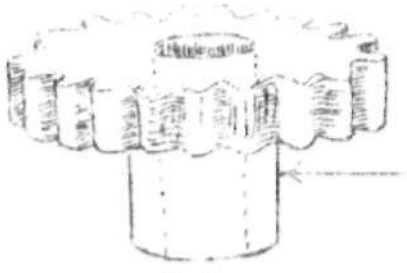
a. 

b. 

c. 

Cross-Section View

d. Cerated-Edge Unit



2.5 cm.



e. The assembled wheelhead.

The Bearings were slipped onto the shaft, the bigger one with about 2.5 cm. hole, from the top and the smaller one with about 1.6 cm. hole, at the lower tip of the shaft. A ring with screw was also used to support the fly-wheel.

Special but simple casings were constructed for the bearings. For the top one, a metal sheet was cut, drilled and folded as in **Figures** 6 and 8 ; and a plywood sheet - 2 x 11 x 18 cm. was cut and screwed to the main frame as in **Figures** 6, 7 and 8.

The Seat was made out of a plywood sheet 2 x 26 x 31.5 cm., it has the the shape of a truncated - isosceles triangle with 14 cm. in front, 26 cm. at the back and 31.5 cm. side measurement; a bent metal sheet, two iron pipes, one slipped into the other. The outer pipe was welded onto a bent and drilled metal sheet, supported with four small iron rods. The seat is made adjustable by drilling holes through the two pipes. So it could be moved up or down to suit the user.

Assembling

The 2.5 cm. hole at the plywood base of the flywheel was given a slight cut, so that the screw on the wheel-support-ring can fit into it. This keeps the wheel-head and shaft rotating as the fly-wheel rotates. The space left by the clay pyramid was filled with cement, making sure that the shaft is at right angle to the top plane of the fly-wheel. Try-square was used to check it at all sides. Except for the flywheel that has been described above, see Figure 8 for other parts.

Figure 6.

SOME PARTS OF THE KICK WHEEL

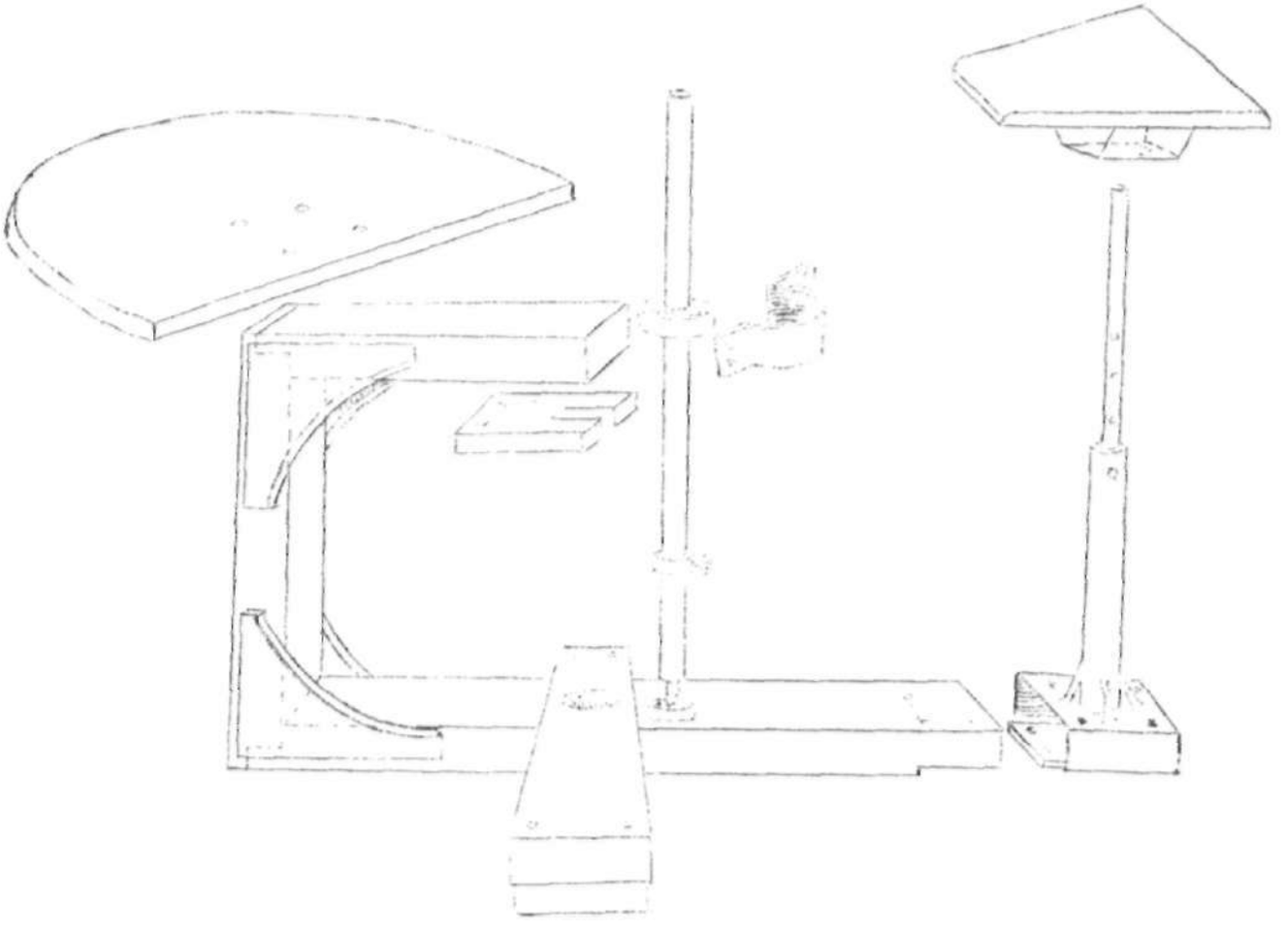
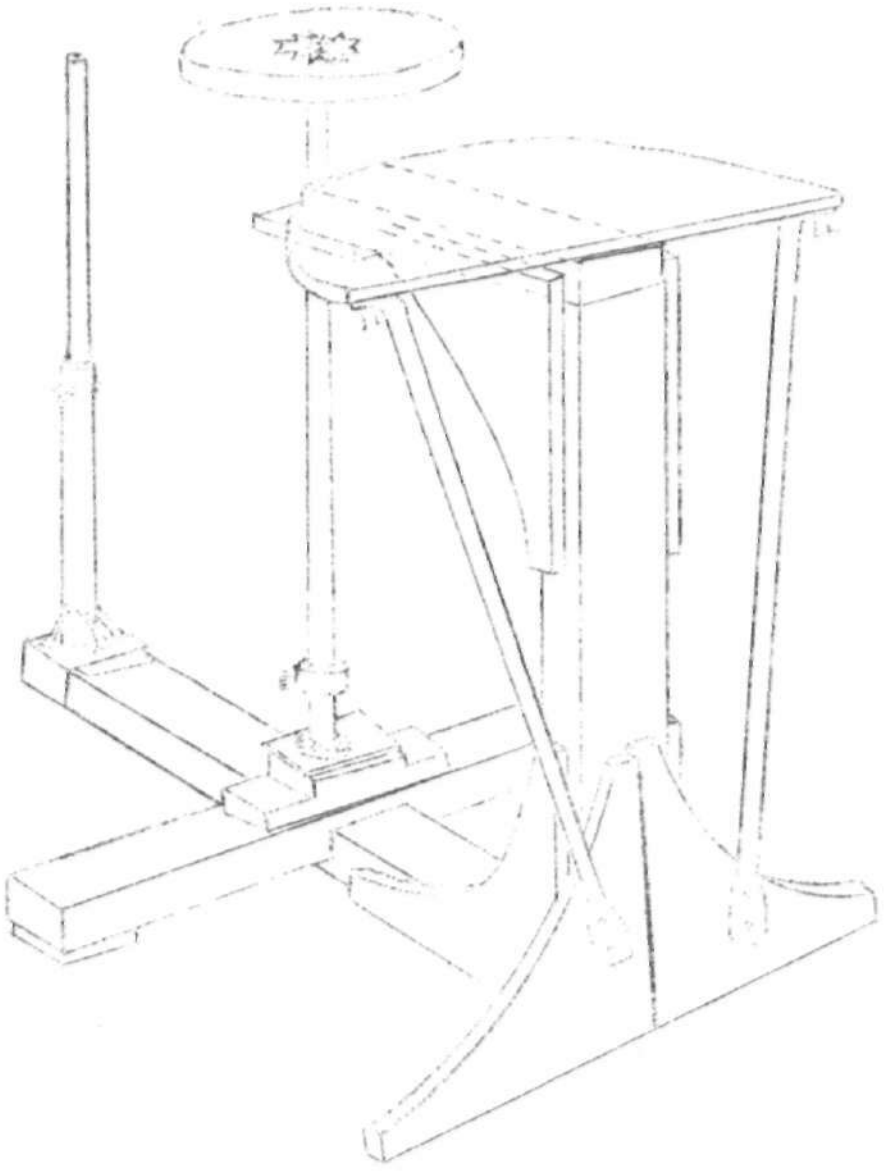


Figure 7.

ASSEMBLED PARTS OF THE KICKWHEEL WITH THE AMENDMENTS



iii - Problem with the Wheel

Because of the inadequate supply of the necessary materials at the time of construction, the following difficulties were encountered leading to problems with the wheel -

1. The wood used for the basic structure of the frame was unseasoned, rough and had warped.

2. There was neither cascamite nor evostik-glue to use for the joints of the frame.

3. There was not enough triagulation and the floor on which the wheel was placed was uneven and unstable.

4. There was no proper foot-rest. Foot-rest was improvised from bricks stacked on one another.

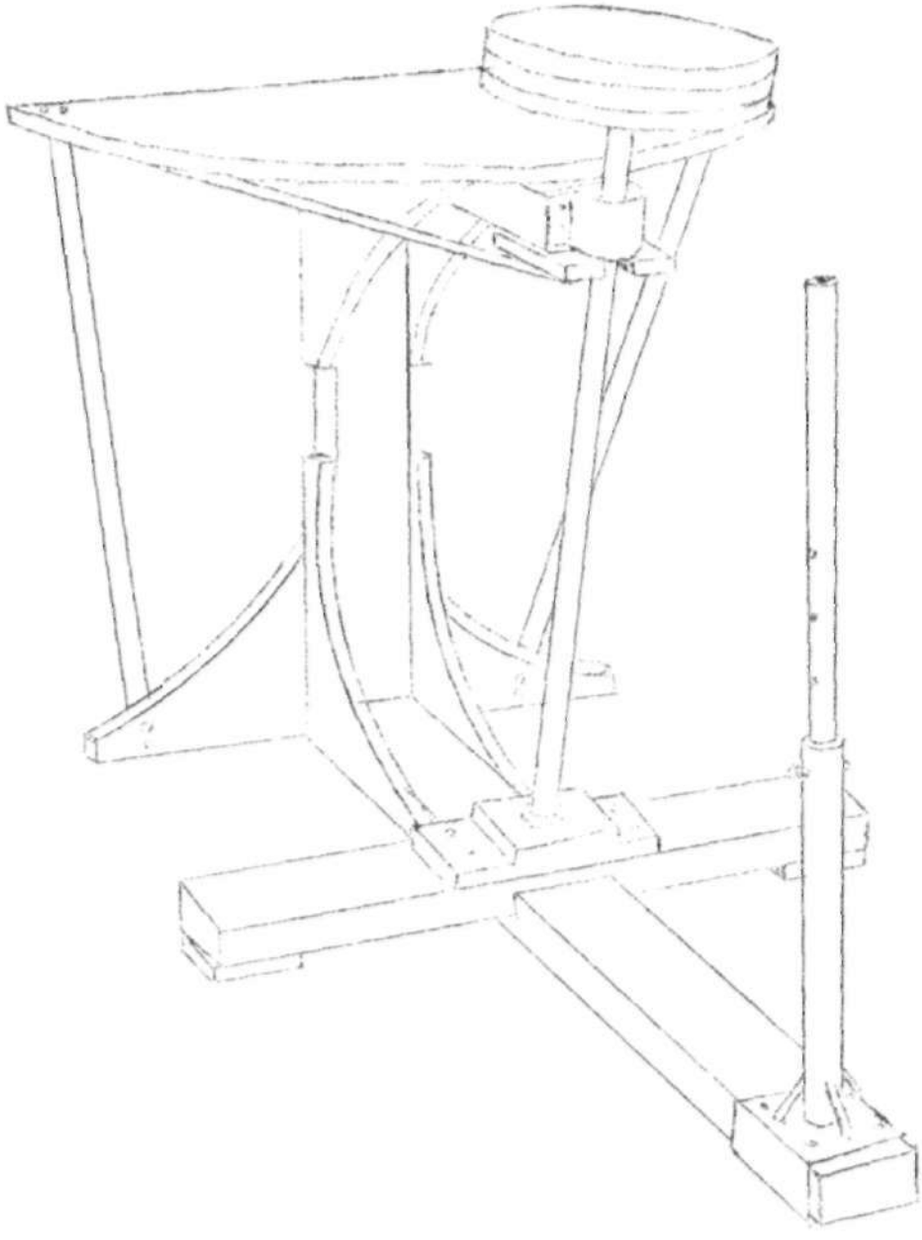
5. The seat was unstable because of the unstable structure of the whole frame caused by the afore-mentioned reasons.

iv. Amendment

The major fault with the kickwheel is in the superstructure which has affected other parts of it. To overcome this, it was occasionally wedged with stones or wood-blocks at the initial stage. Later two nails were tacked on to work-bench in front of the kickwheel. This is a much more stable structure. On the kickwheel itself, two iron pipes (78 cm.) long each were beaten flat at ends, and one end each bent to an obtuse-angle, drilled and screwed on to the work-table and the triangulation plywood at the front of the kickwheel see Fig.8. These two pipes were tied to the nails on the work-bench. It is not uncommon to screw a wheel to the wall or the ground to make it stable, "often wheels are

Figure 8.

THE KICK-WHEEL (WITHOUT THE SEAT AND THE FLY-WHEEL)



bolted to the floor or wall to prevent it from walking".[1] It was fairly stable after this amendment. Further, an m/s rod was beaten flat at ends and mid-point, drilled in six places - two holes each on the flat areas, and bent into a rough-V shape. The two ends were screwed to the work-table, while the mid-point was screwed to a point near the top bearing. This contributes further to its stability.

Further amendment could still be made by constructing a more permanent foot-rest out of bent iron-pipes, screwed to the main frame.

The seat could also be cushioned to make it more comfortable. Because of the size of the kickwheel, it may be too energy - sapping for the fairly young ones to operate. The advantage of the fairly heavy flywheel - which keeps the wheel-head rotating for many rounds per kick may be too much for a kid not physically capable to control. Solving this problem leads to construction of a wheel that could be used by the secondary school children.

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1. Reginald Marlow, "Pottery making and decorating" p. 85.

CHAPTER IV

SECOND CONSTRUCTION OF A KICK WHEEL FOR THE SECONDARY SCHOOLS

From the experience in the first construction, it is necessary to construct another one that could be used by the age-group of children in the Secondary Schools especially those in forms IV, V, and VI.

i. Materials used in construction

The super-structure of the wheel is constructed from an Iroko timber planks. For its characteristics see appendix B. The frame was built from planks cut into the following sizes. The full length of each plank is 5 x 15 x 366 cm.

Four (5 x 15 x 100) cm. for the legs

Four (5 x 15 x 26) cm.
Four (5 x 15 x 22) cm. } for the cross bars

Six (5 x 15 x 75) cm. for brazing or triangulation

Two (5 x 15 x 26) cm. for shaft and Flywheel support.

Flywheel

Two plywood sheets of 2 cm. thick and 62.5 cm. diameter are to be used for base and top of flywheel.

1 cm. m/s iron rods for reinforcement

One 154.5 cm. long rod, bent into a circle of 51.5 cm. diameter and a 96.5 cm. long rod, bent into a circle of 30.5 cm. diameter. Four straight ones of 43 cm. each, bent into a wide -U- shape. The two ends measure about 25.5 cm. apart. The rods were assembled as in Figure 11 and welded at joints - sixteen joints in all.

Cement, sand and gravels are also needed for middle part of the flywheel.

Bearings

Two bearings were supplied by the ceramic store. One for the base of shaft and the other for the top part support of the shaft. The bearings are Kinglube SKF ball-bearings, type FY 100 L interchangeable with SLF 1, and they are self aligning.

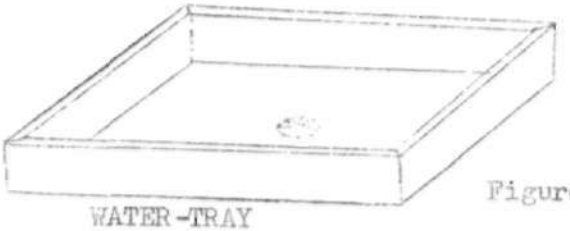
The shaft is cut out of a 2.5 cm. (1 inch) water pipe. About 85 cm. long will be used.

The Wheel-Head

This is constructed from three sheets of 2 cm. x 20 cm diameter plywood discs. They were glued and screwed together. Rasped to smoothen and square up the side rim, and the top edge rounded off a bit. A constructed shaft - cup (Figure 4) will be screwed to the centre of the wheelhead. A crowsfoot as in Figure 9 could also be used but shaft end must be threaded by a plumber.



Figure 9.
A CROWSFOOT

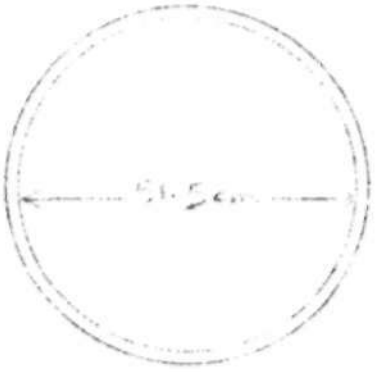


WATER-TRAY

Figure 10.

Figure 11.

IRON ROD REINFORCEMENT

a.  bigger iron circle

b.  smaller iron circle

c.  Four straight rods

d.  Bent U - Shape rod

e.  Assembled and welded.

Water-Tray

This is built of plywood 66 x 66 x 10 cm. The base was drilled at a point to allow the shaft through - Figure 10

ii. Construction Procedure

The Frame was built by the Department's carpenter. The planks were drilled and bolted firmly together using glue on the contact surfaces before bolting them together. Two bolts were used at each of the joints.

The Flywheel is to have a top and base of plywood. Nails were tacked on the plywood base. The top plywood also have nails tacked on it at specific and measured points from the centre. Cardboard strips were cut to 3 cm. wide and 183 cm. long, and 5 cm. by 184 cm. long for outside circumfrence of the base plywood. The plywood base was drilled at the centre to a circle of 2.5 cm diameter.

For the concrete part of it, one measure of cement to two measures of gravels to three measures of sand were mixed together dry. This mixture was weighed to be able to calculate the overall weight of the flywheel. The two plywood and the iron-rod reinforcement were also weighed. Plywood is 3 kilograms 290 grams each and Iron rod reinforcement weights 2 kilograms 70 grams. Water was then poured into the cement mixture, shoveled together and poured into the plywood base and cadboard side treated like in chapter II. At corresponding points to the nails on the top plywood, clay shapes

were stuck into the cement concrete. When the concrete had set, the clay bits were removed, filled with cement and the plywood placed on it; the nails going into the fresh cement mixture. When set, these will hold the top plywood into its place.

The Shaft

Before the top plywood was put on top of the concrete, the shaft was first placed in its position from the top, with the iron rods welded to it resting inside the cement concrete, and filled with fresh cement. While still wet, the shaft was checked to be perpendicular to the top plane of the plywood.

Bearings

The lower (base) bearing was screwed to a cross-bar inside the frame. The top one (bearing) was also screwed onto the cross-bar on top after the flywheel-shaft unit has been put inside the frame, the lower end of the shaft resting inside the bearing below.

The Water-Tray was then placed on top of the frame, screwed on it. The Wheel-head was then fixed on the shaft.

Seat - A firm stool is to be used along with this wheel for the following reasons:

1. This will make the wheels if they are many to occupy less space.

2. These stools could also be used at other art classes - for drawing etc.

3. It will make the production cost of the wheel less.

4. The strain and stress usually caused by seating on the wheel and kicking will also be less, therefore prolonging the life span of the wheel.

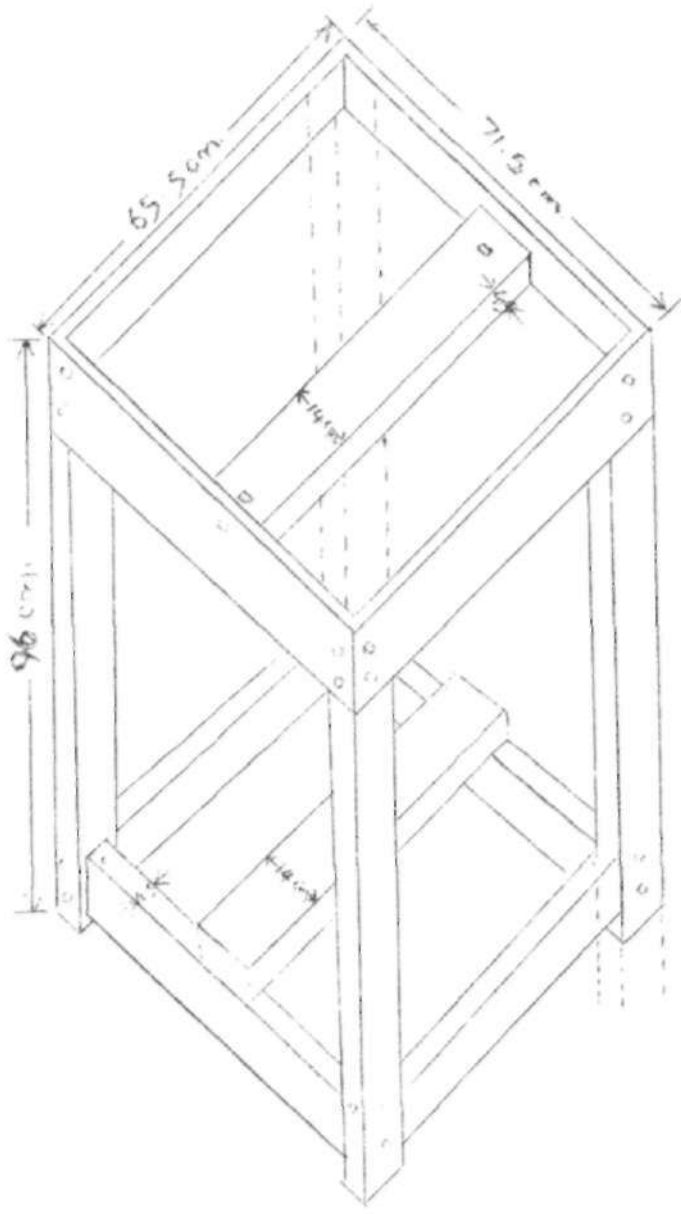
iii. Maintenance of the Kickwheel

After construction the wheel is to be painted with undercoat and later with enamel paint. This will make the wooden part of it well protected.

Occasional oiling or greasing of the bearings is necessary. So also is the occasional cracking of the bolts necessary. If the top of the wheelhead is chopped, change it.

Figure 12.

THE FRAME OF THE SECOND KICKWHEEL



PHOTOGRAPHS OF THE COMPLETED WHEELS

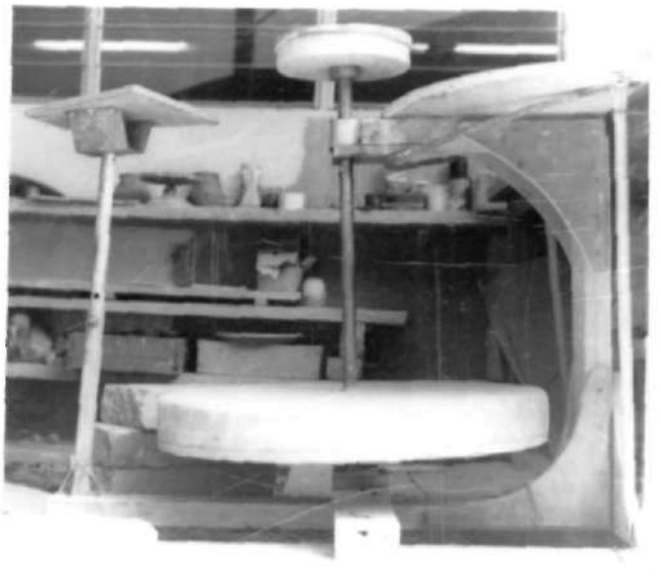


PLATE 1
THE FIRST KICKWHEEL

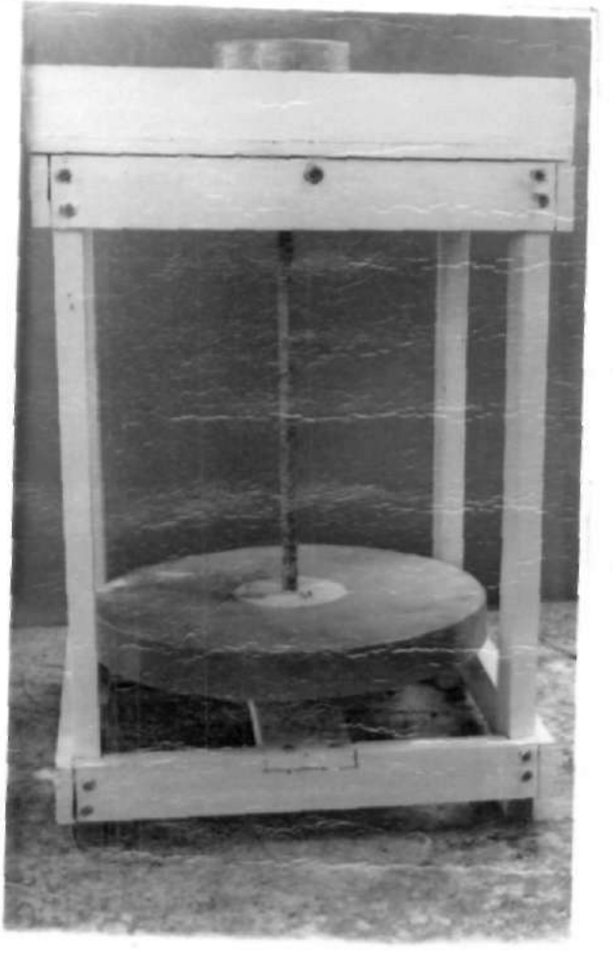


PLATE 2
THE SECOND KICKWHEEL

CONCLUSION AND RECOMMENDATIONS:

Since it is difficult to divorce the past from the present, adaptation of the traditional Nigerian pottery, which could be synthesized to meet the modern and technological era is imminent. Nigeria is planning to establish iron and steel industries, ceramists are no doubt needed to man some aspects of these industries; Nigeria cannot continue to depend solely on foreign expertise. The realization of this objective is leading to some extent, to the Nigerianization policy and fulfilment of certain social order.

In the past, talents have been completely wasted by being diverted to ill-suited fields of discipline simply because what their aptitudes were best suited for were entirely absent or wrongly presented to them by unqualified counsellors. With the application of the findings of this study in schools, talents could be discovered and utilized for the benefit of the individuals and the country at large.

It is hoped that the result of this study and recommendations put forward should facilitate the use of available local raw materials for locally constructed kickwheels in Nigerian Secondary Schools; and generate a reasonable degree of consciousness about the untapped resources in ceramics. These resources when tapped will lead to Nigeria's self-reliance in the use of the abundant ceramics raw materials. This should eventually lead to large scale experiment into the use of the materials.

Because of the difficulties usually encountered in ordering ceramics equipment for schools and the large amount of our currency that goes into the foreign exchange, it is recommended that these ceramics abundant raw materials should be experimented with and used.

Because of the inadequate number of qualified teachers to teach ceramics as a subject in Nigerian schools, local potters of quality should be employed to complement the work of the art teachers in schools. This will provide opportunities for the students to experience an important aspect of our cultural heritage and draw inspiration from it to build for the future.

Finally, it is recommended that instead of depending on expensive imported kickwheels (See pages 2, 16, and Appendix A for some of these kickwheels) locally constructed ones, as suggested in this study, could be used and Nigerian Government should encourage our engineers to carry out experiments on building kickwheels. This could be done in collaboration with ceramists.

APPENDIX A.

Figure 1.

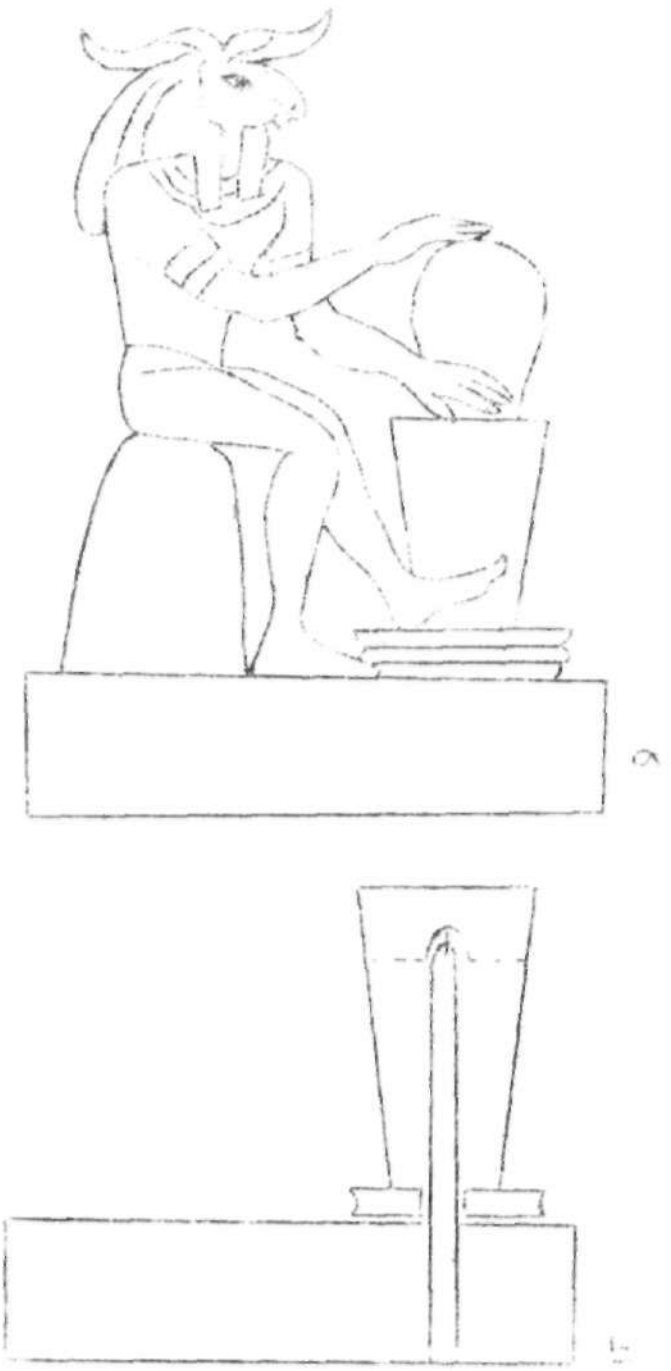


FROM " MANNERS AND CUSTOMS OF ANCIENT EGYPTIANS", WILKINSON

Etyptians making pottery on a wheel. From a tomb wall-painting at the Beni-Hassan. (1) The inside and lip of a cup are formed as it turns on the wheel. (2) Potter forms the outside of a cup, indenting it at the base with his hand preparatory to removing it (3) The cup is removed from the clay mound. (4) A fresh piece of clay is placed on the wheel. The small forms about the figures represent the pieces already made.[1]

(Lester; K.M. "Creative Ceramics" p. 137)

Figure 2.



a. "An Egyptian potter's wheel turned by foot: the god Khnum is working the wheel, at which he was supposed to have modelled the first human being from clay (from the west wall of the Osiris Temple at Philae);

b. A reconstruction of the wheel.

(Rada P., "Book of Ceramics" p. 82)

Figure 3.



A potter using hand-wheel.
(Rada P. "Book of Ceramics", p.83)



Chinese potter's wheel of clay "In the surbubs and villages around Peking, where Pottery is manufactured, two kinds of wheel are in use." Figure 4 is made of a hat-shaped mass of clay, which is hardened by the addition of pig's hair and straw. It is used for turning out circular vessels of small and medium sizes, and may be regarded as the common, typical wheel used throughout Northern China. It is claimed that a clay wheel lasts for five years and can be made in four days without cost to the potter. A wooden wheel lasts for about ten years being made by a local carpenter. For Rs. 1-8; a stone wheel will last lifetime, and is usually brought from Mirzapur or ludore at an average cost of Rs. 4.

(Laufer B., "The Begining of Porcelain in China" Plate xi)

Figure 5.



Chinese Potter's wheel of stone:

This is made up of a weighty stone disk made in the great industrial centre, the town Husai-In in Shan-si Province. It is used for making fairly heavy vessels of large dimensions. A round wooden board is placed on the stone disk as support or table on which the mass of clay is shaped Both Figures 4 & 5 are of identical mechanical construction. Both revolve on a wooden vertical axis, the lower extremity of which is fixed into a pit, so that the upper surface of the disk lies on the same level as the floor of the shed in which the potter works. The potter squats on the ground in front of the wheel, and sets it in motion by means of wooden stick which is inserted in a shallow cavity near the periphery of the stone disk.

(Laufer B., "The Begining of Porcelain in China" Plate xii.)

Figure 6



INDIAN POTTER'S IN THE SHAPE OF A CART-WHEEL (Sketch after Holder, Journal of Indian Art)

The wheel, a clumsily constructed and defective apparatus, is composed of several thin pliable pieces of wood or bamboo, bent and tied together in form of a wheel about three feet and a half in diameter. This is covered over thickly with goat's hair or any fibrous substance. The four spokes and the centre on which the vessel rests are wood. The pivot is of hard wood or steel. The support for the wheel consists of a rounded mass of clay and goat's hair in which is embedded a piece of hard wood or stone with one or two slight depressions for the axle or pivot to move in. The wheel is set into motion first by the aid of a long piece of bamboo, one end of which fits into a slight depression in the wheel. It keeps rotating for 5 - 7 mins. "b" is a corss-section of the wheel.

(Laufer B., "The Begining of Porcelain in China", p. 157)

Figure 7.



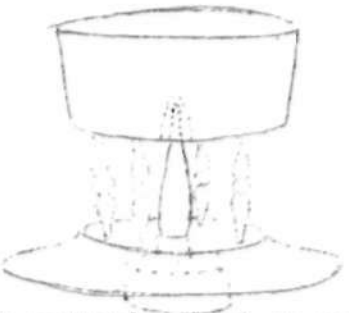
A potter's wheel from the first half of the 19th century. Its weight (40 - 50 kg.) gives a considerable increase of momentum.



A French hand-driven potter's wheel of 17th century



A Russian Hand-driven potter's wheel fixed to a portable bench.



A potter's wheel as used by Habans

(Rada P., "Book of Ceramics". P. 84)

Figure 8

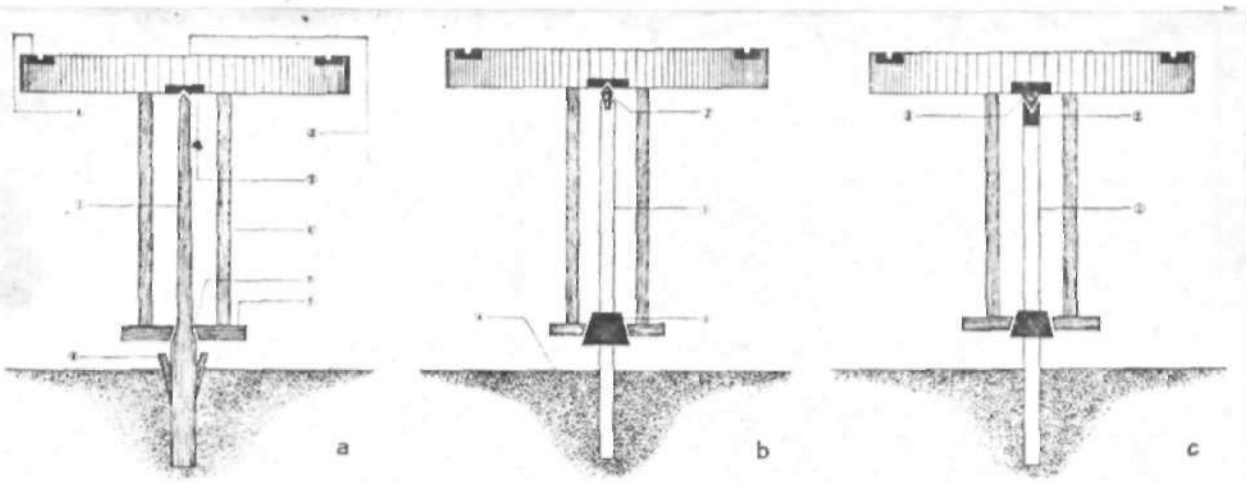


Fig. 9. (a) The early handwheel had a wooden shaft with a conical tip [1]. In the stage shown here, the conical hole in the underside of the wheel head [2] has been replaced by a porcelain bearing with a cone-shaped cup [3] into which the top of the shaft fits. The holes in the surface of the wheel head have been reinforced with porcelain cups [4] to prevent wear. The stabilizing block [5], connected to the wheel head by wooden slats [6], shows a close fit (*habaki*) [7]. The shaft, set in stone or concrete, is held solidly in position by wooden wedges [8].

(b) The wooden shaft is replaced by an iron pipe [1] with a wooden tip [2] set in the top, and the close fit of the stabilizing block around the shaft has been improved by a cylindrical porcelain bearing [3] set on the pipe. The pipe shaft, which is more durable than the old-style wooden shaft, is set in a cast-concrete base [4], thus eliminating the need for wooden wedges.

(c) A solid metal rod [1] with a conical cup [2] at the top has replaced the pipe shaft with a wooden tip. A cone-shaped cast-iron tip [3] has replaced the porcelain bearing on the underside of the wheel head.

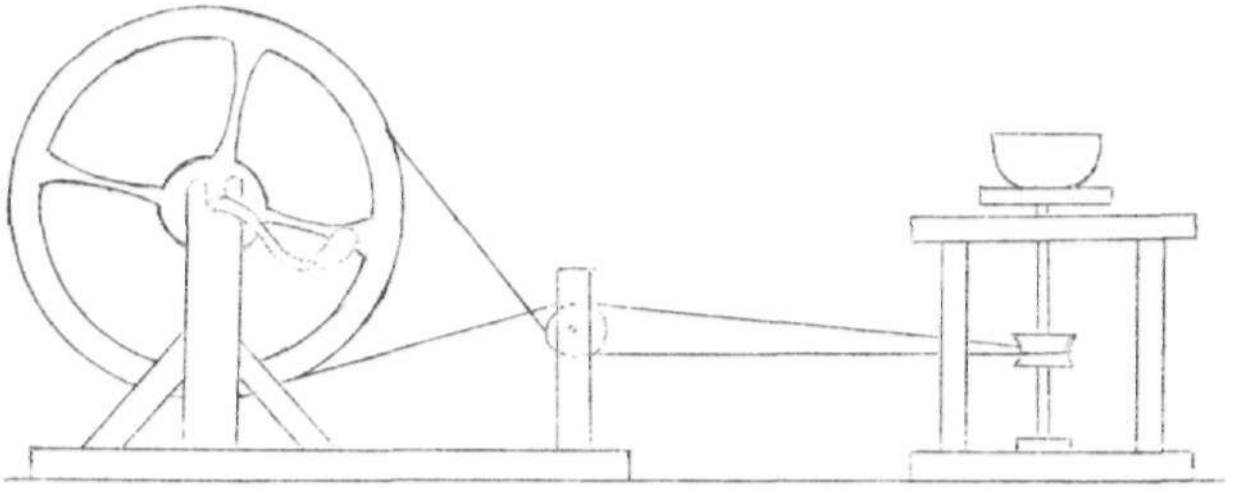


(d) Modern handwheel. Such wheels are still found throughout Japan, and some of the older potters take pride in the fact that they have never used an electric wheel.

(Sanders, H.H. "The World of Japanese Ceramics." p. 68)

Figure 9:

An 18th century English potter's wheel as used by Wedgewood.
The Large wheel is hand-turned by an assistant.



(Rada P., "Book of Ceramics" p.84.)

Figure 10

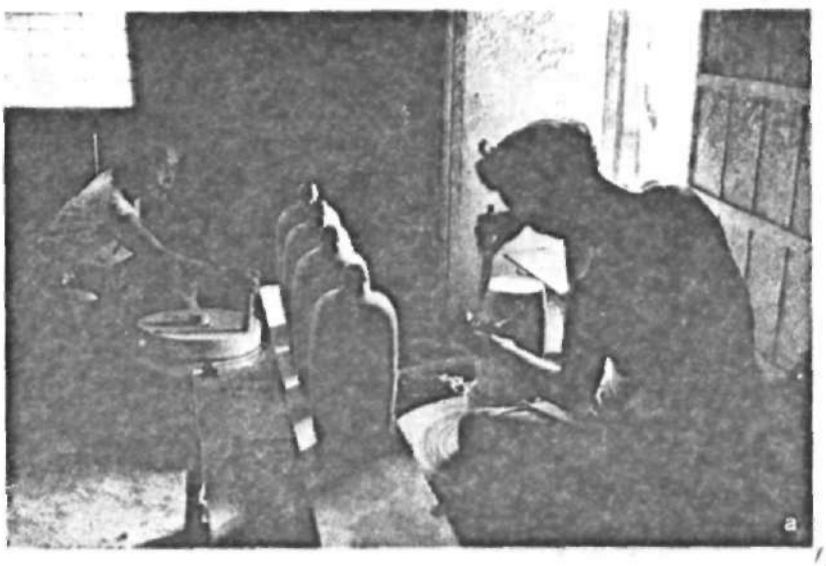




Fig. 11. Two-man wheels, first introduced in the Meiji period, still are used in a few places in Japan for the production of large pieces.

(a) At Takada (near Tajimi, Gifu Prefecture) the assistant turns a wheel patterned after a grain grinder, from which a belt passes to the potter's wheel for the production of large, approximately gallon-sized saké bottles.

(b) This two-man wheel used by Rakusai Takahashi of Shigaraki, Shiga Prefecture, is turned by a hand-held cord. This system, particularly, demands that the potter and his assistant turning the wheel work in complete harmony.

Is another example of rope wheel requiring an assistant. This is in Japan.

(Sanders H.H., The World of Japanese Ceramics p. 67)

Figure 11



Another Chinese wheel requiring an assistant. The illustration was reproduced by Julien after the first edition, it shows the potter squatting at the end of two low benches, stedying his feet on the latter; an assistant bends over a bench, and sets the wheel in motion with his left hand.

(Rada P., "Book of Ceramics", P. 83.)

Figure 12.



A Chinese wheel requiring an assistant and driven by foot.
"The wheel rests on the grounds and the potter squats beside the wheel. A helper stands near by, steadying himself with a rope that hangs down from the frame above or, the branch of a tree; holding on to this end resting on the foot, he kicks the wheel around with his unshod foot."

(Rada P., "Book of Ceramics". p. 83.)

Figure 13.

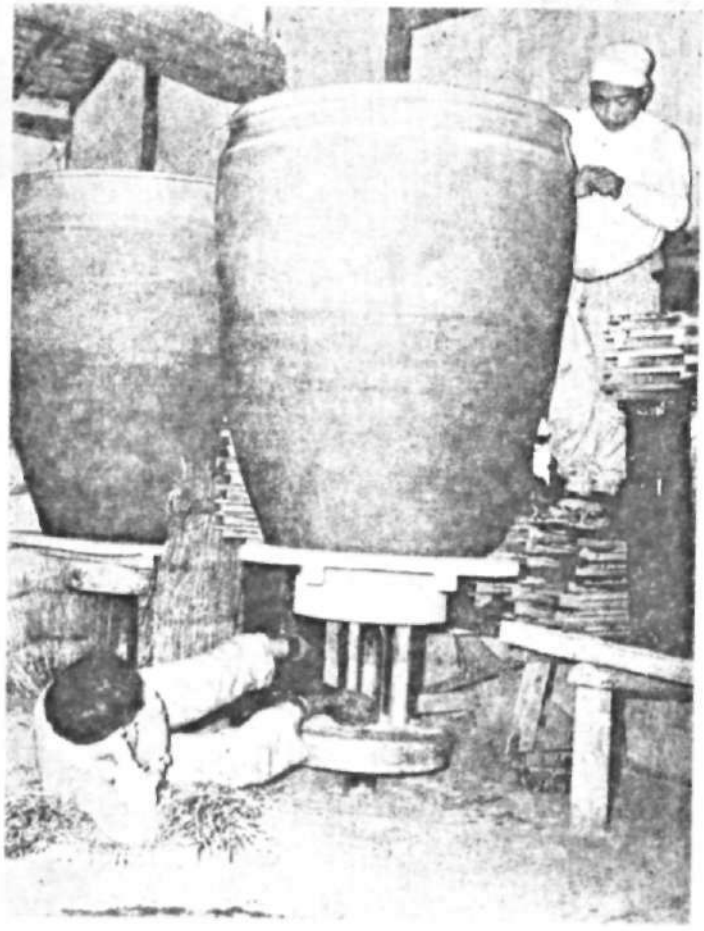


Fig. 12. Without mechanical power, the potter's wheel in Japan saw an interesting adaption to the production of huge pieces. This unique wheel is still in use on the island of Shikoku.

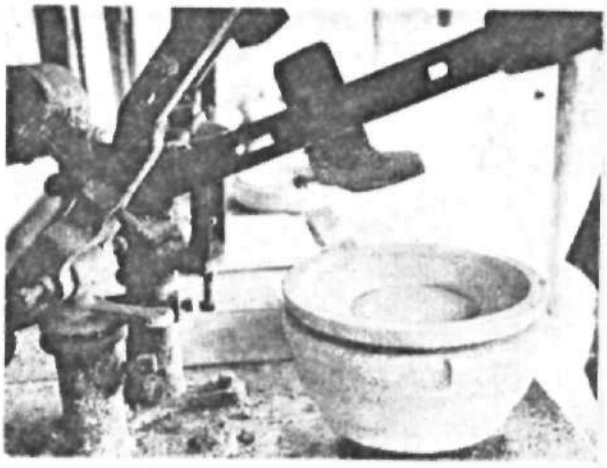
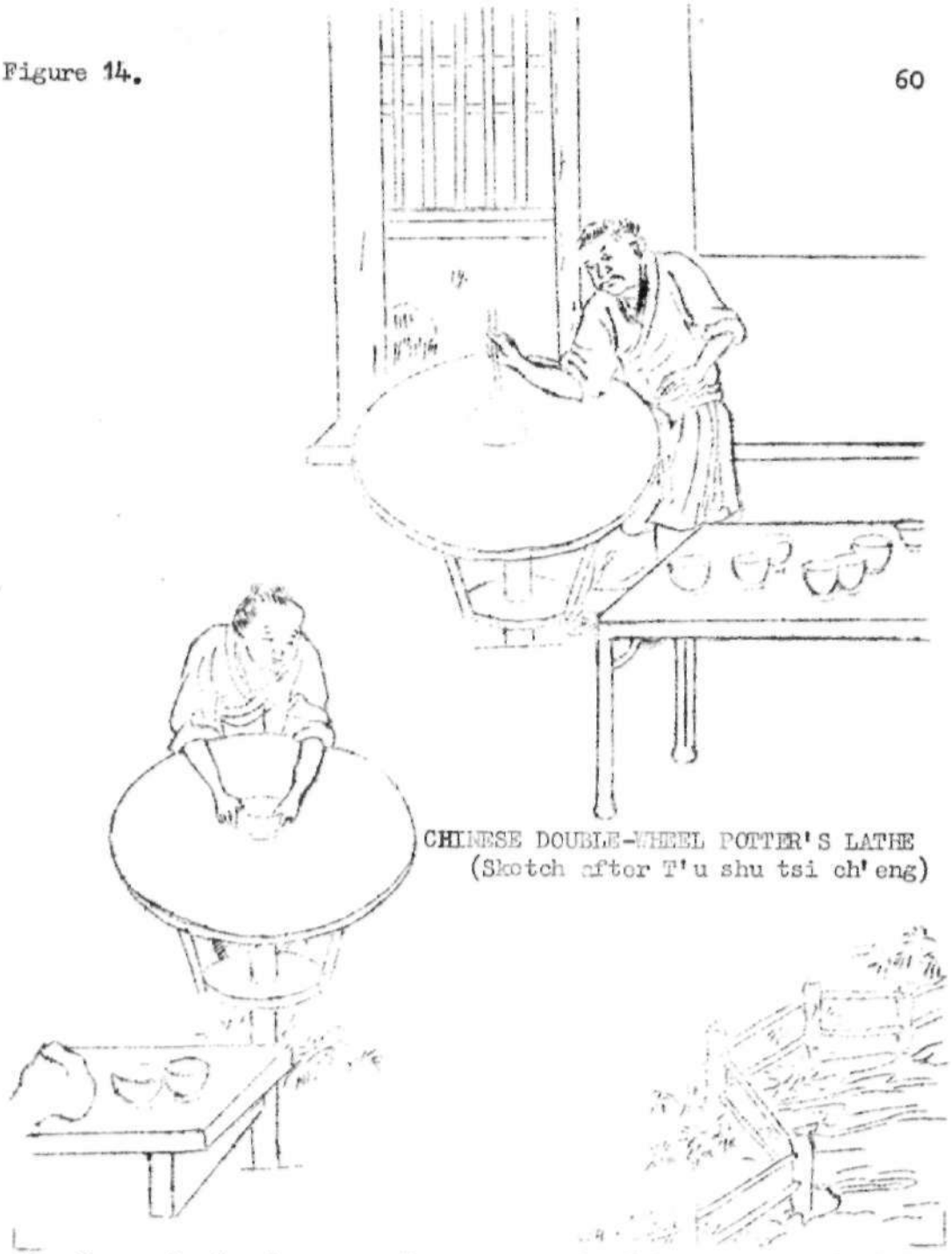


Fig. 13. The jigger wheel.

A Japanese potter using a help-mate to assist in kicking the wheel while he throws a giant pot. Note the help-mate lying on the floor to kick.

(Sanders, H.H., "The World of Japanese Ceramics." p. 68)

Figure 14.

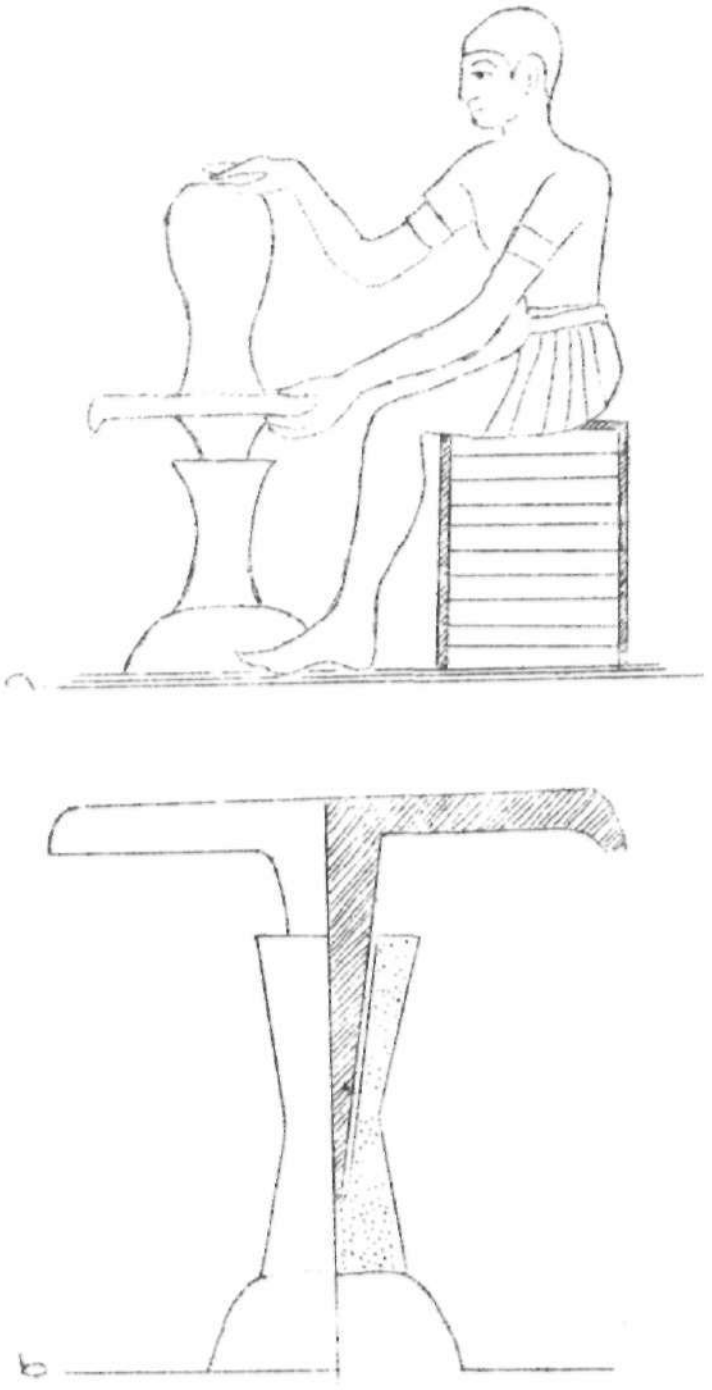


CHINESE DOUBLE-WHEEL POTTER'S LATHE
(Skotch after T'u shu tsi ch'eng)

Besides those wheels above, another one use in China is a wheel with double disks. There are two horizontal, parallel disks or wheels connected by a vertical spindle. The lower one, being of considerably smaller diameter, is operated by the feet of the workman, and accordingly turns the upper one which is reserved as potter's table.

(Laufer B., "The Begining of Porcelain in China," p. 167)

Figure 15



a. An Egyptian potter's wheel turned by hand (from the West of the Tehutihop grave at El Bersech - 12th dynasty);

b. A reconstruction of the wheel.

(Rada P. "Book of Ceramics". p. 82)

Figure 16.

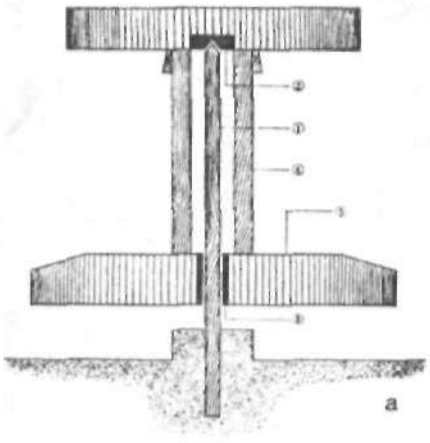


Fig. 10. (a) The *ke-rokuro* or "kick wheel" has retained either the orange-wood shaft or the pipe shaft [1] with a wooden tip, as well as the porcelain bearing [2] set in the underside of the wheel head. The kicking block may have either a ball bearing set in its underside or a porcelain sleeve-bearing [3] that is the full thickness of the block. The stabilizing slats of the handwheel have been replaced by an octagonal wooden housing [4] that attaches the kicking block [5] to the wheel head.

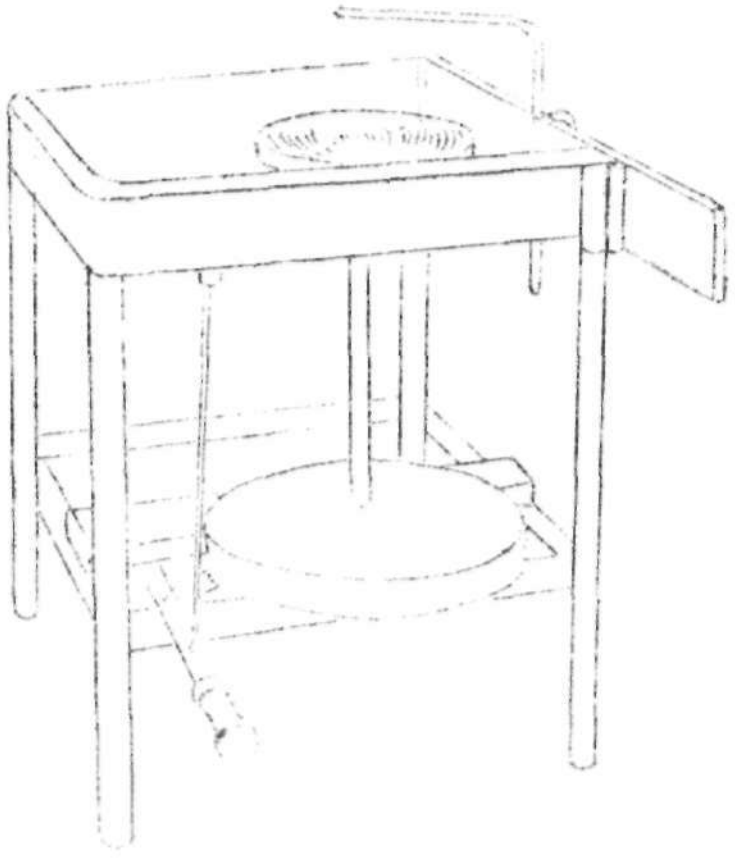
(b) The modern kick wheel.



A Japanese old and modern kick-wheels.

(Sanders H.H., The World of Japanese Ceramics. p. 66)

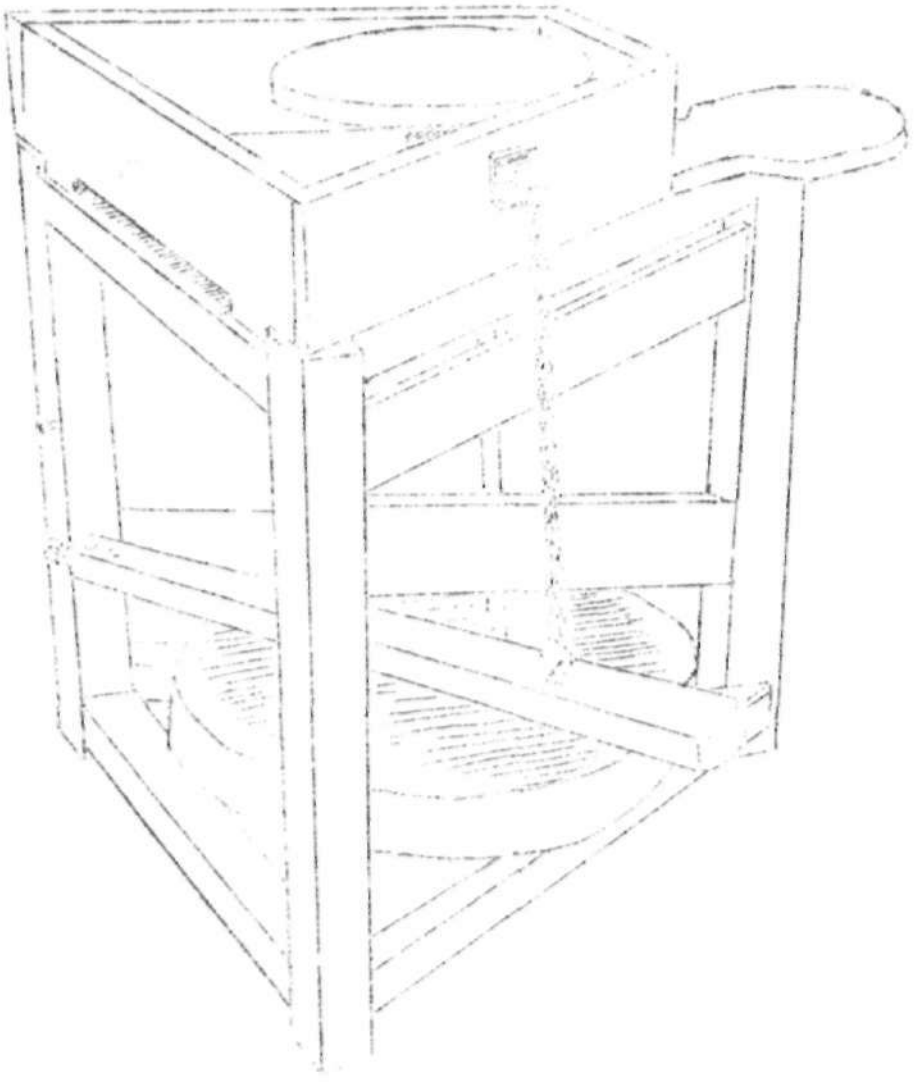
Figure 17.



An advertised H.3. Klopfenstein treadle wheel, about $230.00.
It has 30 x 3 x 36" cast iron Throwing head. 100 lb., 20" flywheel.
Constructed of $1\frac{1}{2}$ x $1\frac{1}{2}$ x $3/16$" angle iron. All seven points of action are precision ball bearing, Hip rest (non adjustable) Being a side treadle kick-wheel, the disadvantage here is that one has to keep on kicking all along and therefore one is unsteady standing on one leg, controlling the clay and kicking at the same time. This is not easy for a beginner.

("Ceramic Monthly" December 1955 edition p. 109)

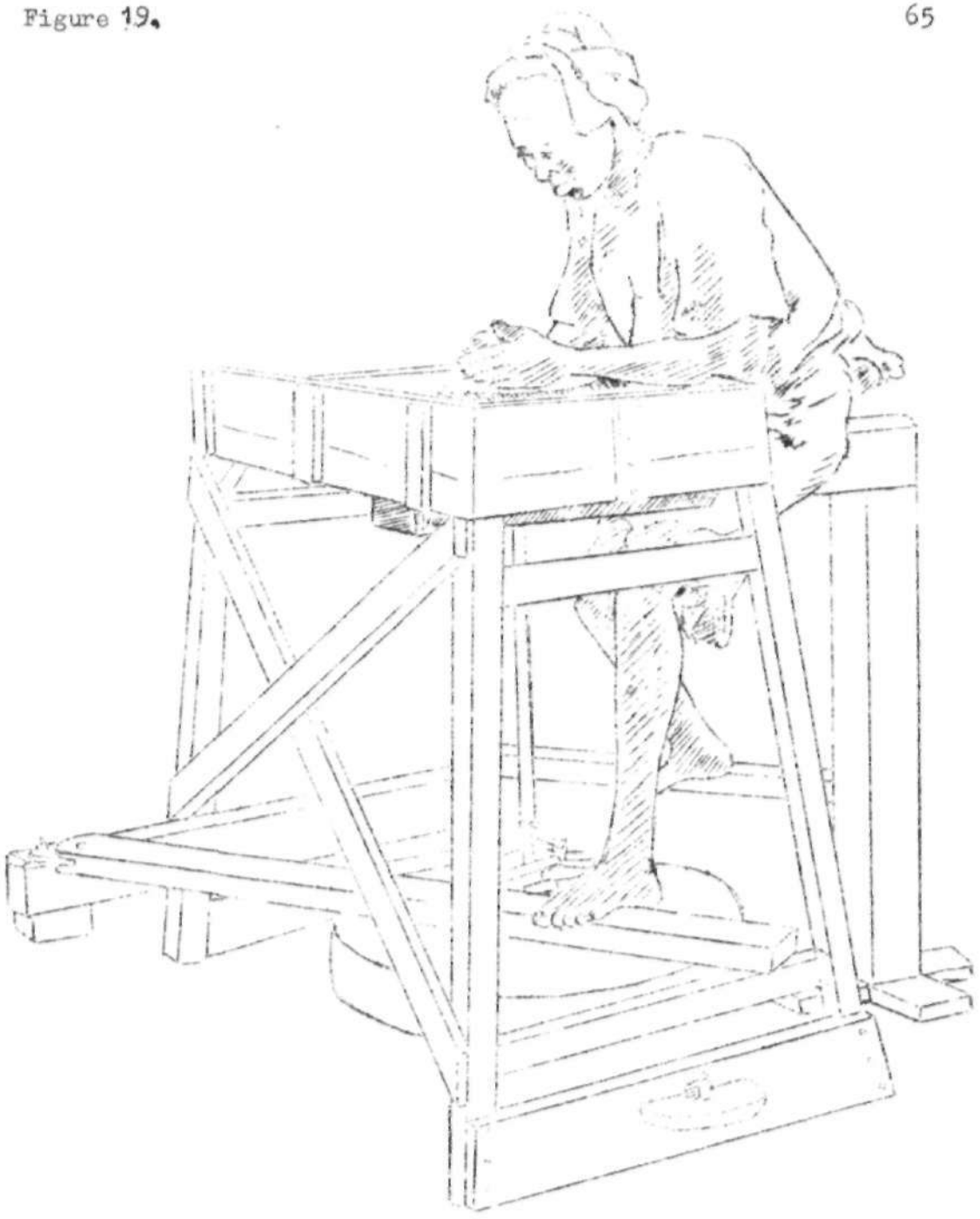
Figure 18.



Denton Vars side-treadle wheel designed by Bernard Leach. Hardwood frame; weighted flywheel, fiber glass pan, 13" aluminium wheel head.

(Nelson Glenn C., "Ceramics" p. 274)

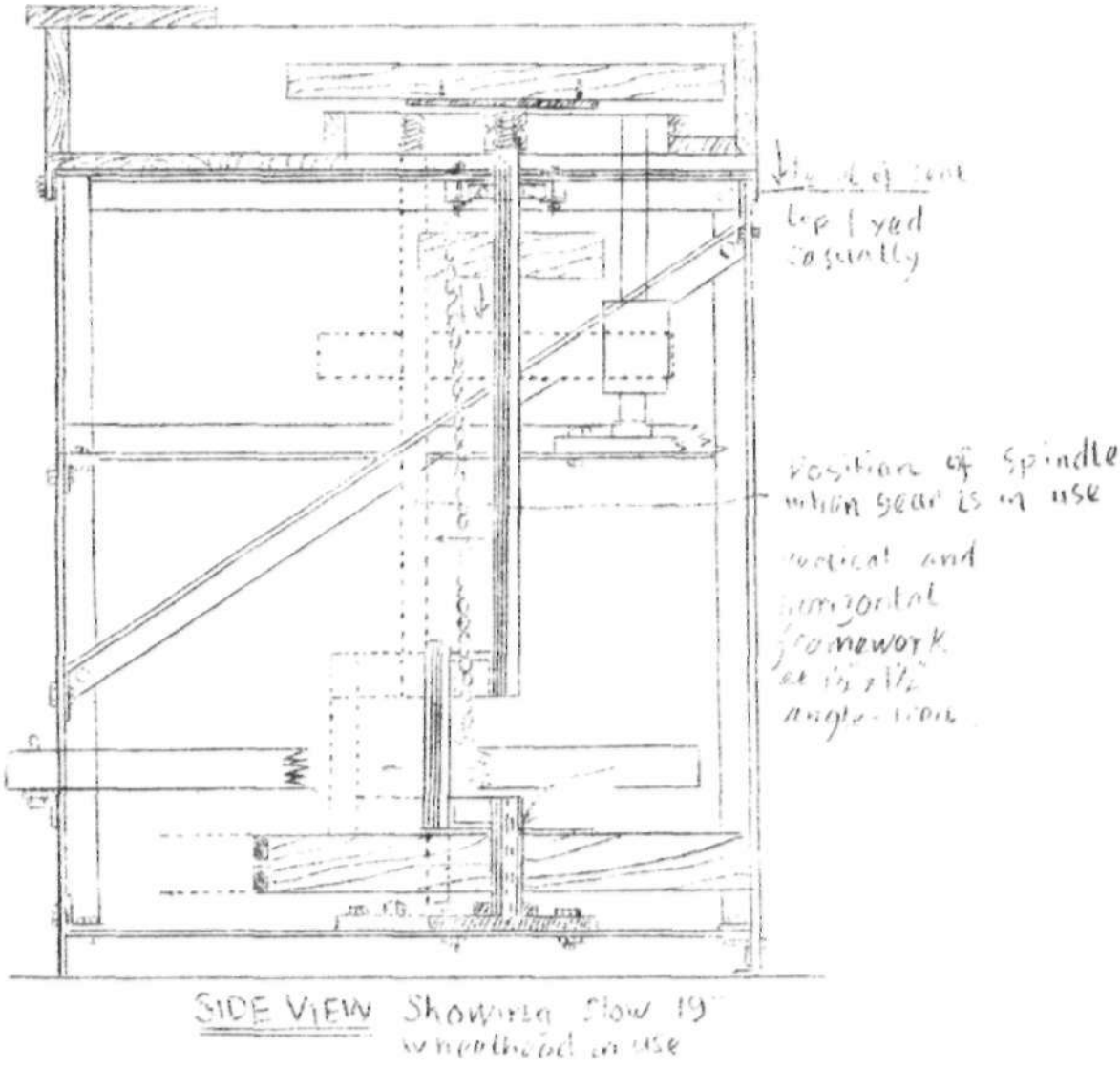
Figure 19.



This is a potter's wheel in use at Okigwi. Though designed in such a way that the fore-arms could be rested on the water-trough, a skillful control of the body is still needed to retain steady-hands while kicking and throwing.

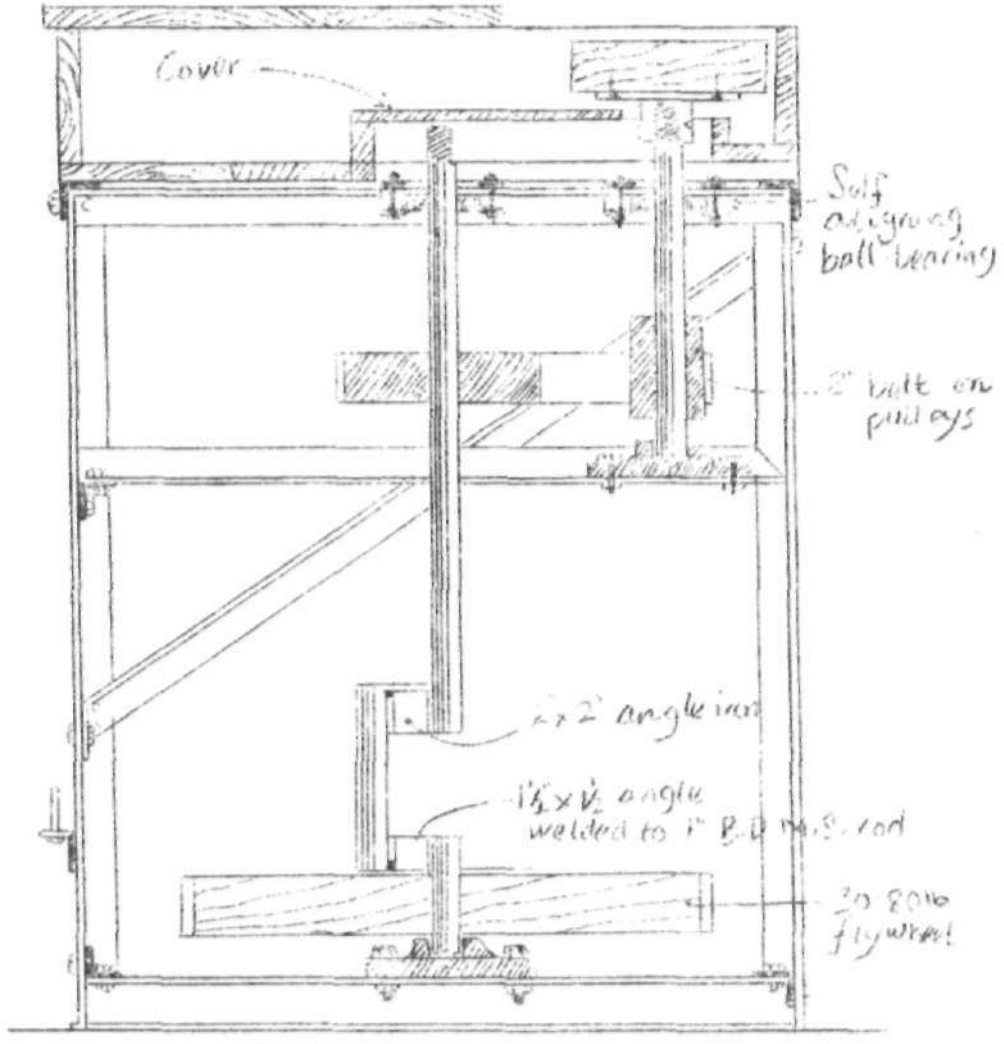
(Nigeria, A Quarterly Magazine, No. 36, 1951. p.453.)

Figure 20.



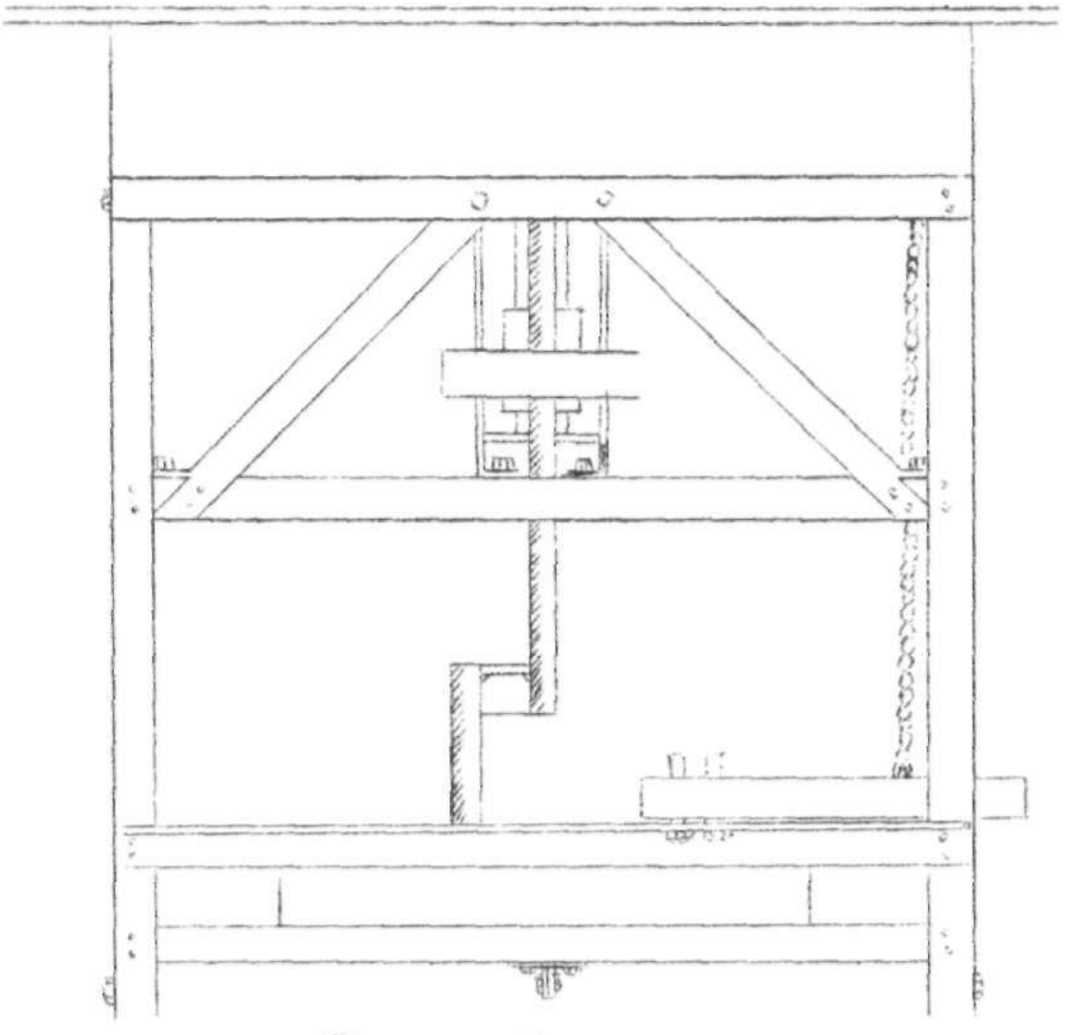
Figures 32 - 37.
Show series of study of a kickwheel adapted from Harris (Wrecclesham) geared wheel by Michael O'Brien, 1975.
Though sophisticated equipment were used in constructing it, yet does not satisfy the elements of functionalism aforementioned in the earlier chapter (Chapter II). It has the disadvantage of being a treadle wheel, the uneffective that it has jerky movement, moving fast when kicked and dead slow when pulled.

Figure 21.



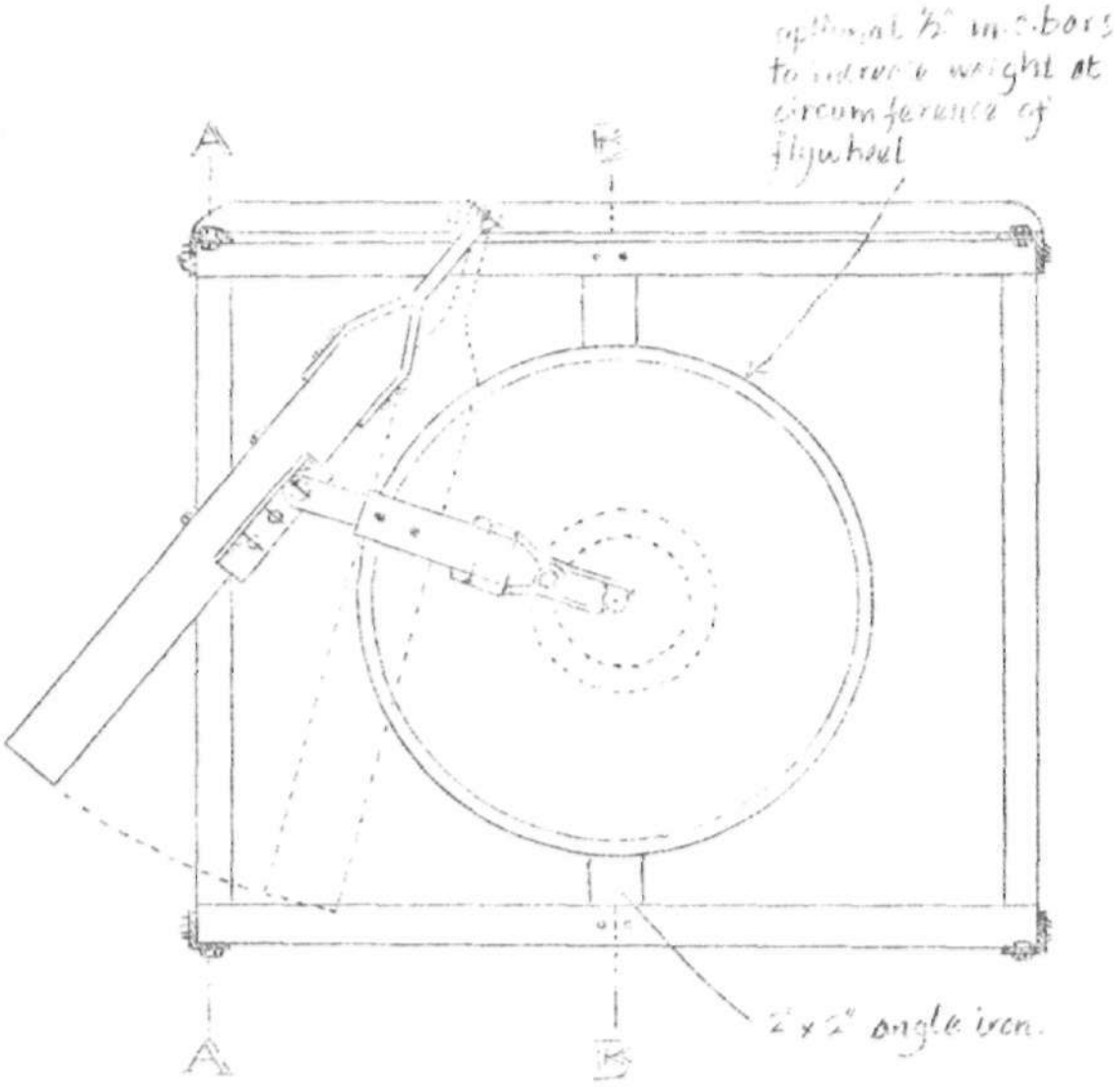
Centre Section showing 8:1 gear in use

Figure 22



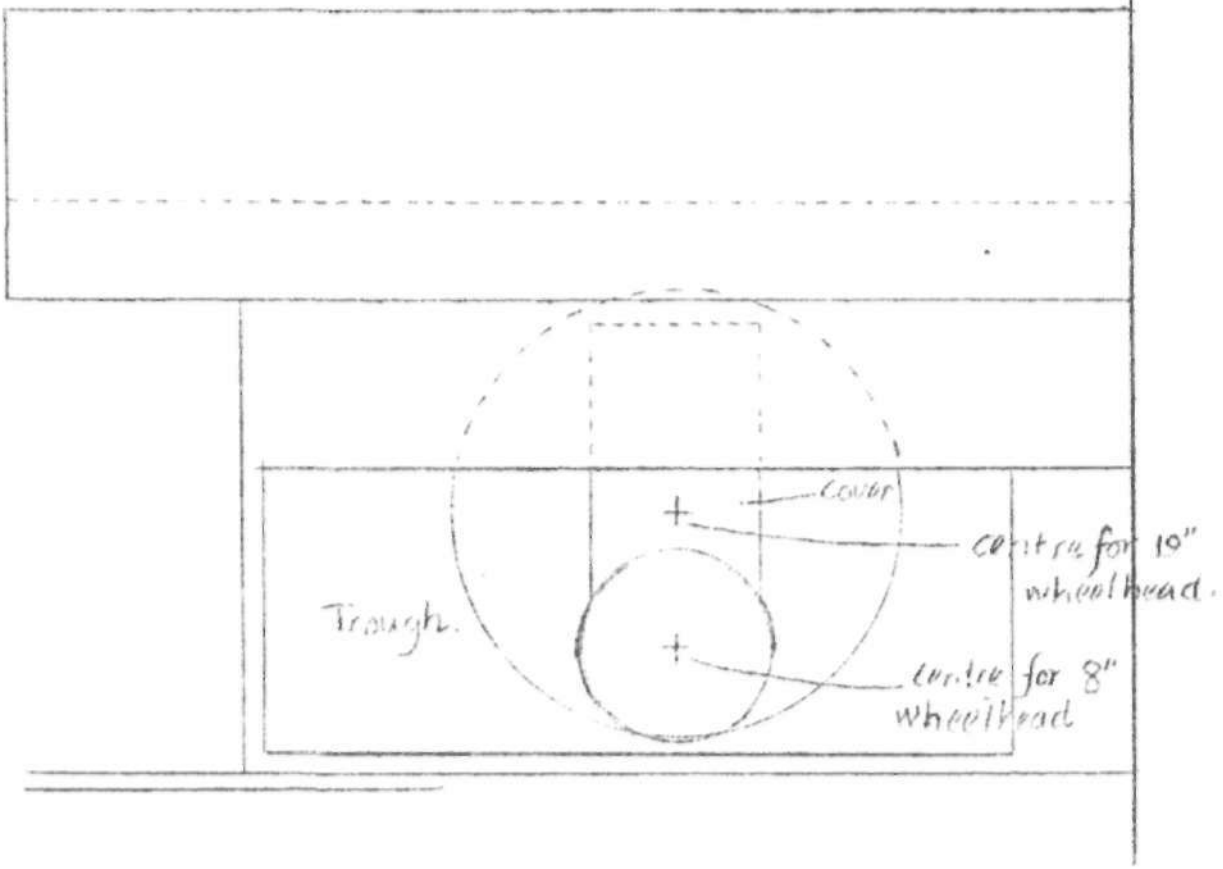
FRONT VIEW

Figure 23.



PLAN VIEW of KICKBAR & FLYWHEEL

Figure 24.



PLAN of TOP

Figure 25.

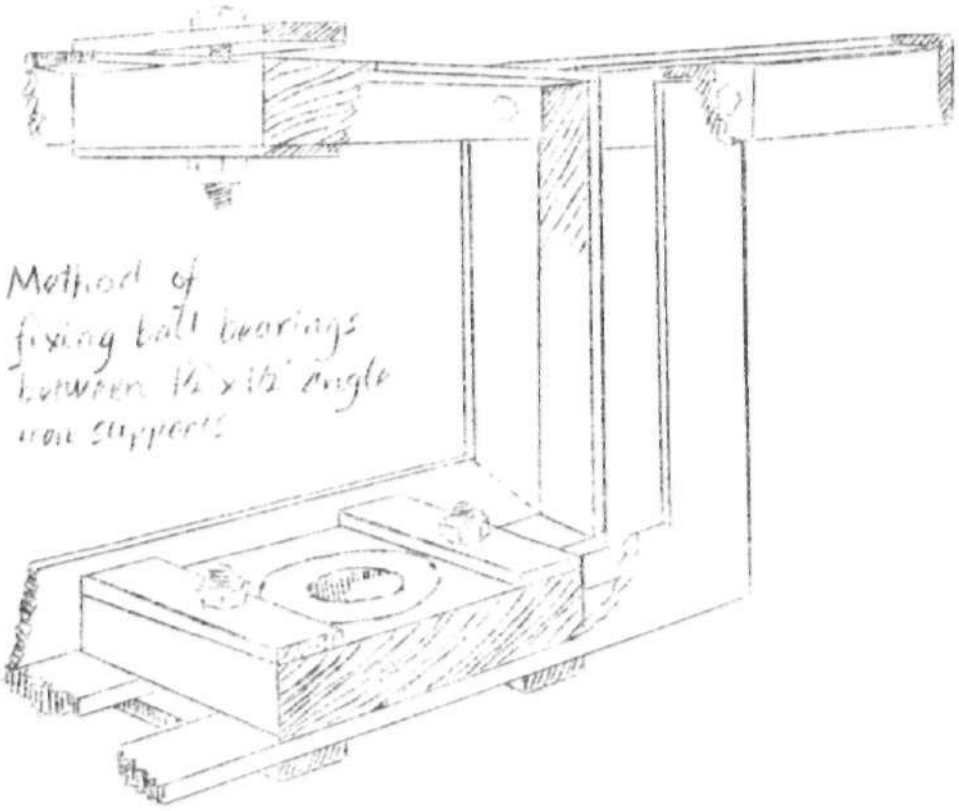
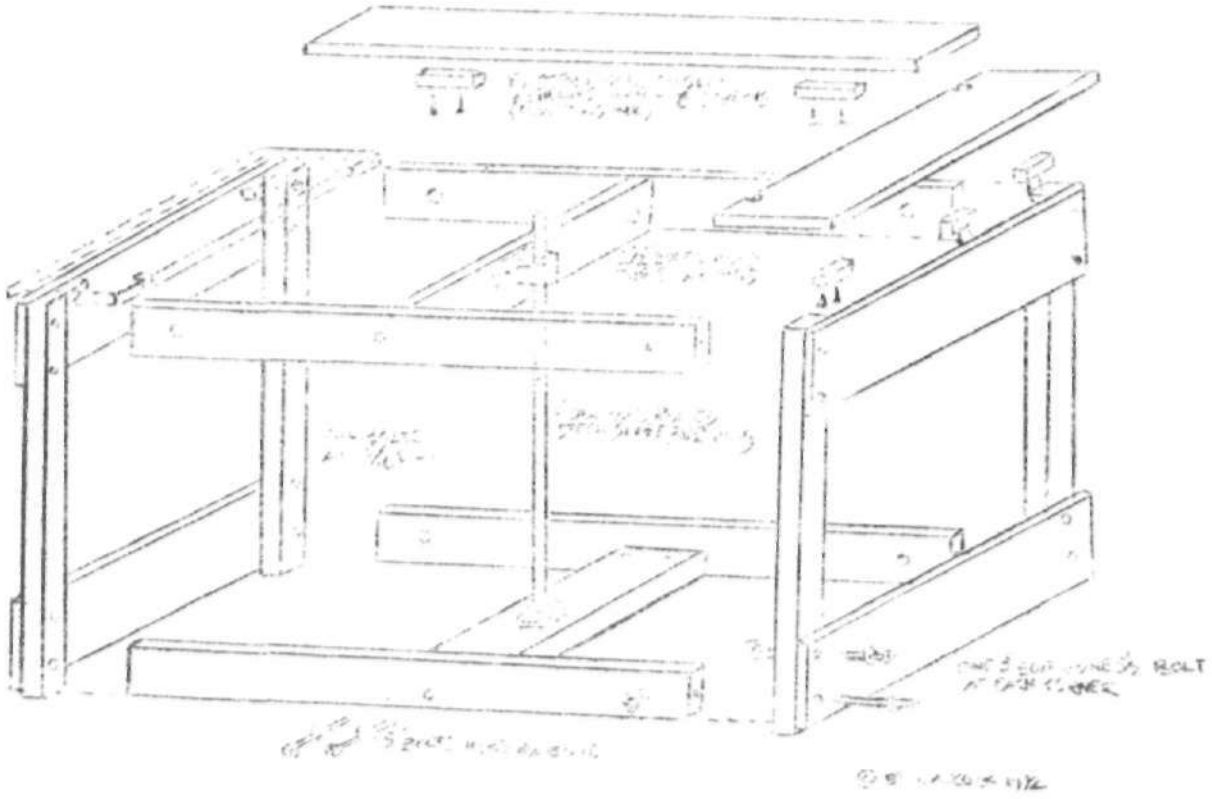

Method of
fixing ball bearings
between ½ x ½ angle
iron supports

Figure 26.



Figures 38 - 40.

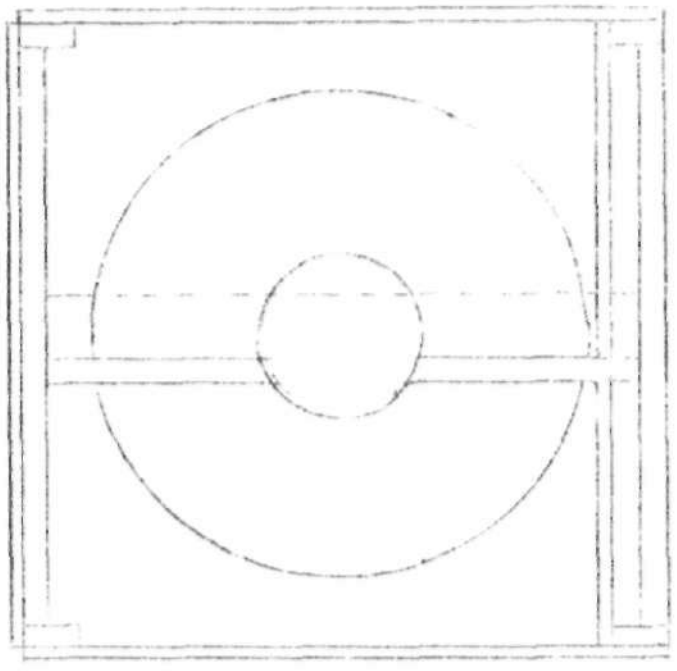
These studies are of a kickwheel designed by Charles Count. It is fairly easy to build but it needs a bit of triagulation, and for a class-room it is too big 106.5 cm. Also it is not easy to get either into it or get out of it. Materials needed for construction are:

(1) Two sheets of $\frac{3}{4}$ one] Ac grade plywood, from which to cut:

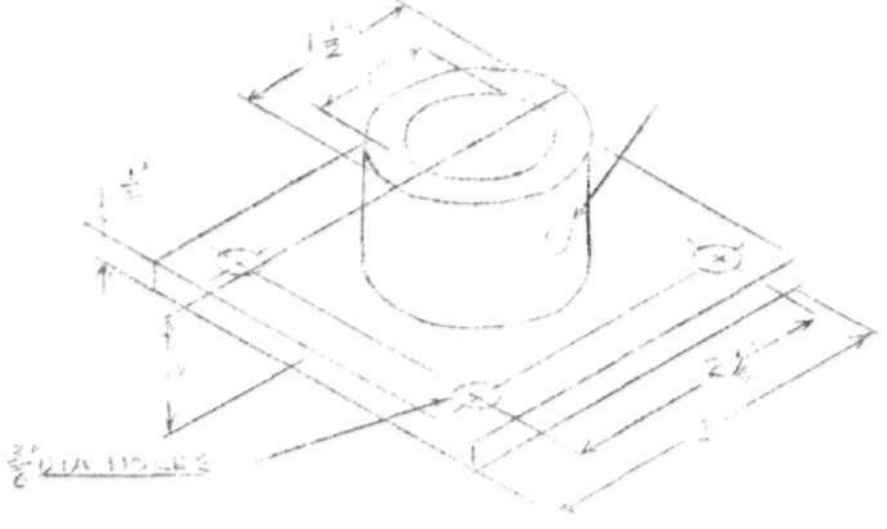
3 full circles: 32 inches in diameter, 16 - inch radius.
4 half circles, 16 - inch radius (flywheel) 6 pieces;
6 inches wide, 42 inches long (braces)
2 pieces: 8 inches wide, 42 inches long (side shelves)
2 pieces: 10 inches wide, 42 inches long (Seat and Shelf)

(Counts, Charles, "Pottery Workshop", pp. 28 - 32)

Figure 27.

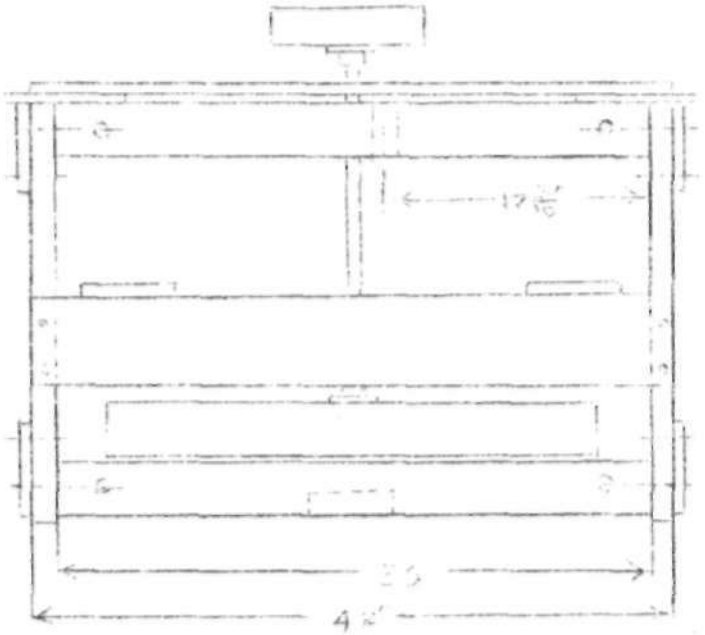


TOP VIEW
(SEAT & SHELVES NOT SHOWN)

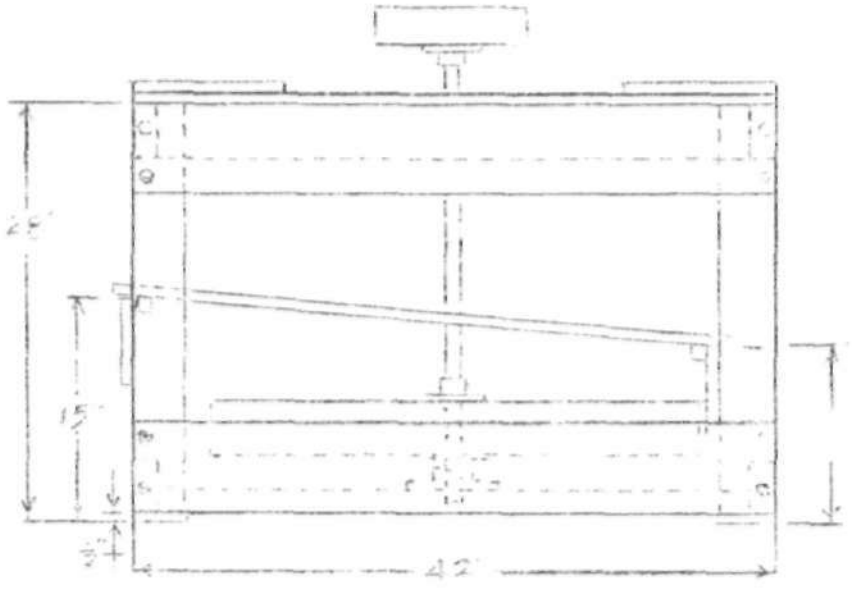


2 REQUIRED - HAVE 1 RIGHT
AND 1 "LEFT" ON SHAFT

Figure 28.



FRONT VIEW



SIDE VIEW

(2) Enough 2 by 4 (C.grade fir preferred) to make:
4 pieces, 28 inches long (legs)
5 pieces, 39 inches long (frame)
One 39-inch piece of 2 x 6 or 2 x 8.
NOTE: These dimensions are based on a so-called 2 x 4 that is really $1\frac{1}{2}$ x $3\frac{1}{2}$ inches, as is now standard. If 2 x 4s that are really $1\frac{5}{8}$ x $3\frac{3}{4}$ inches, change the specified 39-inch lengths to $38\frac{3}{4}$-inch lengths and change the bolt patterns to fit the centre of the 2 x 4 at the eight corners of the frame.

(3) Two 40-inch pieces of 2 x 6 fir or pine, for foot-boards.

(4) Fourteen small blocks, $\frac{3}{4}$ x 1 x 4 inches

(5) Three flanges; one for the head, and two for the wheel.

(6) Two ball-bearings assemblies: one, a FAFNIR PBS - 1" or LCJT - 1" (Your bearing suppliers can tell you the equivalent in other-brands). For fastening it all together, you will need:

(1) 8 machine bolts, $\frac{5}{16}$ x $5\frac{1}{2}$ inches (one for each corner of the frame)

(2) 6 machine bolts, $\frac{5}{16}$ x $5\frac{1}{2}$ (two for the top frame; four for the bottom)

(3) 8 carriage bolts (machine bolts will do) $\frac{5}{16}$ x 3 inches (one for each corner)

(4) 4 machine bolts, $\frac{5}{16}$ x $2\frac{1}{2}$ inches (to hold the bearings)

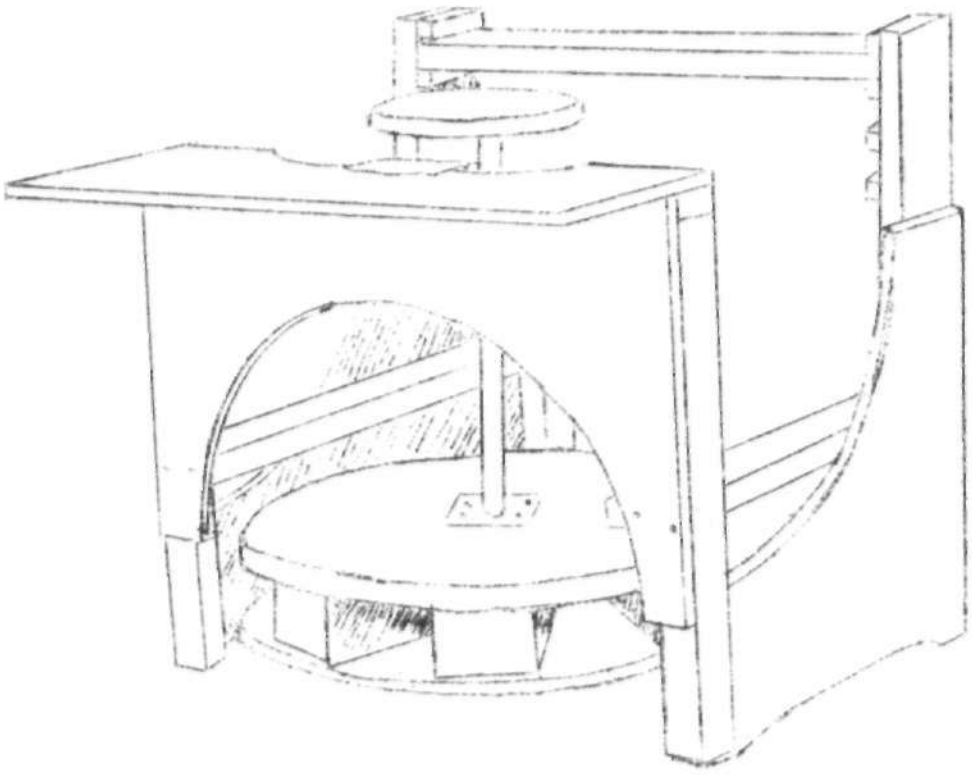
(5) 28 flathead wood screws, 1 - inch, #8 (for the blocks)

(6) 20 lag screws $\frac{1}{4}$ x $1\frac{1}{2}$ inches (twelve for the flanges; eight to hold the foot-board supports) (All the bolts need nuts and washers; eight of the lag screws need washers.)

Constructing the wheelhead:

The head has the tightest requirement. It should be made of medium-weight mapple or birch, by laminating three thickness of wood, each 10 inches in diameter and $\frac{3}{4}$ - inch or 1 - inch thick. (In laminating, be certain to use a water-proof glue.) Bore a hole 1 inch in diameter, halfway through the centre.

Figure 29.

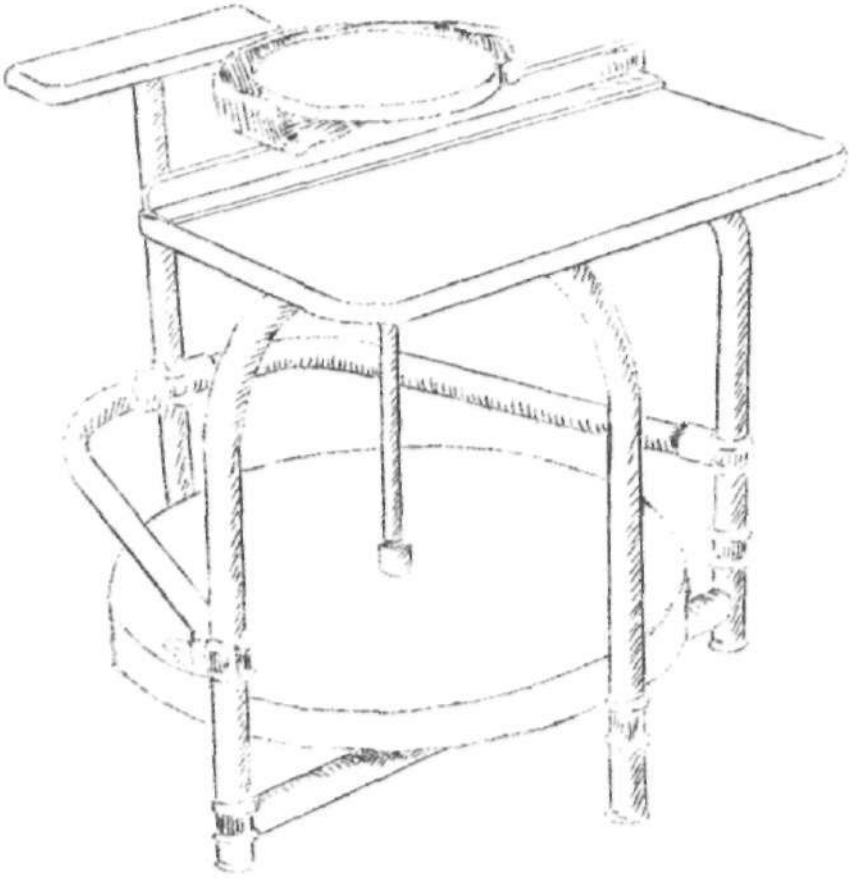


Robert Brent

Robert Brent's Plywood Kickwheel. It has $\frac{1}{2}$" exterior plywood stressed skin, weighing 19 lbs. costs $ 49.50.

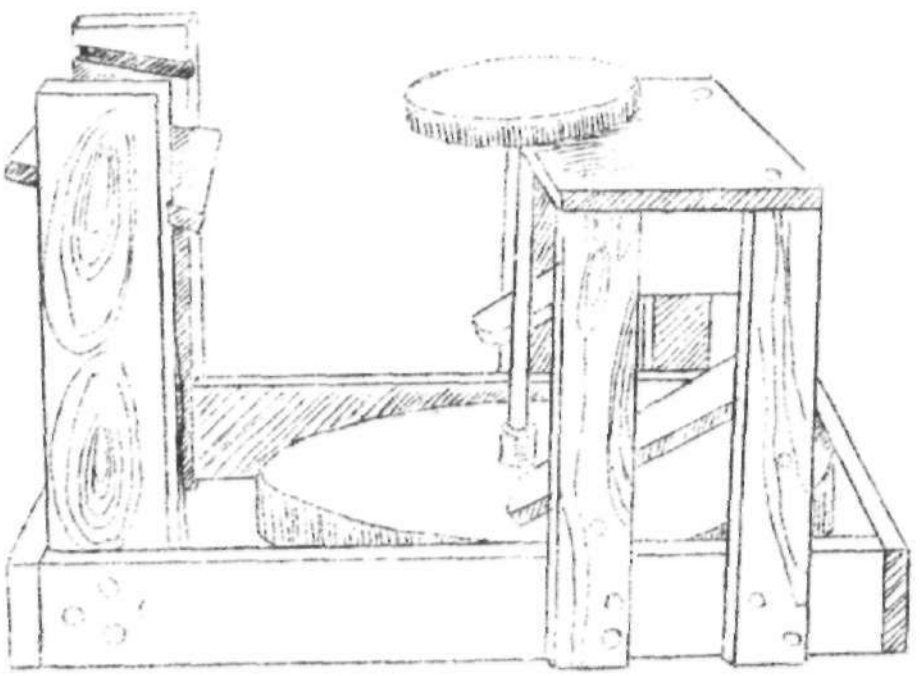
("Ceramics Monthly", June 1965 edition, p. 6.)

Figure 30



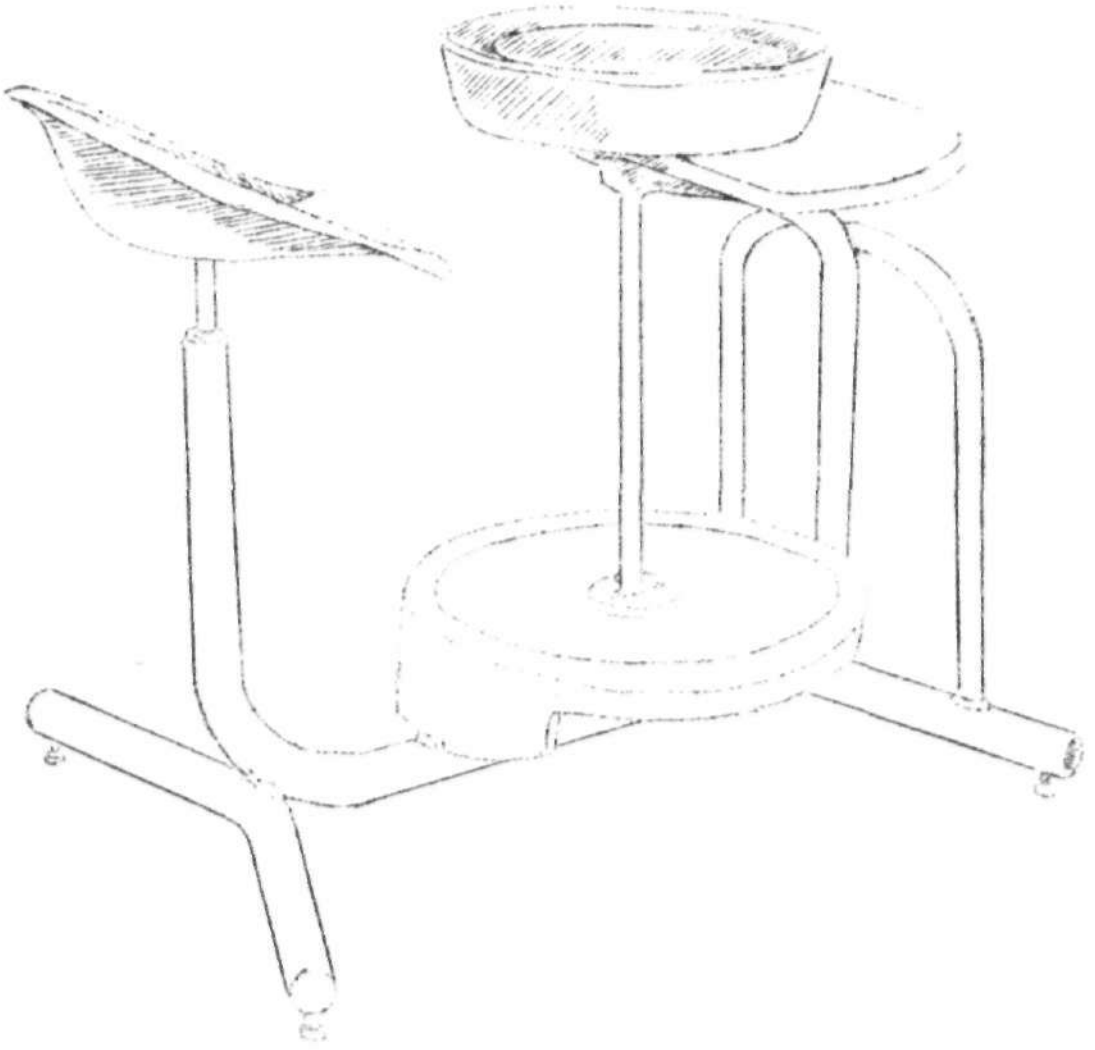
Thomas Stuart Wheel made of steel frame bolted together. It costs $ 160.00

("Ceramics Monthly", June 1965 edition, p. 17.)



A Walrus Kickwheel, made of wood and concrete. 150 lb. concrete flywheel. Costing $ 155

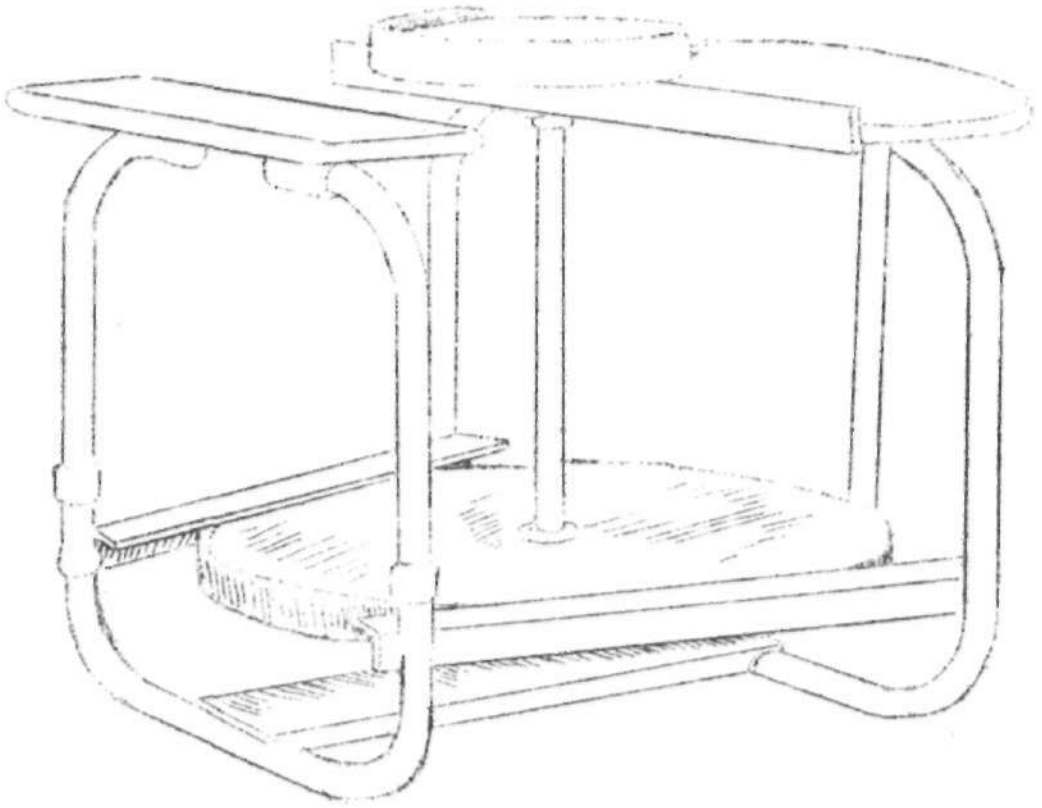
("Ceramics Monthly" December 1975 edition, p. 83.)



Alpine Kickwheel built of metal frame, could be adapted to use motor.

("Ceramics Monthly", October 1975 Edition, p. 14.)

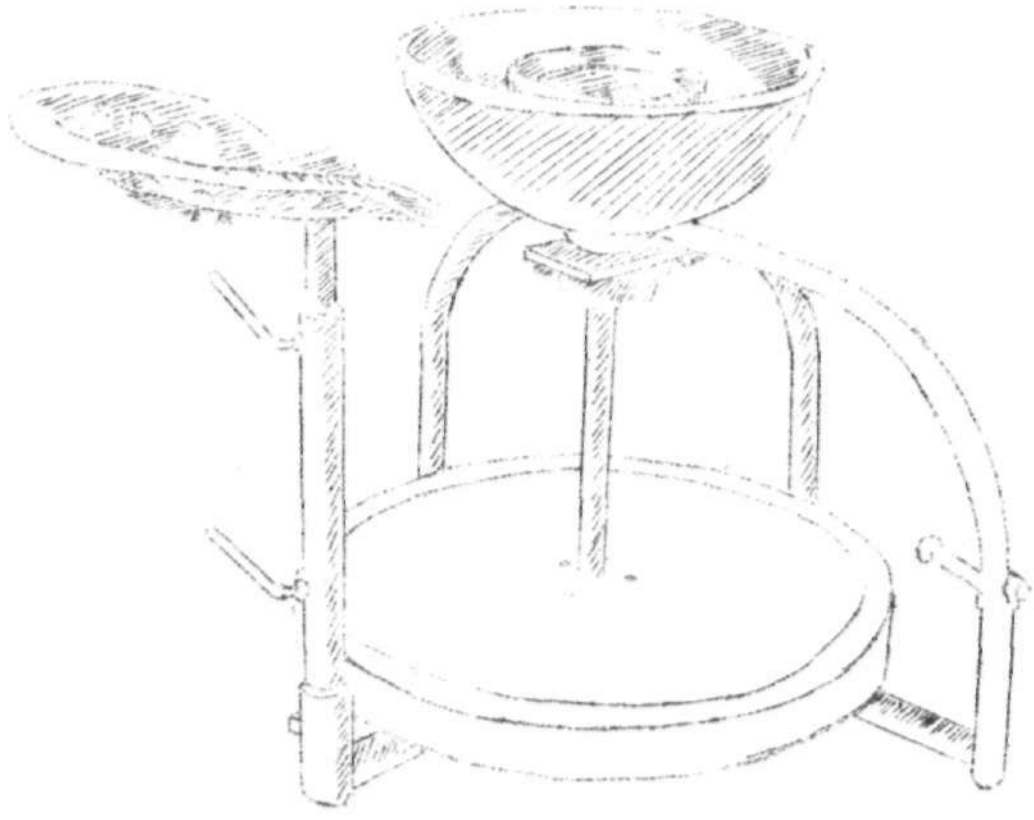
Figure 33.



Soldner kickwheel. Welded-pipe frame; reinforced concrete flywheel, weight 90 lbs.; 14" aluminium wheel head; 20 x 38" work table. Available with $\frac{1}{2}$ - horse power 5 - 100 rpm motor attachment.

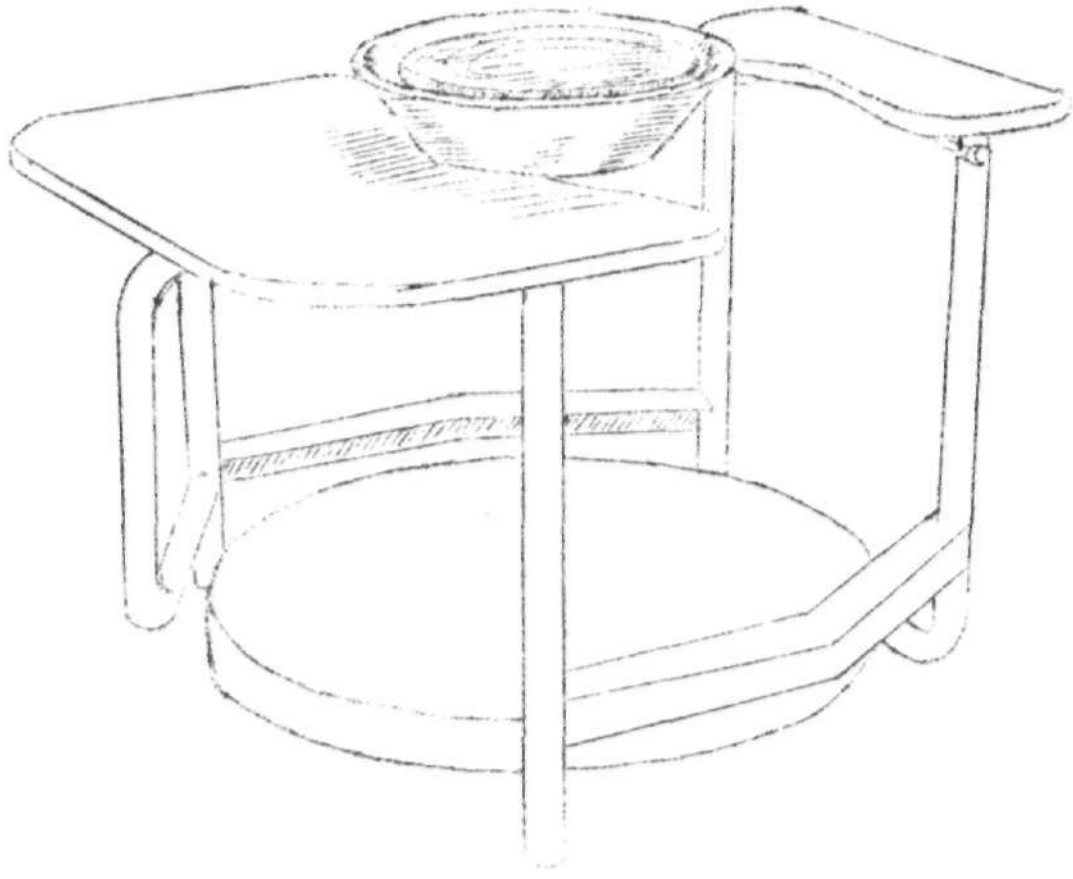
(Nelson, Glenn, C., "Ceramics", p. 274.)

Figure 34.



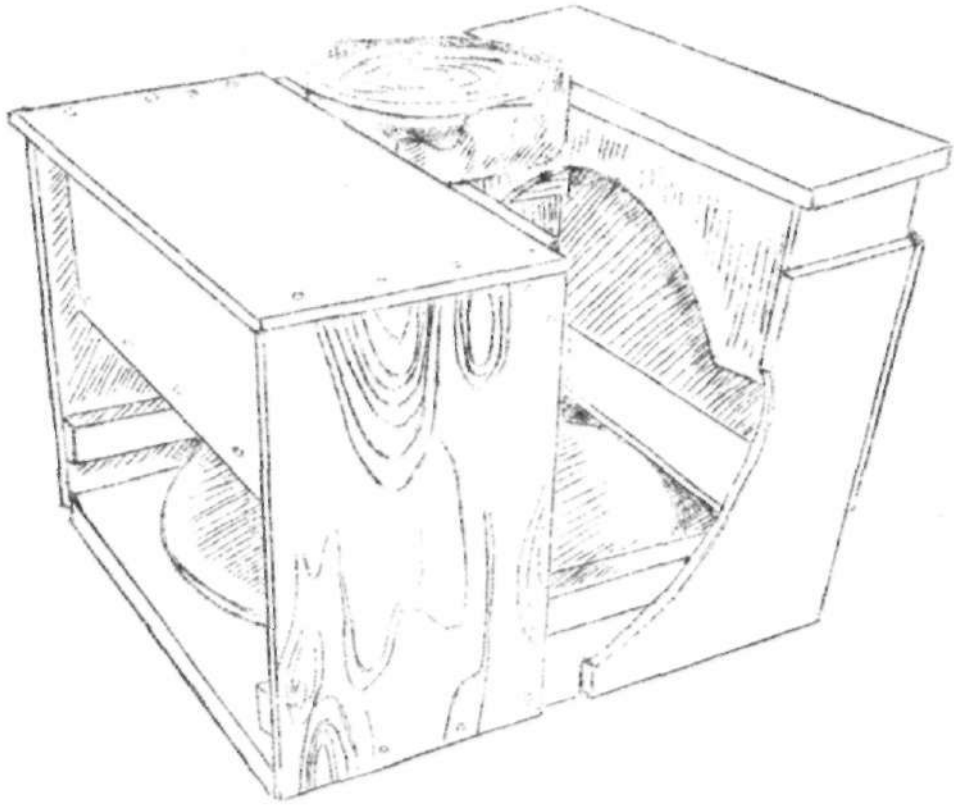
Randal kickwheel. Welded steel frame, 9" recessed aluminium wheel head. 19" aluminium plash pan, adjustable bucket seat; 28" flywheel, standard weight 115 lbs. (adjustable if desired); overall shipping weight 200 lbs. Available with $\frac{1}{2}$ - Horsepower motor attachment.

(Nelson, Glenn C., "Ceramics". P. 274)



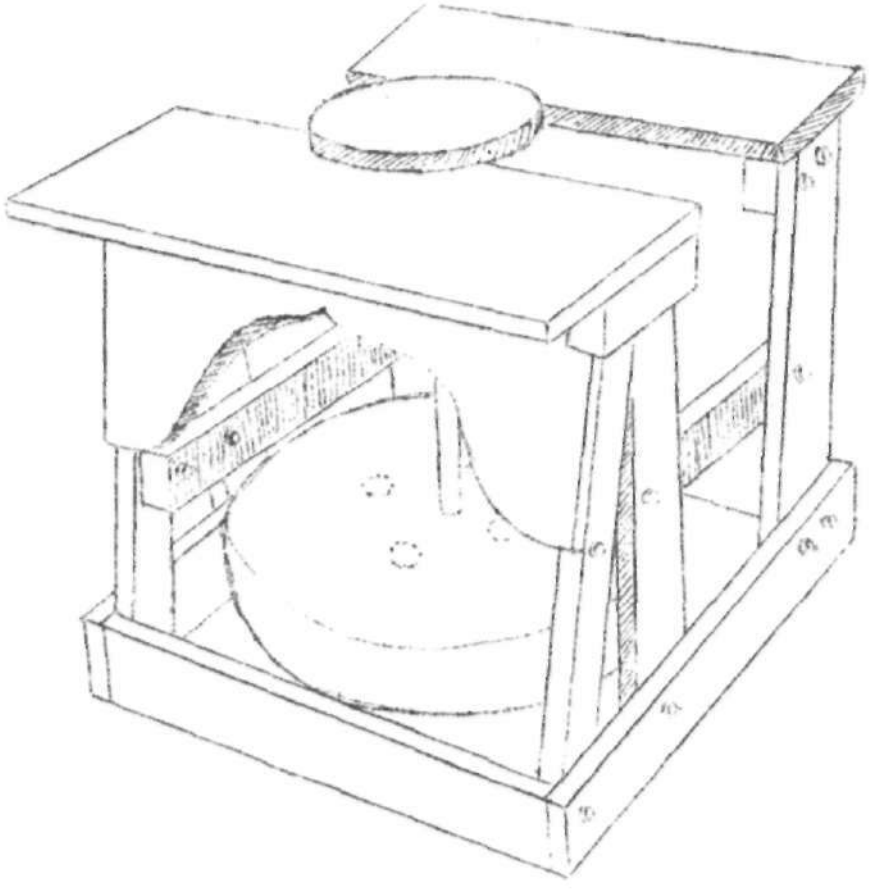
Conway Wheel partly welded and partly bolted steel frame. Concrete flywheel. It could be adapted to electric wheel. cost ₰ 190.

("Ceramics Monthly" September, 1975 edition p. 79)



Oak Hill traditional kickwheel, waterproof plywood frame; 31" flywheel, iron weight 80 lbs.; 14" aluminium wheel head; overall shipping weight 170 lbs.

(Nelson, Glenn C., "Ceramics" p. 274.)



Pacific wheels - Sierra model.

("Ceramics Monthly" December, 1975 edition p. 76.)

APPENDIX B.

NOTES ON AVAILABILITY AND CHARACTERISTICS OF SPECIES

These short notes are prepared for two purposes:

(a) as a guide to where some of the timber species recommended in the use guide may be obtained in reasonable quantities, and (b) to call the timber users' attention to some of the species that present special problems and recommend some means of overcoming them. With this object in view, species that are well-known or those with which the user is not likely to have any problems, have been omitted. The 22 species dealt with in these notes represent only a small proportion of the wide variety of species one is likely to come across. But they have been selected carefully as being a reasonable representative of the many problems that deserves special attention. Most of them have one defect in common and that is that they are not durable. It has already been emphasized, and it is here repeated, that timbers that are not durable but are permeable to impregnation are by no means inferior to those that are durable. Non-durability is therefore not really a serious defect and timbers should never be rejected on this basis alone.

ABURA

Occurs abundantly in fresh-water swamps of Benin, Ondo, Ijebu-Ode, Port Harcourt, Obubra and Calabar areas. Seasons well and is easy to nail but has slight blunting effect on tools. It is not resistant to preservative treatment and being a non-durable timber, this treatment is recommended.

AFARA (BLACK)

Commonly known as Idigbo. Available in Lagos area, the West, Mid-West and East Regions. Though classes as durable, preservative treatment is recommended as the sapwood is indistinguishable from the heatwood. The wood works well and nails well. If used in contact with iron, it should not be oil painted, in order to prevent a possible corroding effect on the metal.

AFARA (WHITE)

This species is of very wide distribution and is available in plentiful quantities through-out the West and Mid-West Regions, in Eastern Nigeria and in Kabba, Kafanchan, Benue areas of the North. The timber must be treated with preservative to which it is readily permeable in order to protect it against decay and insect attack to both of which it is very susceptible. Worm holes which are usually present in the timber do not impair its use for certain purposes. The heartwood is sometimes black and provides a very decorative furniture timber.

ALBIZIA

The two species (Albizia zygia and A. ferruginea) occur throughout the rain forest areas of the south and in the 'Kurmi' in the north. The timber is abundant in sawmills at Abeokuta and Ilaro. There is very great variation in the properties between the species and within the species. Albizia ferruginea has a colour range of from reddish brown - brown - grey with intermediate colours between these. It is very durable. A. zygia is brown, sometimes pink, grey grey-brown etc. It is not durable. This wide colour variation has been observed in different pieces from the same tree. Both species have very wide sapwood (over 6") and should be treated with preservatives especially where used in direct contract with the ground.

If properly stacked, the timber would not warp in drying and if properly seasoned, the timber works easily though it would tear and fray in sawing and planing in wet condition. The timber shoul therefore be well seasoned before manufacture even though it is said to cause mild irritation of the nose in the dry state.

ALSTONIA

Available throughout southern Nigeria (East, Mid-West and West). Its deep sapwood (over 9") makes it liable to insect attack and fungal stain. But this danger may be minimised by adequate treatment with preservatives which it absorbs easily. Also very quick extraction and immediate conversion after felling are recommended. It seasons well, nails well and works well.

ANTIARIS

Very common in Benin, Ishan, and Ibadan areas of the West and in Awka, Ahoada and Bende districts of the East. It also occurs in Benue, Lokoja, Ilorin and Kafanchan areas of the North. The tree often produces exceptionally good shaped trunks. Preservative treatment of logs and sawn timber, quick extraction by land and immediate conversion are all essential and are recommended as a means of protecting the timber from fungal and insect attack to which it is very susceptible. Sharp tool edge and narrow hook angle will facilitate sawing and working.

APA (AFZELIA)

Occurs in the West, East and the North. Abundant in Obubra area of the East and in the drier forest areas of Owo, Akure and Abeokuta. The timber is hard and durable and difficult to nail. It should therefore by pre-bored. It is liable to warp and split during drying unless it is carefully stacked and adequately end-coated. It dulls cutting tools but planes well.

AYAN

This species is of wide distribution in the East, West and Mid-West Regions, occurring abundantly in areas such as Ahoada, Bende, Ikom, Obubra, Calabar, Itu, Awka, Onitsha, Ondo, Benin, Ijebu-Ode, etc. The timber works, nails and planes fairly easily. Being liable to stain, the timber should be protected from wetting by rain during seasoning. Seasons easily without warping or splitting.

CANARIUM

Available in the rain forests of the West and drier forests of the East. Common in Benin, Akure, Abeokuta, Onitsha, Ahoada, Udi, Okigwi, Calabar and Kafanchan areas. The presence of woolly grains makes the timber sometimes difficult to saw. Vanadium-tipped saws are recommended. Spraying of logs and preservative treatment of sawn timber are recommended as safeguard against fungal and insect attack to which its deep sapwood renders it liable. The timber seasons well.

COTTONWOOD

Widely distributed throughout the country - south and north. Very common also in farm lands. Rapid extraction and conversion and preservative treatment of logs and lumber are essential protective measures against stain and insect attack to which the timber is susceptible. It should be seasoned carefully.

CELTIS

Occurs with high frequency in dry forest zones of the south particularly in Benin, Ishan, Ondo, Ibadan and Abeokuta areas. Saws, planes and polishes well. Being a non-durable timber, it should be converted as soon as possible after felling, the sawn timber being impregnated with preservatives which it absorbs readily. It is liable to give out an offensive odour thus limiting use for internal works. This smell is however prevented by adequate seasoning.

DAHOMA

Abundant supplies available in both rain and drier forests of the south and in the middle-belt and 'Kurmi' of the north. It is said to be common in east of the Niger and uncommon in the northern limits of Benin forest. Works with blunting effect on tools and is difficult to kiln dry. Air seasoning is therefore recommended. Like Celtis, it is liable to give off an offensive smell if wet especially when used in confined spaces.

DANTA

Occurs mainly in the drier forests of Abeoluta, Ijebu-Ode, Akure, Benin, Onitsha and Bende areas. Seasons well but slowly. Liable to split on nailing. Tendency to pick up it quarter sawn.

ERIMADO

Abundant in dry forest areas of the south where it attains a height of over 100 feet and a circumference of 8 feet and more. It also occurs in farms and farm regrowth. It is recorded as available in Benin, Ondo, Ilesha, Ibadan, Abeokuta, Illah near the Niger, Onitsha, Awka, Owerri and Oban areas. Though one of the timbers in Nigeria most susceptible to insect and fungal damage, it is nevertheless very permeable to preservatives with which it must be treated. Rapid extraction and conversion are also recommended. The timber works easily though the finish tends to be woolly.

ERUN

Common in Ijebu-Ode, Benin, Owerri, Obubra, Onitsha. Very durable even to marine borers. No special treatment required.

Warning - the bark is very poisonous.

ESSIA

Frequent occurrence in Ondo, Oyo, Ijebu-Ode, Ishan Ogoja, Ikom and Calabar areas. Durable and not easily impregnated. Liable to split in seasoning.

ILOMBA

This species is almost universally distributed in the south, occurring at Benin, Oshun, Oban, Ondo and Onitsha. It is liable to destroying insects and fungi, unless it is impregnated with preservatives to which it is very permeable. Works well and seasons easily.

ODOKO

Not abundant though locally common in lowland rain forests of east and west. It is available at Ikom, Itu Ahoada, Ijebu-Ode, Ibadan and Benin. The timber has deep sapwood indistinguishable from the heartwood. Though not durable, it is easily permeable to preservatives, and must be impregnated before use. Thick dimensions season badly Saws and planes easily.

OGEA

Very common in the south. Its wide sapwood (over 6") renders it very susceptible to stain and insect damage and it should therefore be properly treated with preservative before use. With sharp tool edge and narrow cutting angle, it saws with ease. Seasons well though tends to warp.

Okwen

A very common species often occurring gragariously in forests of the south and 'Kurmi' of the north. It has a wide distribution. The timber, which has very attractive appearance and colour, is hard to work. It should be carefully seasoned as it is liable to check or warp. Sawn timber should be dip-treated or sprayed with preservatives to protect it from fungal and insect attack.

PTERYGOTA

Widely distributed in wet forests of the south. Very common in Olokemeji, Ijebu, Ekiti and Akure, Owo, Benin, Ogwashi-Uku, Nsukka, Ikom, Obubra, Calabar. Rapid extraction and conversion and preservative treatment of logs and timber (it is very permeable to preservatives) are recommended as preventive measures aginst stain and insect attach to which it is very liable. It seasons reasonably well, works well and peels well.

STROMBOSIA OR AFINA

A tree of frequent occurrence in the rain forests of the south. Straight boled. The sapwood is brownish yellow and the heartood is brown with dark reddish-brown steaks. Timber is very hard and fair ly straight grained. Seasons fairly well, though liable to slight and splits. It is resistant to fungal and insect attack yet permeable to preservatives. Works well and polishes well. Suitable for telegraph poles, tool handles and flooring.

APPENDIX C.

LIST OF SOME SAWMILLS IN NIGERIA (JULY 1963)

*Northern Nigeria Timber Coy., Lafia near Ankpa, Igala.
*Dogon Kurmi Sawmill, Jemaa Division, Zaria Province.
Okeya Sawmill, Okeya; Ajasse District, Ilorin.
*Oron Sawmills, Marina Road, Oron.
*Nemco Sawmill, Niger Street, Fegge, Onitsha.
*Isiokpo Sawmills Ltd., Isiokpo near Port Harcourt.
*ENDC Boat Yard, Opobo.
*Brandler and Rylke Ltd., Obubra via Abakaliki.
*Dolcino & Co. (Nig.) Ltd., Elechi Beach, Diobu, Port Harcourt.
Achuko Sawmill & Co., Ltd., Elechi Beach, Diobu, Port Harcourt.
*Nigerian Hardwood Co. (Nig.) Ltd., Obiaruku via Abraka.
*Central Sawmill, Upper Market Road, Warri.
J. Thomas Estate, Sapele Road, near Sapele.
*Joseph Asaboro Ltd., Ogorode, Sapele.
*A.T. & P. (Nig.) Ltd., Sapele.
*British West African Timber Coy., Ogharefe near Sapele.
G.I. Obaseki and Sons, Mission Road, Benin-City.
*A.O. Obasuyi and Sons, East Circular Road, Benin-City.
*J.I. Idehen and Sons, Asaba Road, Benin-City.
*Mid-West Industrial Co. (Nig.) Ltd., Irrua, Ishan.
*Finch & Co. (West Africa) Ltd., Omolege, near Ifon.
J. Asaboro Ltd., Ikaro, Ifon.
R.S. Brothers, Ondo Road, Akure.
*Pilot Sawmill, Apomu, Akure.
*Ekiti Lumber Prod. Coy., Ikerre Ekiti.
*African Industrial Timber Co., Agbabu, Ondo.
*Ilesha Sawmills & Co., Oshogbo Road, Ilesha.
Fajuke & Sons, Oshogbo Road, Ilesha.
J.D. Omishakin, Ondo Road, Ife.
Odumoson & Brothers, Ilesha Road, Ife.
A.B. Yusufu Sawmill, Ojoyin Street, Ife.
*G.E. Ojutalayo & Sons, Ondo Road, Ife.
Ajilogba (Sawmills) Brothers, Marina Street, Epe.
*Ajagumolu Sawmill, Ijebu-Ode.
*Adeite Timber Industries, Ibeju-Ode.
*Omo Sawmills, via Ijebu-Ode.
Ibadan United Timber Dealers Co. Ltd., Gambari, Ibadan.
*Ibadan Timber Industries, Abeokuta Road, Ibadan.
*Obadeyi & Sons, Oyo Road, Ibadan.
*Oni and Sons, Ibadan.
Adekunle Sawmills, Ilaro via Abeokuta.

*S.O.O.S. Sawmill Industries, Ibadan Road, Abeokuta .
Adebo Band Sawmill, Abeokuta.
Jimo Yesufu Sawmill, Abeokuta.
Adura Band Sawmill, Abeokuta.
Shafon Sawmill, Abeolita.
Oluwa Lowi Sawmill Industry, Abeokuta.
Egba United Co., Abeokuta.
Adeyemi Commercial Syndicate Sawmills, Bola Street, Ebute-Metta, Lagos.
Straight Edge Sawmills, Market Street, Ebute-Metta, Lagos.
*Olugunwa Timber Co., Ebute-Metta, Lagos.
Timber Export Industry Ltd., Yaba, Lagos.
Igbin Sawmill Industry, Coates Street, Ebute-Metta.
Adesokan Sawmills, Osholake Street, Ebute-Metta.
E. Rognoni Timber Co. Ltd., Osholake Street, Ebute-Metta.
Ojikutu & Sons Sawmills, Osholake Street, Ebute-Metta.
Musa Adesoga & Sons Sawmills, Jebba Street, Ebute-Metta.
Thomas D. Ogunbiyi & Sons, Bola Street, Ebute-Metta.
Jinadu & Sons Sawmills, Bola Street, Ebute-Metta.
Olaiya Sawmills, Bola Street, Ebute-Metta.
Lamidi Asuni and Sons, Bola Street, Ebute-Metta.
Kogbagbe Africa Co., Cementry Street, Ebute-Metta.
Olasoju Sawmill Industry, Ajibola Lane, Oko-Baba, Ebute-Metta.
Nigerian Progressive Sawmill, Aiyetoro Street, Ebute-Metta.
Adetoro Sawmills Enterprice, Tafa Street, Ebute-Metta.
Perseverance Sawmills, Agoro Court, Ebute-Metta.
Agu Sawmills, Tafa Street, Ebute-Metta.
Adeyoyin Sawmills, Oko-baba Street, Ebute-Metta.
Solanke Sawmills, Oko-baba Street, Ebute-Metta.
Sawyers Progressive Sawmill Association, Ondo Street, Ebute-Metta.
M. & B. Oredola Sawmills, Oko-baba Street, Ebute-Metta.
Sunbeam Sawmills, Osholake Street, Ebute-Metta.
Endurance (Kosebine) Sawmills, Osholake Street, Ebute-Metta.
Endurance (Olagoshin) Sawmills, Osholake Street, Ebute-Metta.
Endurance (Shode) Sawmills, Osholake Street, Ebute-Metta.
O. M. Ajao and Sons, Market Street, Ebute-Metta.
Aduralere Sawmill Industry, Ebute-Metta.

APPENDIX D.

(i) The Federal Ministry of Commerce and Industries, Lagos;

(ii) The Nigerian Timber Association, P.O. Box 2264, Lagos;

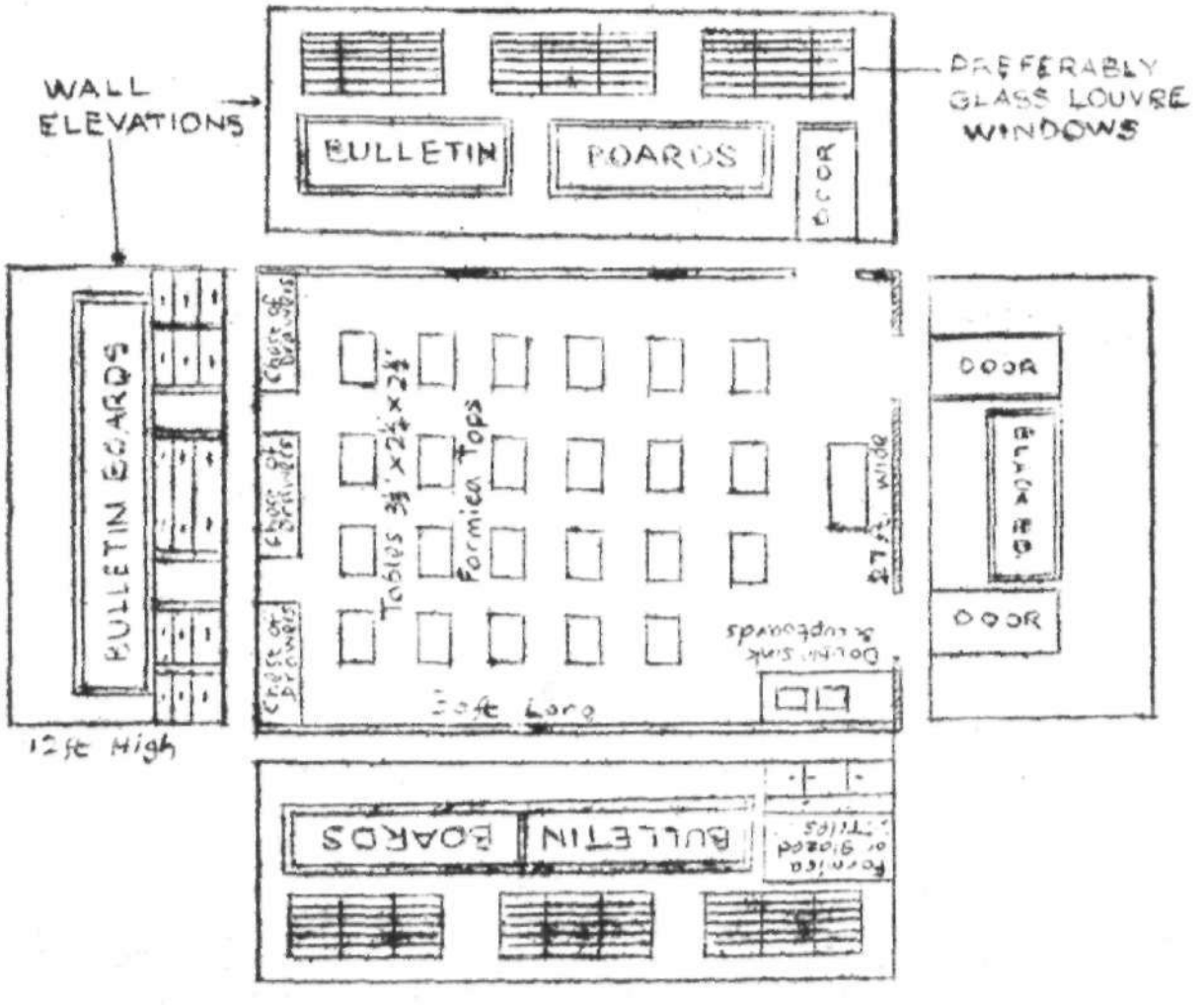
and enquiries on technological data, wood properties and utilization may be directed to -

(iii) The Director of Forest Research, P.M.B. 5054, Ibadan, Nigeria.

Figure 38.

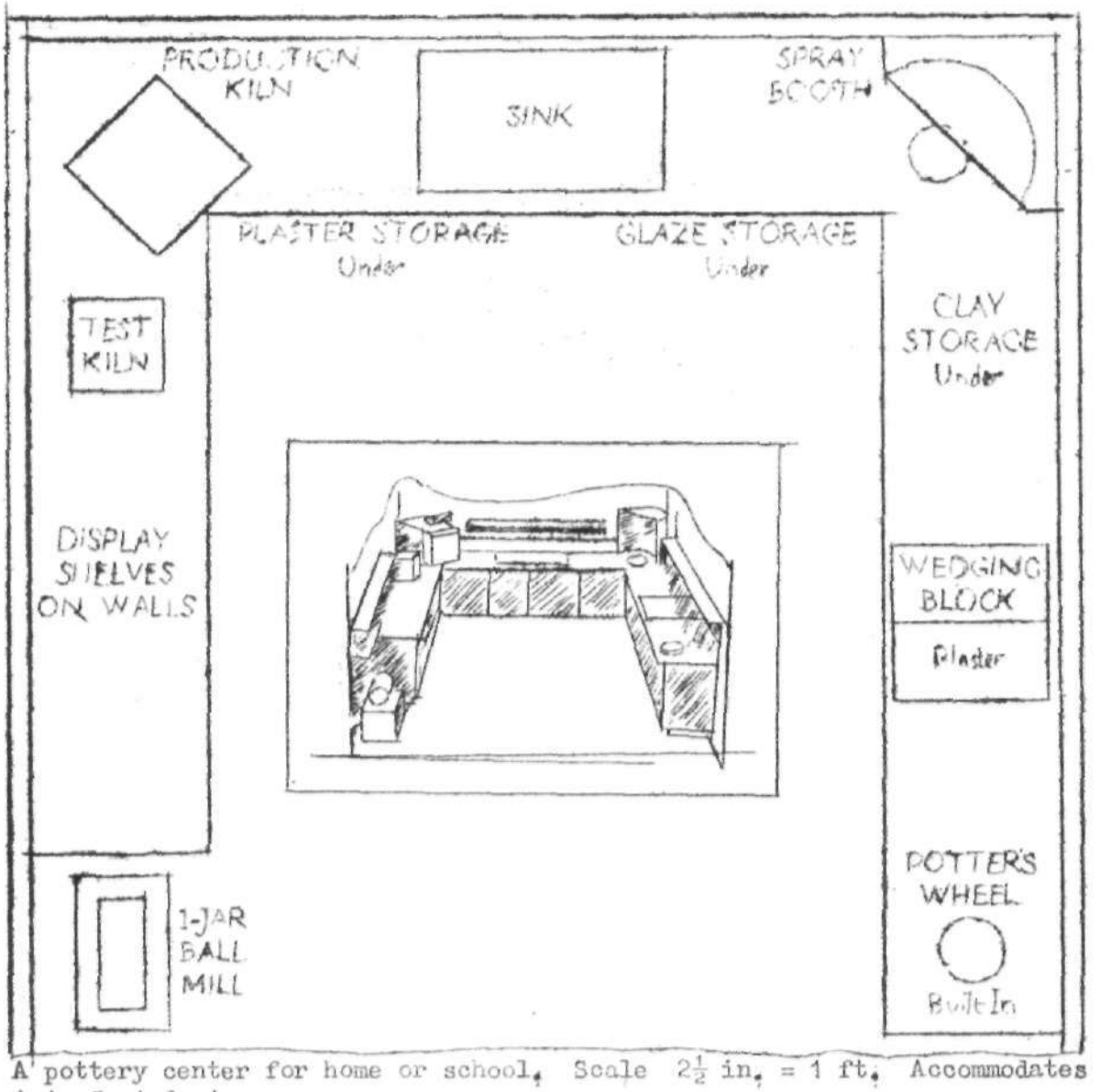
APPENDIX E.

FLOOR PLAN & WALL ELEVATIONS OF AN ART ROOM (A)



(Adenuga, Adeyemi & Leonard, Mary "ART for Nigerian Children". p. 142.)

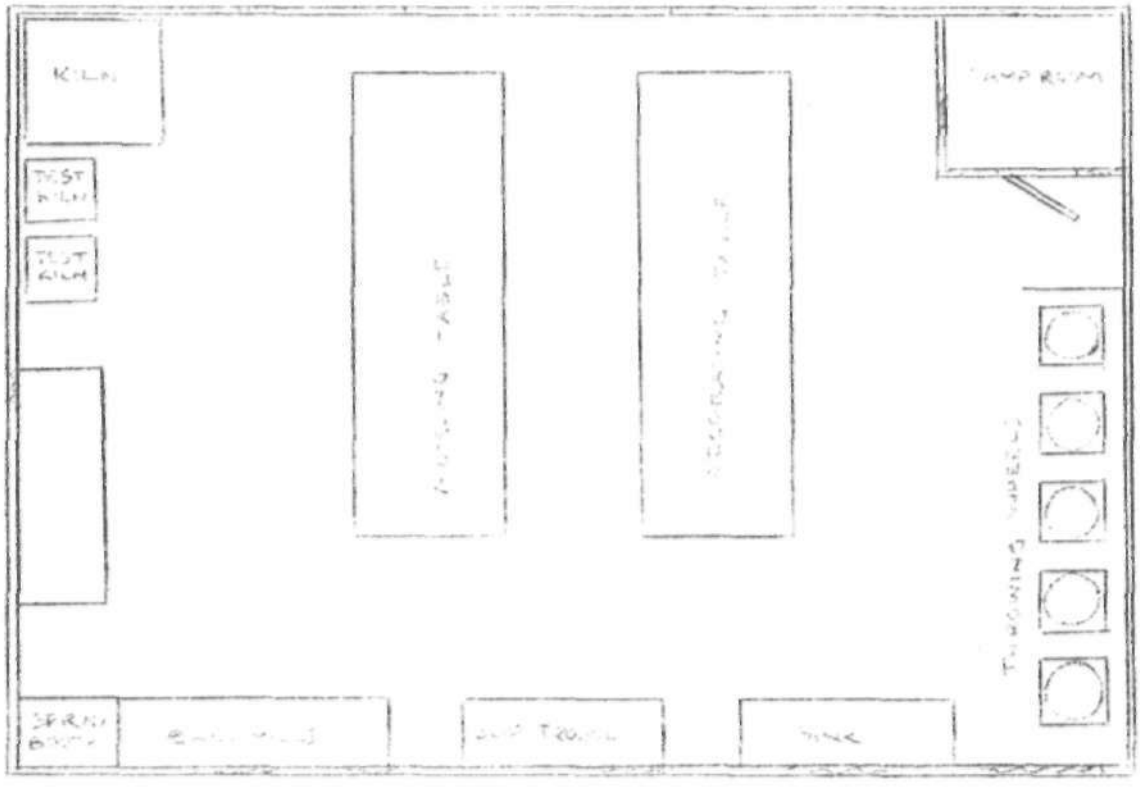
APPENDIX F.



A pottery center for home or school. Scale $2\frac{1}{2}$ in. = 1 ft. Accommodates 4 to 5 students.

(Olson, W., Pottery: Getting started in Ceramics p. 100)

Figure 40.



A PLAN FOR SCHOOL POTTERY

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