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OPEN END SPINNING OF SHORT STAPLE FIBRES

by

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1. **Introduction**

Every country in the world is dependant on some form of the textile industry for its economic progress and well being of its people, and whilst the emphasis on a particular aspect of the complex textile field may vary from country to country, each of us is affected by technical progress in one way or another. This is particularly true in the field of yarn production and usage. The consumption of yarn is an essential part of human existence and we are all involved in improving the capability of yarn production, either to meet an ever increasing home consumption market, or for export trade purposes.

For these reasons a developing country must pay close attention to proven progress in textile technology and particularly when this involves staple fibre yarn production. With any new process it seems to be inevitable that there is at first a cautious delay in world wide adoption and this is perhaps understandable in the competitive and critical textile field, but once a new process is shown to be established and viable in a certain area, the textile industry is not slow to adopt it for its own local conditions and particular advantage.

This is the stage we are now at with yarn production by the Open End Spinning method, which we can definitely take to be an established part of the general staple yarn production scene. Open End Spinning has already been adopted in many countries and has clearly illustrated its technical and economic acceptability. What we should now consider is applicability of the open end process to developing countries and examine some of the circumstances that may give particular advantages in those areas.

In its early stages, Open End Spinning was regarded as a "risk venture", and, as such, tended to find its first application where the economic advantages were so great as to far outweigh the technological and investment risks that were held to apply. That "risk phase" is now well behind us, the viability of Open End Spinning is clearly established both in terms of operating economics and yarn technology, and it is now possible to consider other areas where it can be used to advantage.

2. The Ring Frame

For this purpose we have to bear in mind the circumstances which have led to the world wide interest in the process of Open End Spinning.

Apart from a few remaining outposts of mule spinning, the predominant method of producing staple fibre yarn is the ring frame. Faced with the fact that there are nearly 140 million cotton type ring spindles operating satisfactorily throughout the world, and plenty of new ring frames being bought, one must wonder why there is so much interest in Open End Spinning as an alternative method of producing staple fibre yarn.

Despite its pre-eminence, the ring frame has certain restrictions which have made it necessary to consider alternative methods of yarn production. It appears that the scope for the further economic development of the ring frame is severely limited, particularly in terms of production rate, power consumption and package size. These limitations are clearly evident when we look at the striking advances in production rates and versatility that have been achieved in Carding and Preparation machinery over the last decade, compared to the relatively little progress* in ring spinning production rates.

It is worthwile re-examining the limitations of the ring frame for a few moments, as this throws a lot of light on the objectives of a viable Open End Spinning system.

In ring spinning the twist is inserted in the yarn by rotating the yarn package and the amount of twist inserted is proportional to the ratio of spindle speed to the front roller speed, thereby requiring high package rotation speeds for twist insertion. Basically it is this high speed rotation of the package for twisting purposes that imposes the limits to ring spinning production rates, with the following important consequences:-

1. Excessive power consumption in the spindle/package section.
2. Traveller burning and replacement problems.
3. Control of yarn tension from the balloon related to yarn strength and end breakage rate.
4. Problems in re-piecing broken ends.
5. Fly shedding, windage and lashing of broken ends.
6. Drafting limitation that necessitates a speed frame bobbin creel.
7. The small yarn package capacity associated with limiting the above problems and the consequent high frequency of doffing which results.

The high speed combined twisting and winding rotation of the package is fundamental to ring spinning and it is clear that today's maximum speeds are near the economic limit for this machine.

3. Open-End Spinning

In Open End Spinning, the twisting action is separated from the winding action and the yarn package need only be rotated at the relatively low speed required to wind up the yarn. This is where we find the basic advantage of Open End Spinning which, as shown in Fig. 1, we can define as the process of separating staple fibres from an input feed bunch and transporting them to the revolving open end of a re-assembly and twisting point to form a yarn, which is then wound up as a package.

A variety of physical forces can be utilised in this method of spinning but it is abundently clear that the most practical one is the Aero-Mechanical approach in Rotor spinning as shown in Fig. 2, where fibres are delivered in an airstream into a revolving rotor to form a fibre ring around the periphery. A seed yarn is introduced into the rotor and its tail picks up the fibres lying around the periphery from where they are twisted into the yarn by the rotation of the rotor.

It must be recognised that this is a different physical process to that involved in ring spinning, and as such the yarn produced will have characteristics of its own, which can be summarised as follows:-

1. The twist formation is different.
2. The fibres are less parallel than the case of ring yarn.
3. Up to 20% more twist is required to spin a yarn.
4. The yarn strength is typically 15 to 20% less than ring yarn.
5. On the other hand, elongation is typically 20% higher than ring yarn.
6. Open end yarn has better regularity and better appearance.
7. Open end yarn is cleaner and less neppy.
8. Open end yarn appears fuller and less hairy than the equivalent ring yarn.
9. Open end yarn has better abrasion resistance.
10. Open end yarn has better dye up-take characteristics.

From the above, it is clear that a textile firm has to consider carefully the ranges of products for which the characteristics of the yarn give advantage and it does seem that the firms which will have the greatest success are those which will consider the implications of the open end process right through spinning, weaving, knitting, finishing and marketing.

4. Economics

There is no doubt at all about the economic advantages of Open End Spinning for coarse count carded yarns, even in the low labour cost countries. The extent to which this is true and the point to which the "break even" count with ring spinning can be extended, depends on the savings which can be achieved in the principal variable production costs. These can be summarised as:

Machinery Investment Depreciation
Initial Accessories
Building and Plant Investment and Upkeep
Labour
Power
Raw Materials
Consumables (Tapes, aprons, oil, travellers etc.)
Maintenance.

In the count range 6's to 12's Ne, it can be shown that all these variable costs are lower for open end than for ring spinning. As the count range is extended to say 18's Ne, we then start to rely for our economic case principally on a reduction in labour cost, savings in raw material and the possible elimination of winding, given these factors it is possible to make an economic case up to and possibly beyond 24's Ne. Of course, the wages levels, practical labour productivity, power cost(Kw)in each country have a direct bearing on the equation.

The basic reason for the changing relationship of economic value to yarn count can be appreciated from the following table:-

Count Ne	6	12	18	24
Rotors/900 lb/hr	1200	2100	3900	5900
Spindles/900 lb/hr	5760	9600	13,320	17,316
Ring Sp/Rotor	4.80	4.57	3.42	3.40
Rotor rpm	← 45,000 →			
Twist Factor (say)	← 4.75 →			
Ring Sp.* rpm	8500	9350	11,500	13,500
Twist Factor (say)	4.25	4.25	4.0	4.0

Table 1. Production Comparison Ring-v-O.E.S.

Thus, as the count becomes finer the speed advantage of the Open End machine is reduced and consequently there are relatively higher requirements in investment, space and power.

This arises because Open End production is related directly to count and twist, since essentially it is a constant speed machine, whereas, over the range in question, the ring frame spindle speed is increased and twist factor slightly reduced.

It will be understood that the increases in ring frame speed are achieved at the expense of smaller packages and cannot be increased indefinitely.

In practice, the situation is less simple since with some fibres Open End yarn twist could also be reduced.

We will now consider some of the important aspects of these cost factors and their relation to developing countries.

<u>Investment for Machinery</u>

For the present comparative purposes, we have employed the annual charge method where the Open End and ring spinning machines are depreciated over what we would consider to be a reasonable estimate of economic life; this is 10 years with interest at 8% per year on the outstanding capital - expressed as 10 equal charges.

It has been argued that, as Open End Spinning is a new development, it is subject to rapid further development; hence the investment should be amortised over a life shorter than that for ring frames. We believe that this reasoning is fallacious on several grounds, and if carried to a logical conclusion, would retard a great deal of worthwhile innovation. We believe that the following factors are conclusive:-

(a) For all practical purposes, operating speeds have now settled in the 45,000 r.p.m. region, and it will be some time before any further significant advances can be considered to be commercially viable. Furthermore, there are reasons for anticipating diminishing returns on speed advances: thus economies, although important, will tend to be marginal.

(b) If a textile concern finds that Open End yarn is suitable for its market(s) and for its range of yarn counts, offers important economies in production costs, an investment life for the Open End machine similar to that for ring frames often will reduce risk: subsequent development may reduce its competitiveness, but will make the ring frame even less attractive.

(c) Open End yarn is not simply a replacement for ring yarn - in many instances there are improvements in quality, e.g. cleanliness and regularity, and advantages in the fabric characteristics. These circumstances, plus economies in production costs, describe a typical "early entry" profit making situation.

The "annual charge" method is a useful way of presenting comparative economies in a simple manner but, of course, it ignores the important features of investment incentives, tax relief on interest, taxation on profits and the effects of inflation. D.C.F. (discounted cash flow) is an admirable means of summating these factors but, unfortunately, a hypothetical profit on the yarn would have to be included for present purposes and this, together with the fairly complex calculations required, would make the results appear to be contrived.

Sometimes, we find that simple summations of the operating costs, in terms of £ per year, related to the total investments, is the best way of presenting economic information to a customer. He can then apply his local investment incentives; interest charges and taxation and take his own view on the effects of inflation.

In many developing countries, often there are substantial investment incentives and unusual profit opportunities (protected markets), but these would have to be examined on a localised basis. It can be argued that developing countries should minimize investment and Open End meets this requirement in the coarse count range. Inevitably, there will also be examples where a moderate increase in investment can be justified by economies in other resources.

Building and Plant Investment and Upkeep

Depending on whether a new mill or a re-equipment scheme is being considered, it may or may not be necessary to include depreciation charges for new buildings, but upkeep charges would always be necessary to cover such items as building repairs, lighting, local taxes, air conditioning etc. Often in developing countries, comparative economics are decided in the context of new buildings.

The effect of new building charges is to the advantage of the Open End spinner at the coarser end of the count range, where there is a net saving in floor area as shown in the mill plans (Fig 3). As the count becomes finer, the situation changes and building charges become a disadvantage to Open End Spinning - as before, this cross-over point is dependent on the possible elimination or simplification of winding. This is one area where increases in speed of Open End Spinning would make significant economies.

Labour

Our present experience indicates that labour savings of up to 40% may be claimed for Open End Spinning, mainly due to:

1. The elimination of speed frame labour; here, there are savings in machine tenders, supervision, maintenance and transporting.
2. Reduction in overall labour requirements at the spinning process, due to larger creel and doffed packages, with end breakages taken as the same as those for ring spinning, in terms of breaks per pound of yarn spun.

Count	Open End		Ring Frame	
	Input	Output	Input	Output
8	30	200	180	1,800
12	30	200	180	2,400
18	30	200	200	3,600
24	30	200	225	4,500

Table 2. Packages handled/hr for 900 lb of yarn

3. Elimination of winding labour, again there are savings in both direct and indirect labour.

This saving in labour is a significant advantage for Open End Spinning and we must bear in mind that this ensures an increasing cost advantage as labour costs rise and is beneficial where labour, new to the industry, has to be trained. The elimination of the speed frame and the fact that an Open End Spinner is easier to operate than a ring frame, can make it much easier to train operatives drawn from local labour. Both of these points are important to developing countries as their standard of living improves.

Again, it may be argued that, in many developing countries, one of the reasons for industrialisation is to maximize the number of jobs; however, other factors must be taken into account and some of these, which are discussed later, indicate that the adoption of Open End Spinning may provide the basis for the creation of more jobs in other directions.

Power

If we examine the power requirements of the Open End Spinner and the ring frame in isolation, Fig. 4, over a range of counts, it can be seen that the Open End machine uses less power than ring spinning per pound of yarn, up to approximately 17's Ne. The addition of speed frame power requirements to those for ring spinning, raise the cross-over point to 20's Ne, and the inclusion of automatic winding into the ring spinning system ensures an overall power advantage to Open End Spinning to around 30's Ne count.

It is interesting to examine the factors which determine the pattern of power requirements for the two machines. The Open End Spinner is a constant speed machine and has a fixed power requirement per rotor, regardless of the count spun, since it does not suffer from the constraints associated with ring spinning. It follows from this that the number of rotors and, consequently, the amount of power required for a given production for a particular count, varies in direct proportion to the twist inserted.

Similar reasoning can be applied to ring spinning, except that it is possible, within limits, to increase speed as twist increases, at the expense of the package size. However, there is a balance to be found with other interacting components of costs, which eventually limits this approach and, in finer ring spun yarns, as with Open End Spinning, there is then a direct relationship between production, power and the twist inserted.

Since, at present, we employ a somewhat higher twist factor for Open End spun yarns than is used in ring spinning, the latter system enjoys a "creeping" advantage as the yarn count gets finer, but as we have already seen, this is offset by savings in speed frame and winding power requirements up to approximately 30's Ne.

Since power is often a restricting factor to industrialization, this saving, which is substantial when the coarser yarns are spun, could be very important. It would allow a larger textile industry or diversity of industrialization in other directions - both creating more jobs. For example, the saving over a coarse count ring spinning industry of say 100,000 spindles on average 12's Ne yarn, could be over 2,500 Kw/hr, or 15 million Kw per year.

Raw Material

In a conventional spinning mill, standard waste losses are budgeted for at each stage of processing and vary, to some degree, according to the type and quality of the cotton used. For our purpose it is sufficient to note the losses which occur at the machines which we are eliminating by the substitution of Open End Spinning for ring spinning and at the spinning process itself.

Waste losses at both the speed frame and the winding process are usually recognized to be 2% at each machine and we are confident that a further saving over ring spinning of 1% can be achieved at the Open End Spinner.

When planning a mill for a final spun weight, sufficient preparatory machinery is installed to cater for all waste losses. It is possible, therefore, that in some instances, depending on the size of the installation, that a reduction in the preparatory equipment required will be possible with Open End Spinning, taking account of the overall waste savings. This would, of course, reduce investment for preparatory machinery and space requirements.

Hard waste, mainly produced in winding, which cannot be re-worked, is sold to waste merchants at a price much lower than the raw cotton, so that any reduction is a direct saving on the raw material cost of the yarn. Since economic utilization of waste is difficult in many developing countries, where associated waste textile industries are non-existant, this is an important factor.

Trash in the input sliver is a source of difficulty in Open End Spinning and it was, at first, thought that it might be necessary to restrict the use of Open End Spinning to the cleaner and more expensive cottons. However, we are fortunate in having developed a trash extraction attachment, which is unique to our Open End machines, and it is now possible that some spinners, by exploiting this feature could make substantial savings by spinning from lower grades of cotton. This is important in saving monetary exchange reserves if the fibre is imported and equally important if part of the cotton crop is exported.

These quality aspects of an Open End spun yarn, using an efficient trash extraction system, can be of considerable importance to a developing country, which is involved in exporting cloth. They can be used to achieve either a premium fabric or open up new export markets by virtue of the improved fabric appearance and cleanliness - once again we have the possibility of more jobs.

Comparative Economics

Table 3 below shows an economic comparison between our single sided Open End Spinner (Type 883) and ring spinning on 12's Ne yarn.

Count 12's Ne (20.3Nm)

Production 900 lb/hour, 6,000 hours per year.

Plant Required	Open End	Ring
Blowroom	1	1
Cards	14	14
Draw Frames		
1st Passage	4	4
2nd Passage	4	4
Speed Frame Spindles	-	383
Spin Spindles/Rotors	2,100	9,600
Auto-wind Spindles	-	200
Capital Cost	£627,639	£680,000
Building Area	* 54,500 ft^2	88,500 ft^2
Labour		
Number Spinning	85	107
Number Winding	-	32
	85	139
Variable Costs p/lb		
Investment	1.74	1.88
Labour	1.26	2.06
Space	1.01	1.00
Power	0.43	0.66
Others, incl. waste diff.	0.30	0.58
TOTALS	4.74	6.28

*

Table 3. Economic Comparison

In this comparison, the following assumptions have been made:-

Labour £0.4 per hour, with productivity 0.75 x West European Standards.

Machinery depreciation at 10 years and buildings at 20 years with interest at 8%.

Power 0.8p per kw/hr.

The trend of variable costs can be seen from Figure 5: the results conform with the information previously given.

5). PLATT OPEN END SPINNING MACHINES

As we have seen, there are a number of requirements that have to be met by an open end spinner for it to be a viable proposition in the areas that we are discussing, and I would like to look briefly to see how these various requirements of the process are met in the Platt machines.

In the Platt "Rotospin" machines, the sliver is presented to the spinning head from cans, standing either below or behind the machine, depending on the machine type. More will be said about the two designs later.

For optimum results, the input material should normally be fed to the spinner in second passage drawframe sliver form, so as to ensure uniformity of sliver regularity and good fibre alignment. We would normally specify that the sliver be of a weight to give a total machine draft in the range 80 to 100, that is having a hank of 0.10 to 0.20 Ne.

The sliver is drawn into the spinning head by means of a feed roller, operating against a spring loaded feed pedal, and is passed to a rotating beater. This beater is covered with metallic card wire, having a tooth form most suited to the fibres to be handled. It is our experience that this means two tooth forms must be available, one for cottons and one for synthetic fibres.

The rotational speed of the beater can be varied in order to establish good opening and feeding characteristics, without causing excessive fibre damage or other forms of fibre degradation. In practice, this optimum speed is usually established by spinning a number of yarn samples at different beater speeds and selecting that speed which gives the yarn of best characteristics and appearance.

Besides opening the sliver into individual fibres, the beater also performs one other very important function - that of removing entrained trash in the material fed to the machine, in the case of cotton, the neps, seed and other foreign matter, and with synthetics, bunches of fibres tightly stuck to each other.

The incorporation of such trash removal facilities, is a standard feature on both Platt O.E. Spinners, which has done much to enhance their operational characteristics and made it possible to introduce open end spinning into the whole range of cotton processing. Foreign matter mixed with the fibres is the most usual cause of end breaks, so clearly, therefore, its removal is of paramount importance, particularly when dirty cottons have to be processed. Just how effective this trash removal is can best be judged by examining the contents of the trash filter box into which the debris is passed, the improved spinning performance of the machine, as determined by the much lower end breakage frequency and, lastly, by the much cleaner appearance of the yarns and fabrics produced.

Now that trash can be removed from fibres satisfactorily, materials to be processed on Platt machines do not have to be specially selected for cleanliness. It goes without saying, however, that as much impurity as possible should be removed during the preparatory stages, that is in the Blowroom, during fibre opening, and subsequent carding.

Once the fibres have been opened by the beater, they are passed down a feed tube by a flow of air to the spinning rotor. The tube is tapered so that the air is accelerated, a feature which helps to straighten out the fibres before they reach the rotor. Further straightening occurs as the fibres attach themselves to the rotor wall, as its peripheral speed is greater than the fibre velocity.

In designing the Platt machine, very careful consideration has been given to the function to be carried out by the spinning rotor, and in particular to its shape. In the first case, we call it a rotor and not a turbine, as the rotor containes no holes and therefores does not pump air. In the Platt machines, the air flow required to transport the fibres from the beater down the feed tube, is generated by an external suction unit, thus enabling the best aerodynamic characteristics to be chosen for optimum spinning performance. Considerably less power is therefore required to be transmitted from the tangential belt to the rotor, with the result that wear of the driving belt and bearing loads are much reduced and speeds of 45,000 are a practical proposition.

A further advantage is that an air flow is available when the rotor is at rest, so that when an end break occurs, the residual fibres in the collapsed fibre ring are automatically sucked to waste from the spinning rotor, and do not have to be cleaned out manually by the operative.

Also, it is our view that holes only weaken the rotor machanically and this is a particularly important consideration in components rotating at 45,000 rpm. Besides this, because there are no holes, air does not flow across the spinning groove, and out through the rotor base. Instead, it passes down the feed tube with the fibres and then to exhaust over the rotor's edge, taking with it dust and debris which would otherwise accumulate in the spinning groove. Consequently, our design results in a cleaner spinning system, which not only requires less attention from the operator, but also it is one which cannot be starved of air, as is the case when the holes in a rotor become clogged with fibres. When this occurs, poor quality yarns are always produced.

Platt machines are designed to operate continuously at 45,000 rpm and, more recently, even as high as 47,000 rpm rotor speed, without degradation of yarn quality. While the yarn produced is of slightly lower strength than a corresponding ring yarn, its better extensions means that approximately the same work is required to rupture both yarns. Consequently, during subsequent weaving and knitting operations, end breaks are no more numerous than when conventional ring yarns are used.

O.E. yarn is pulled from the spinning rotor by means of a pair of delivery rollers, through what we term the doffing tube. Much work has gone into the design of this component to make it possible to spin at minimum levels of twist. This is, of course, important for at a constant rotor speed, the lower the twist the higher the delivery rate.

Returning then to the spinner, the formed yarn, after passing through the delivery rollers, passes over a stop motion to the packaging system. This incorporates a pattern distributor to ensure that good stable packages are wound, free from cob-webbing. The packages are parallel sided and can be produced either 4½ or 7½ lbs (2 or 3½ Kg) in weight, depending on the type of machine.

As has already been mentioned, Platt offer two designs of short staple open end spinners, as shown in Fig. 6. The "ROTOSPIN" Type 883, of single sided construction, with a down spinning configuration, spinning from large cans up to 20 ins dia x 48 ins high (50 cms. x 120 cms) standing under a gantry type creel behind the machine; and the Type 885, a double sided machine with an up-spinning configuration, but utilising smaller 12 ins dia x 30 ins high cans (30 cms x 76 cms), standing under the machine.

While both the Type 883 and 885 employ basically the same design of spinning head, and spin fibres up to 40 mms in length, there are two essential differences. Firstly, the Type 883 can be supplied with up to 100 spinning heads (5 sections of 20) and the Type 885 with up to 140 (that is, 5 sections of 28 heads). Secondly, the difference in can sizes; those used with the type 883 are of a height and diameter that conventional preparation machinery already in a mill can be employed; while those used with the Type 885 are smaller. This is a design feature to reduce the space occupied by the machine, but it does mean that a small can drawframe, such as our Mercury Type 743, must be employed during the second passage of drawing. Both machines incorporate yarn length indicators, which can be pre-set to operate a flashing light when the machine must be doffed, and stop-start facilities, which automatically carries out a piecing operation, simultaneously at each head, when the machine is started up from rest.

Special care has also to be exercised in the design of the machines to ensure easy operation and maintenance. The beater can be taken out by the removal of a face plate and one locking screw. In the event of a fault in the spinning head, this can be quickly removed for inspection and servicing and

and a replacement head fitted; and gears which have to be changed to alter spinning performance are neatly housed in one of the end casings, and so arranged that only one gear wheel has to be changed to alter twist and another, the overall draft of the machine.

A wide range of fibres can be spun on the Platt machines, though these have been unconditionally released only for cotton. With regard to synthetics, the situation is more complex, in view of the vast range of materials finishes, crimp ratios, deniers and fibre lengths available to the spinner today. Many fibres have been developed specially to give optimum spinning performance on the ringframe. In some cases, therefore, they may not spin well on the open end spinner. Much work to resolve this situation is, however, being undertaken, both by the fibre producer and the machinery manufacturer, and progressively the range of fibres suitable for open end spinning is being increased.

Rayons, polyamides, acrylics and polyester fibres have been successfully spun on our machines, both in 100% form and blended with cotton. Limitations however, do apply as there are many differences to be found in similar fibres supplied by different fibre producers. In cases, therefore, where machines are required to spin fibres other than cotton, it is still our policy to recommend a test spin to prove that the fibres will process satisfactorily. We feel that such a course of action is of particular value to the customer, for it provides him with the opportunity of making up the O.E. yarn into the end product, and proving that the properties of the yarn are suitable for the proposed application.

Many end products have been made from open end spun yarns. It is well known that O.E. yarns are generally fuller and more voluminous than ring yarns. They have better dye uptake properties, resulting in the speed up of the dyeing process and in the reduction of dyestuff costs; and, frequently, fabrics made from the open end spun yarn prove to be more resistant to wear by abrasion and to pilling. Most important is the regularity and the absence of nep and trash on the yarn surface.

Consequently, the yarns and finished fabrics, in certain cases, can command price premiums. Sales of O.E. fabrics, both in woven and knitted form, are known to have been made in dresswear, furnishing, shirting, towelling, table-cloths, bandages, sheetings and denim and coated fabric applications. Many more will undoubtedly be found as the use of open end spinning machines becomes more widespread.

6) Conclusions

From what has been discussed, it is clear that there are considerable opportunities for open end spinning in the developing countries. We do not accept the view that developing countries should only adopt the simpler industrial techniques as this analysis has clearly illustrated the fact that there are good grounds for examining each situation on its own merits.

At first, it might have appeared that Open End Spinning, which economises on labour, was a prime example of an advanced technology, not applicable to countries with low wage levels and where the creation of job opportunities has an over-riding priority. It has been shown that the investment for Open End Spinning can, for some yarns, be less than for conventional equipment when full advantage can be taken of its high speed potential and where it eliminates other processes. In itself, it reduces the size of the work force, but where it releases other scarce resources (e.g. power) it can help in diversification of industry. Economy in the use of raw fibre and wastes can have an important part to play in saving foreign exchange.

The comparison of economic viability is not easy because of the great variability of circumstances and the figures shown can only be regarded as being indicative of typical situations. Any complete equation for a particular country should take into account other factors, such as the superb quality of certain products made from Open End yarn and the effect on competitiveness in both the home and export markets.

As well as the economic advantages in the open end spinning process itself, the other factors I have raised of power saving, waste savings, ease of training and simplicity of operation, are significant incentives for its adoption. In addition, I think that one of the most important factors is the exploitation of the yarn and fabric characteristics.

With our system, which will accept the whole range of cotton types, there are real possibilities for the developing countries to produce yarns from their existing cottons, which will give the possibility of savings either in upgrading the cotton or yarn, or to produce improved fabrics and to thereby enter new home and export markets.

It does seem that the process may best be exploited by the vertical concerns who can control the progress of the yarn from fibre selection right through to the weaving or knitting and, preferably, finishing stages. The mill who is selling yarn on cone or cheese would have to make sure that his customer was fully informed about the characteristics of the yarn and the end uses for which it is suitable.

It is, no doubt, true that in the past some unsuitable industrial equipment has been installed in developing countries, but it is also true that the ready acceptance of new textile production techniques has played a great part in the development of many countries. The introduction of ring spinning, automatic looms and automatic winding have posed problems, similar to those I have discussed today. Wherever, they were neglected, because of "Narrow Economics", or other reasons, there has been cause for regret.

The open end machinery is available and proven - it is now up to the developing countries to carefully study the opportunities that this presents.

This leads to my final point. We have concentrated, in some detail, on the case for Open End Spinning and I trust established some worthwhile opportunities.

What we should not forget is that the Open End Spinner is not a complete replacement for the Ring Frame. Both machines have a place in the spinning field and each must be judged on its merits.

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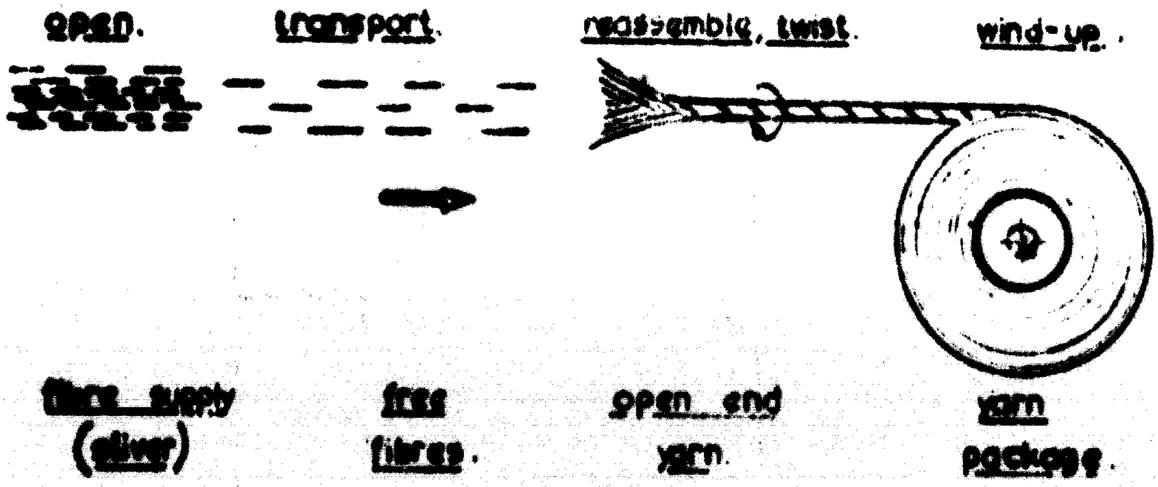


FIG I OPEN END SPINNING

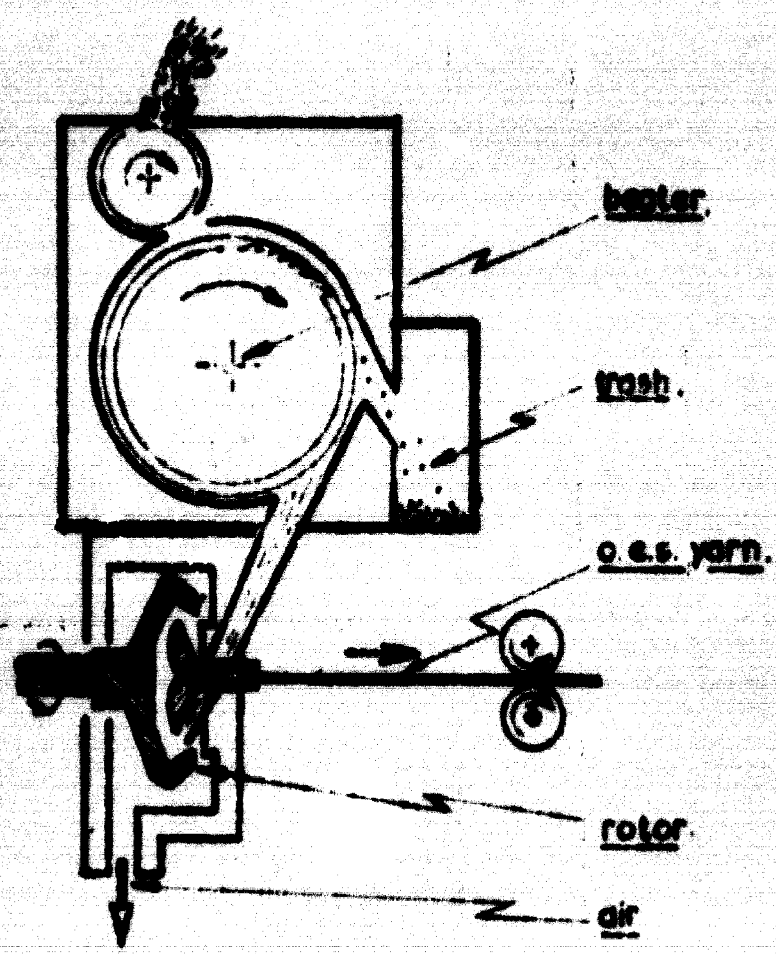


FIG 2 O.E.S. ROTOSPIN

(diagramatic)

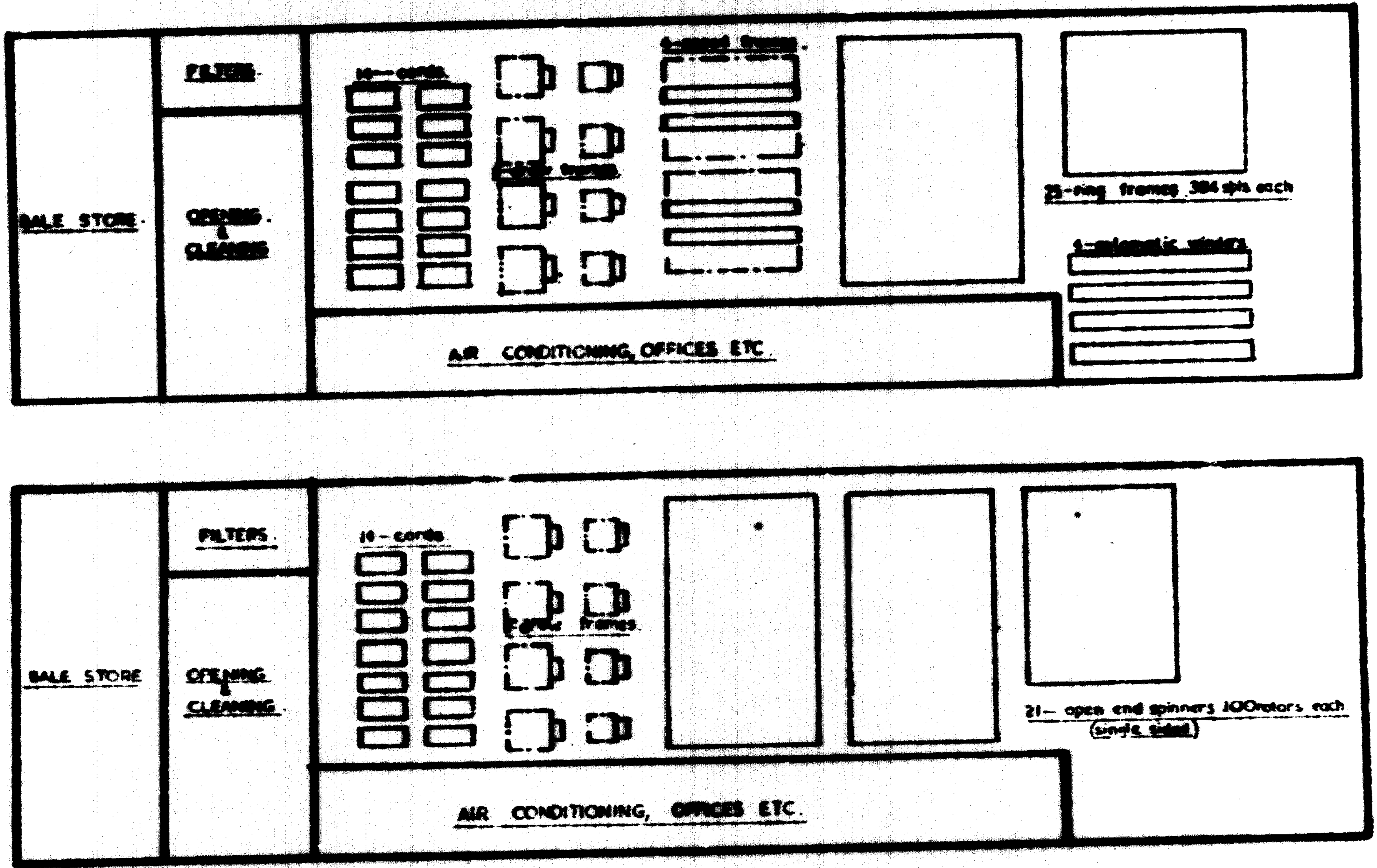


FIG 3. MILL PLAN SPACE COMPn

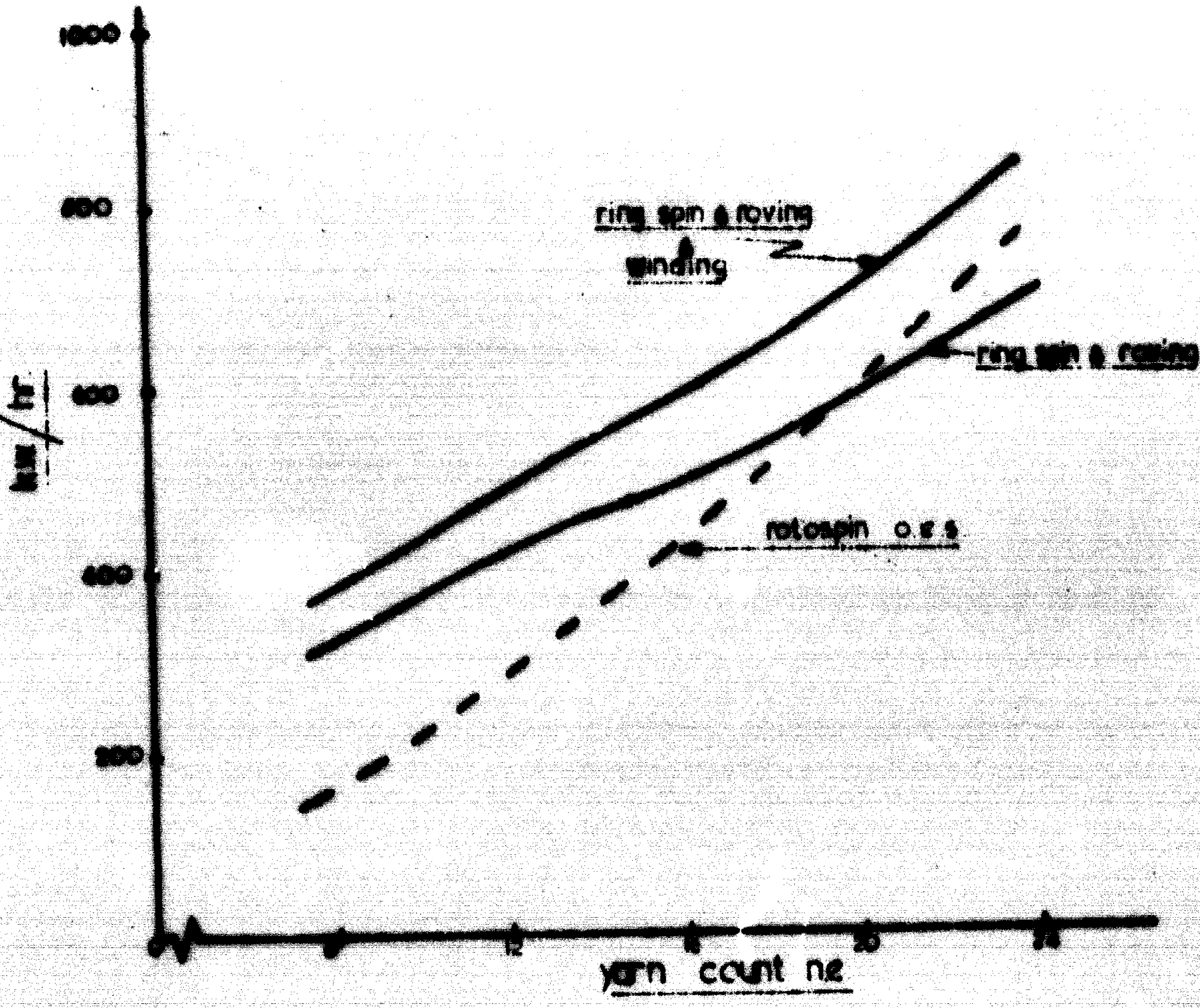


FIG 4 POWER REQUIRED PER 900 lb/HOUR.
KILOWATTS.

unido.paper fig 4

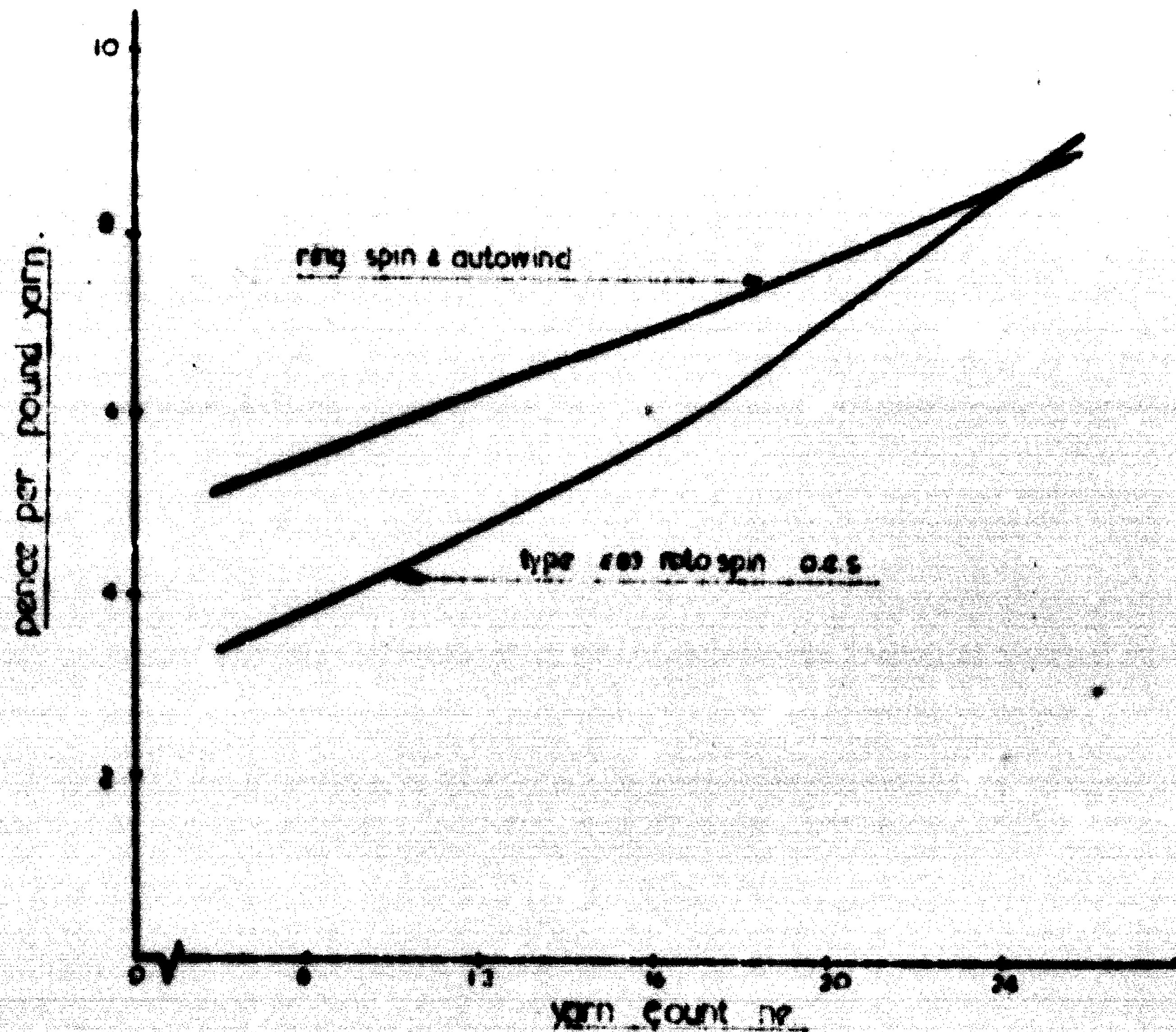
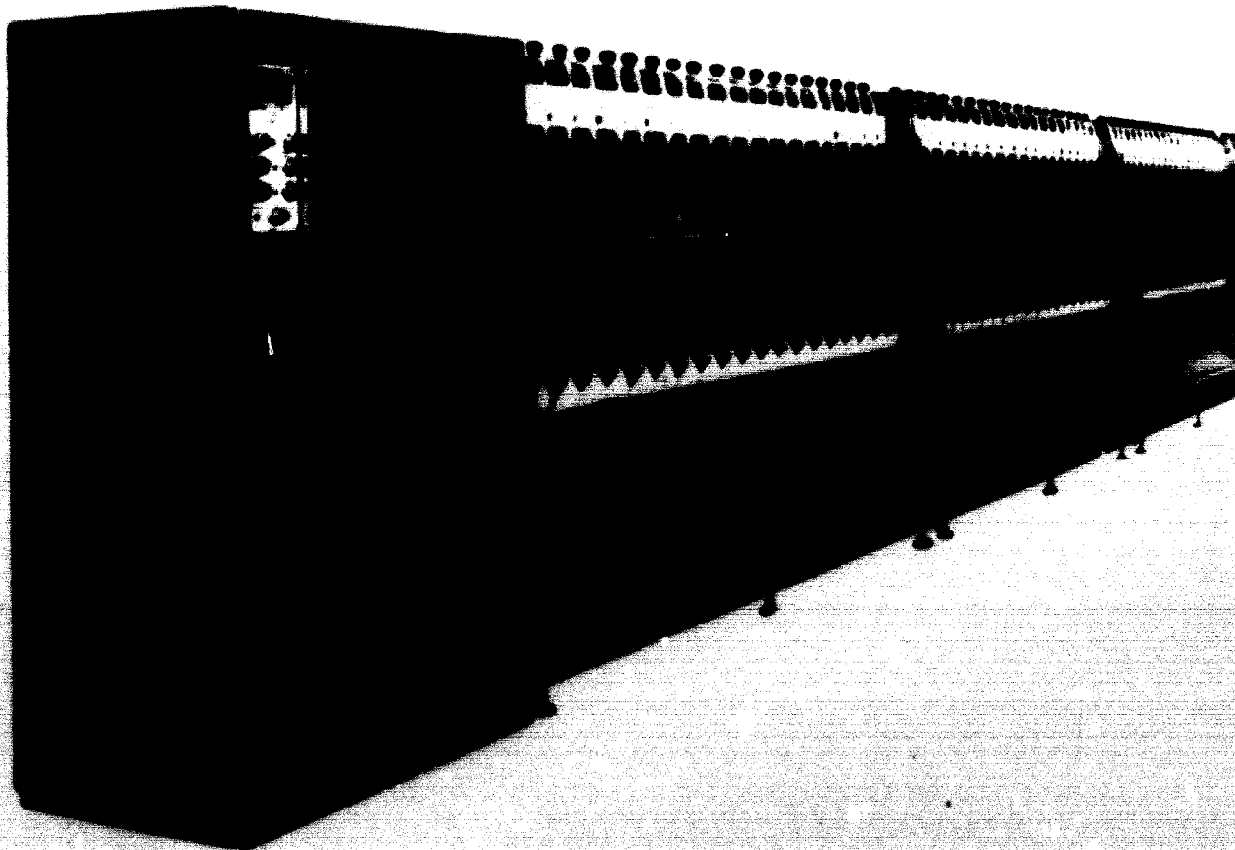


FIG 5. VARIABLE COSTS PENCE/lb YARN



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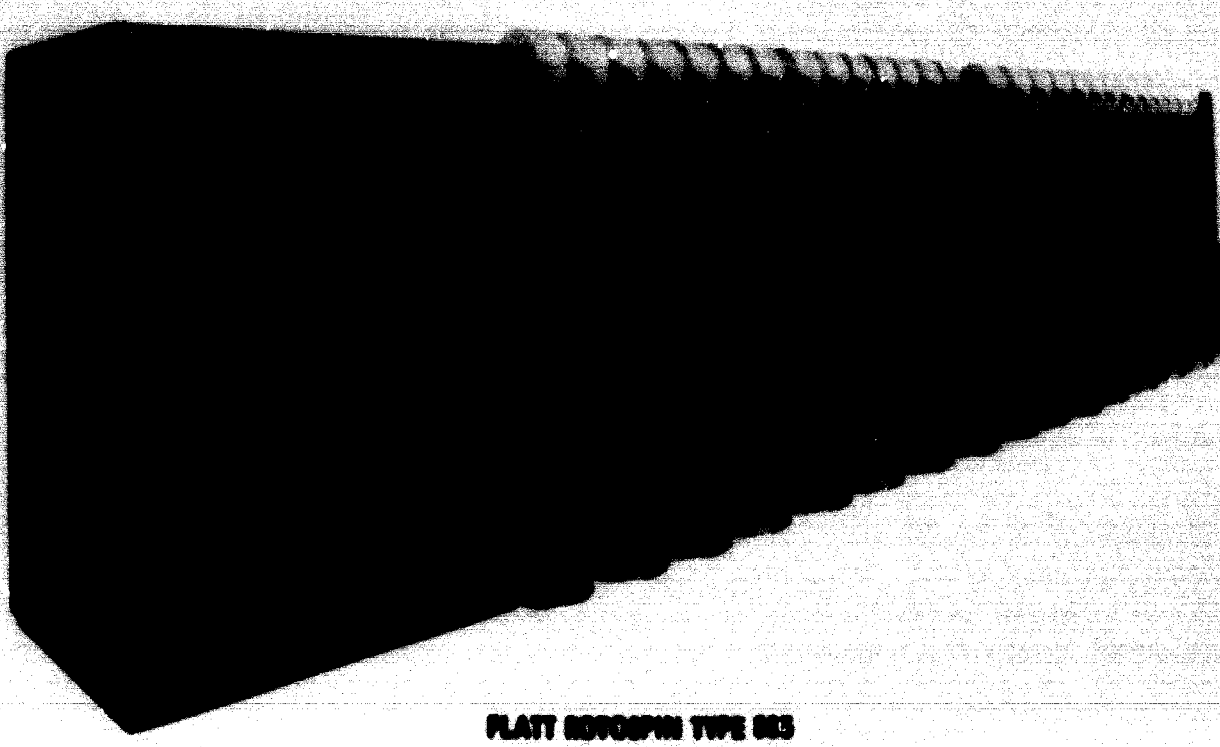
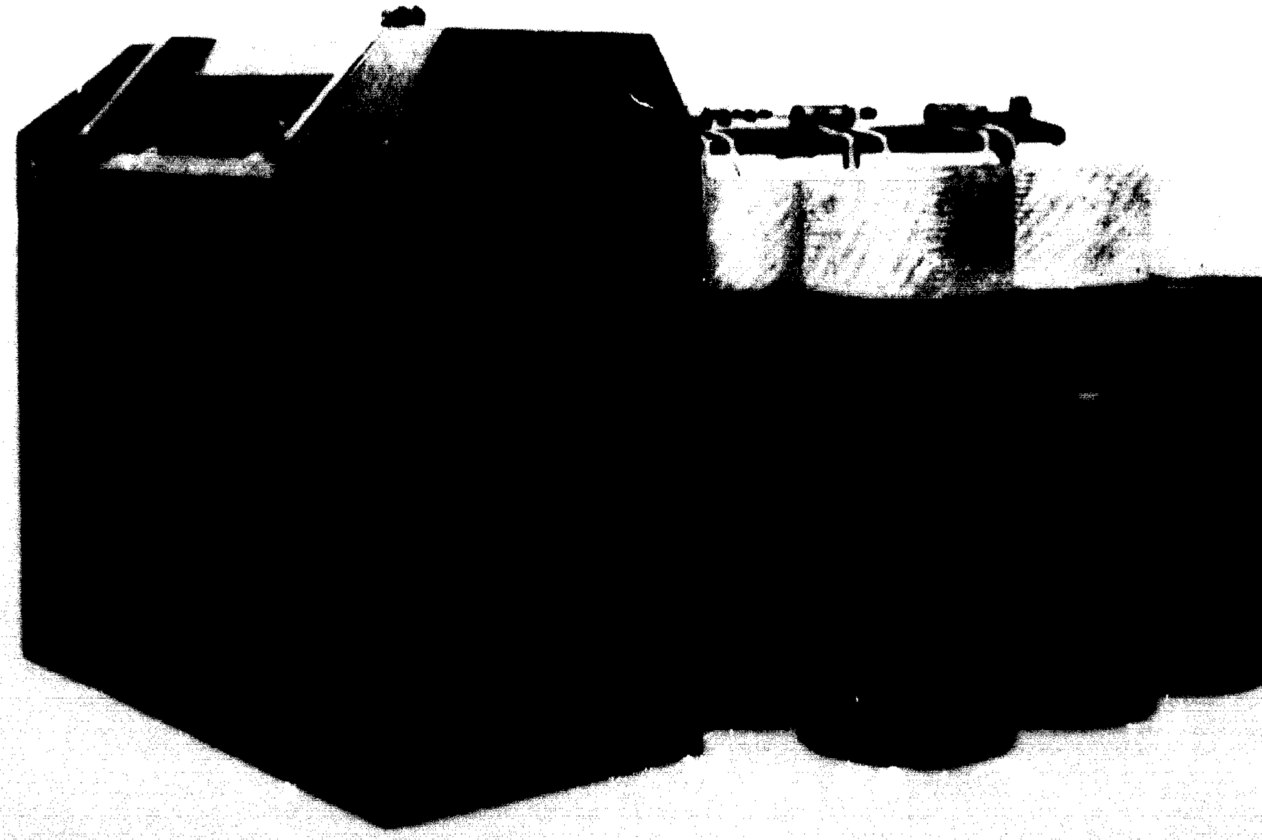


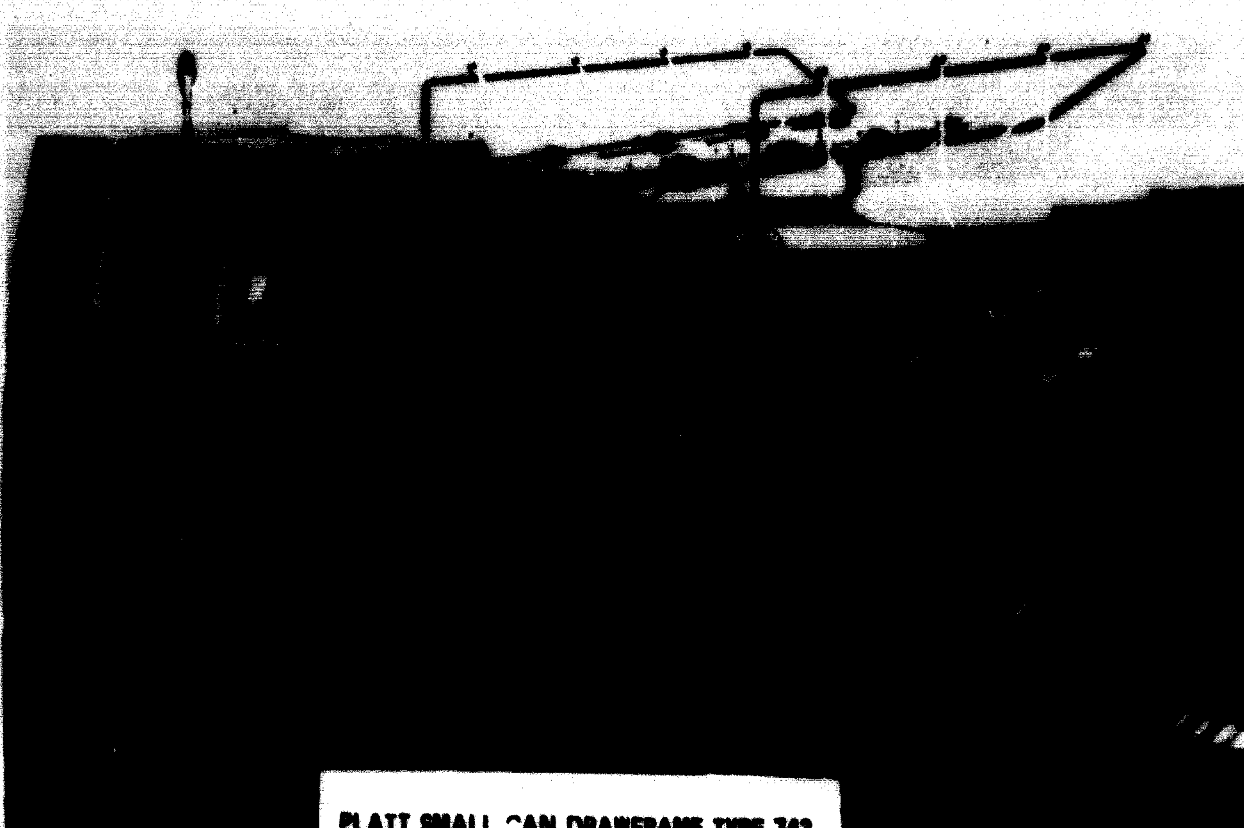
PLATT ROTOSPIN TYPE [illegible]

FIG. 6a OPEN END SPINNERS

U.N.I.D.O. PAPER FIG. 6 a



PLATT GLOBE DRAWFRAME TYPE 7[illegible]



PLATT SMALL CAN DRAWFRAME TYPE 743

FIG. 6b DRAWFRAMES FOR O.E.S.

U.N.I.D.O. PAPER FIG. 6b

31.7.74