

Design Modification and the Process of Technology Transfer.

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ABSTRACT

Industrial development of emerging nations is to a great extent hampered, because of shortage of capital, technological know-how and that of the production facilities. The transfer of plants has failed to achieve the desired effects, because of heavy burden of spare parts, even due to its non-availability. This paper shows one of the means to improve the process of technology transfer. It is suggested to modify and adapt the design of products.

1. Introduction :

Third world countries like Bangladesh depends to a great extent on the spare parts from the developed countries costing millions of dollars. Because the life span of the machines in the developed countries is becoming shorter and shorter, the availability of the spares has become a great problem. Even recently this poor and capital-shy country had to spend more than 480 million taka annually to import spares for the jute, textile and sugar industries only. The amount is increasing due to the price spiral of the exporters.

If this money could be saved by manufacturing the spares inside the country, it would bear the following advantages :

1. Reduction of burden on foreign exchange and thus on national exchequer.
2. Increase the GDP
3. Improvement of the utilization of the production facilities.
4. Reduction of the scheduling and the inventory problems.

Fortunately the Government and the planners are seriously thinking about import substitution. But

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the local manufacture of spares and simple machineries has its problems. A solution to certain problems will be put forward in this paper.

2. Problems of the local manufacture of spares and simple machineries and the solutions.

Such problems may be listed as follows :

1. Spares manufactured locally must satisfy the functional demands. The problem is not difficult in the case of locally manufactured machineries.
2. Problems of copying.
 - i) Because of same or similar design, the same manufacturing processes are necessary. In most of the cases the required production facilities are not available.
 - ii) Use of same material may not always be economic.
 - iii) In many cases, the same skilled manpower as of the originating country is necessary.
 - iv) Because of limited demand, the use of the same manufacturing process is usually not economic.
 - v) International patent right.

Hence any venture of import substitution by local manufacture of spares and simple machineries without any systematic planning may not achieve the desired result. Though, on one side, the production facilities in our factories have a time utilization of 50-60% [1, 2] or even less, we cannot manufacture many of these products, because of balancing problem. For example, one particular machine is necessary for the manufacture a product, the factory does not possess it. Another factory, which has it, cannot utilize it fully.

One possible suggestion could be the change in design of the product before its local manufac-

ture. Its functional capability will not be changed, if it is so necessary,

That design is very important for the manufacturing industries has been established in [3]. The modified manufacturing system theory clearly shows the zone of influence of design. Beitz [4] has also shown that the design (department) influences appx. 70% of the product cost.

The local design of the products will, without any failure, have to take the existing constraints into account. Thus it will make best possible use of available production facilities, the technological know-how, the market demand and the available raw materials. The ultimate goal will be to reduce the problems of local manufacture of these products to a minimum.

3. Adoption of certain Products

3.1, Crankshaft for jute machinery.

It is estimated that the jute mills of the country need 1500 pieces of crankshafts annually. To get the advantage of the continuous grain structure the crankshafts are forged. The local manufacturer, who did not have any forging machine, tried to copy out the same. Fig. 1 shows the flow of production of the crankshaft.

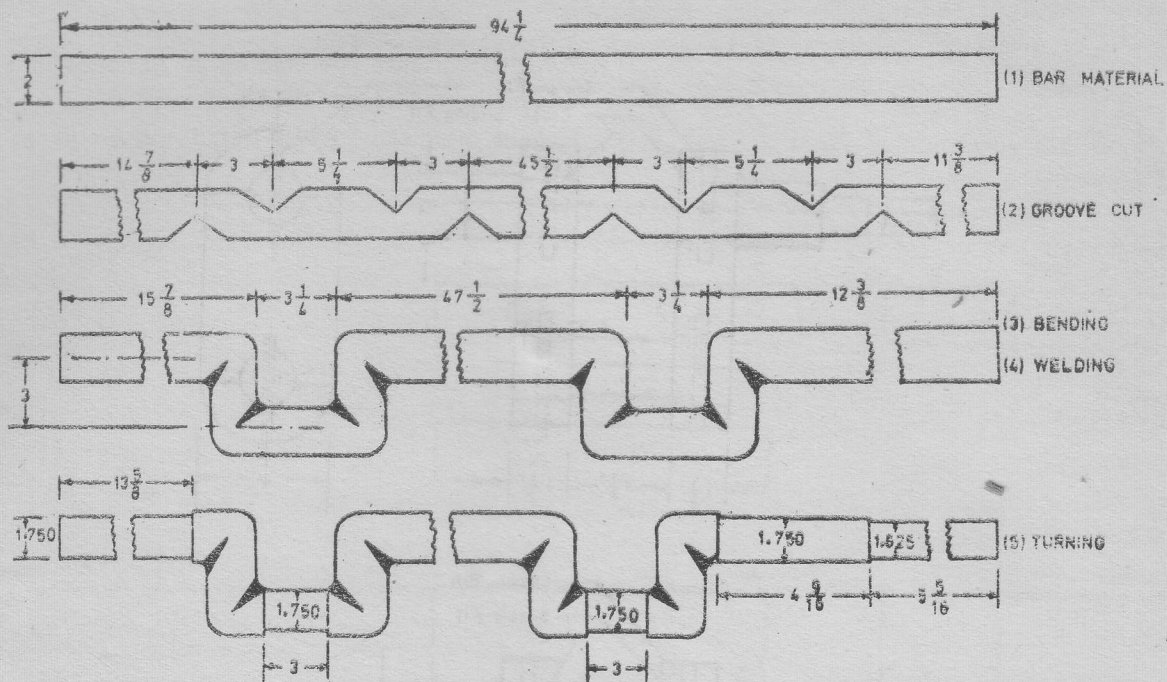


Fig. 1. Old Design of Crankshaft.

The involved processes are

1. Cutting upto size.....(Power saw)
2. Facing(Lathe)
3. Cleaning and marking
4. Groove cutting(Planer or shaping machine)
5. Heating and bending(Oven, manual)
6. Welding the joints.....(Welding equipment)
7. Turning(Lathe)
8. Milling the keyways.....(Milling machine)

The manufacturing method is time consuming (appx. 40 hours per unit) and costly (Taka 1500 per piece). Added to this, the crankshaft did not have the desired life, because it often failed at the welding joints (fig- 1).

On investigation it was found that a typical narrow loom is powered by 1.5 hp. motor and the crankshaft rotates at 120 rpm. Because of this slow velocity, the frequency of dynamic stress on the shaft is low. Hence it may not be necessary to design it as a single piece. The modified design is presented in fig. 2 and fig. 3-

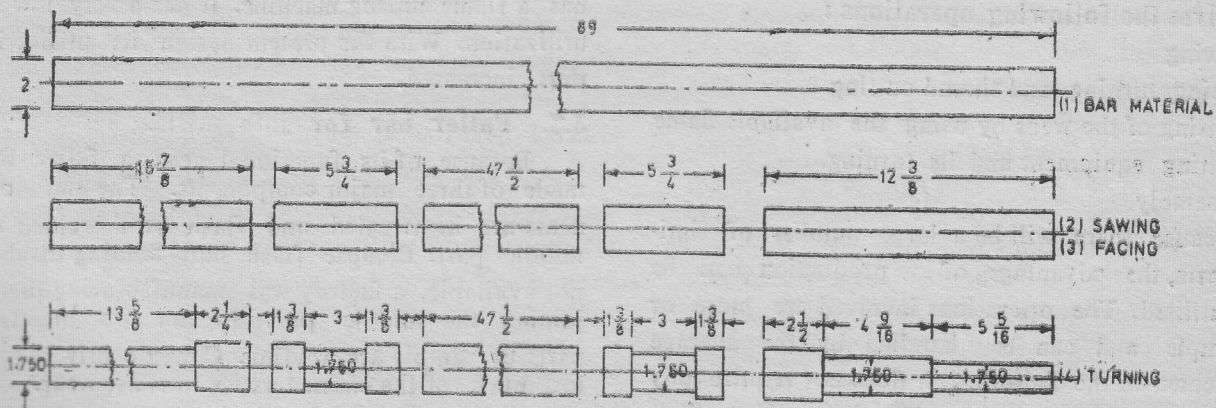


Fig. 2. New design of crank shaft (without crank part).

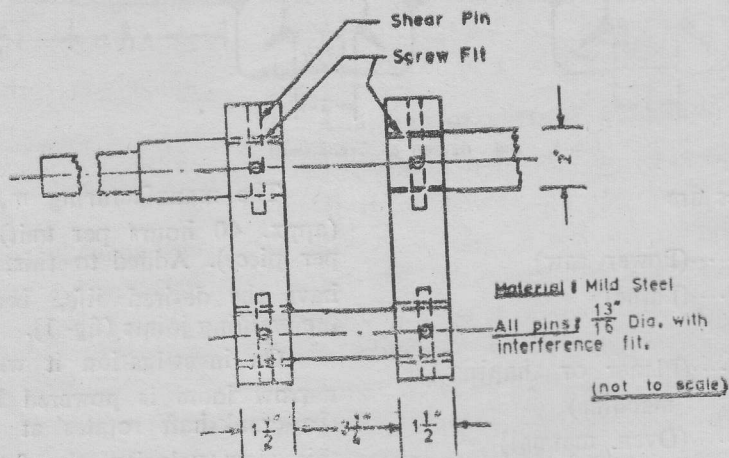
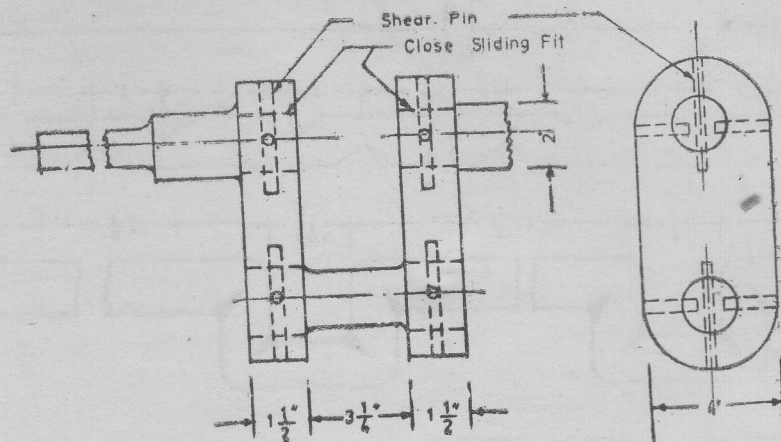


Fig. 3. New design of crank shaft (crank part).

It involves the following operations :

1. Sawing
2. Facing, turning and thread cutting
3. Cutting of the webs by using the available flame cutting equipment and its turning.
4. Assembly

Because there will be a large number of similar parts, the advantage of lot production can be easily utilised. The operations involved are more or less simple and can be handled by the average machinemen in the factories. It does not require any additional production facility. The factory in which the crankshafts are proposed to be manufactured,

has a flame cutting machine. It has a very low time utilization. With the present design its utilisation is thus increased.

3.2. Faller bar for jute mills.

Because of its functional need, a faller bar is made of three major components. The end components are heat-treated and flash butt welded to the middle part. Because flash butt welding machine is not available, a factory was manufacturing them by joining the middle part to the two heat-treated parts by simple arc welding. Consequently the parts lost much of the characteristics to resist wear.

Consultants proposed a flash butt welding machine [5]. But the total volume of work involved

in the production of faller bars and other parts does not justify its purchase. A modification in the design of the faller bars (fig. 4) has been sugges-

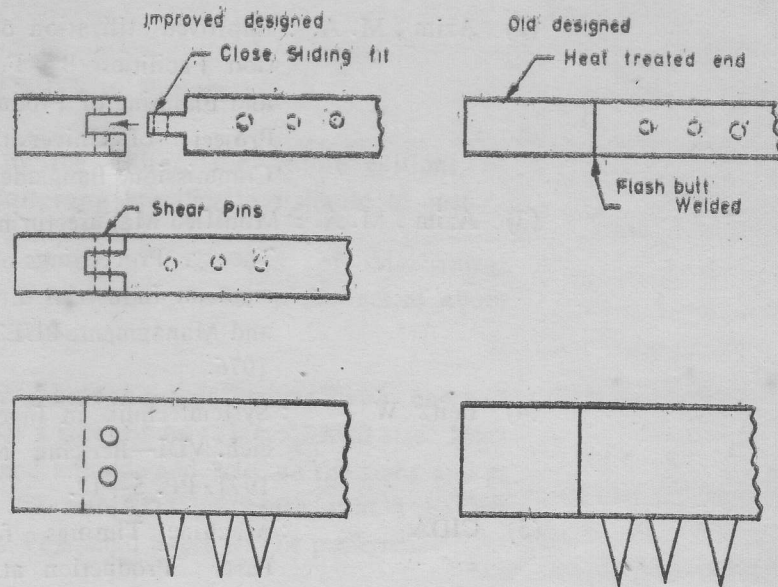


Fig. 4. Faller bar design.

ted, which does not limit its function and does not require any additional production facilities.

4. Conclusions

The industrialisation of developing countries has also its inherent problems. The technology transfer in the way of plant transfer, in many cases, does not bring forth the desired results. The two important reasons are wide gap in the technology, which is ever increasing and the capability to absorb the imported technology. Thus production facilities and machineries remain out of commission because they cannot be repaired locally. Parts are to be sent abroad, so that they can be reworked and made usable. Spare parts are to be imported. Consequently the budget for the maintenance and for the spare parts is swelling up and up.

The procurement of spare parts has also become more and more difficult. Firstly, because of shorter life span and change in model, the manufacturers

do not make many parts any more. Secondly, because of subcontracting and linkage effect, it is becoming practically impossible to trace the original manufacturer of the parts. This adds to the profit margin of the middleman.

One way out of this dilemma is to manufacture the spares and simple machineries locally. There is also hindrance to it. The necessary production facilities may not be available in the country. But the demand of such spares may not economically justify the purchase of such machineries, as it has been shown here. Consequently it may be of use to modify the design of spare parts and simple machineries, so that they can be manufactured within the country.

As a result, not only the burden of the foreign exchange will be lighter, but also the gap in technology will be reduced. It will facilitate the transfer of technology, which is so urgently needed for the development of emerging nations.

Reference

- (1) Azim , M. A. : Utilization of Machine Tools in Bangladesh, Mechanical Engineering Research Bulletin Vol. 1 (1978) No. 1 , PP. 19—26.
- (2) Azim , M. A. : Improved utilization of production Facilities by Forecasting and Planning of Product—Mix. Project of University Grants Commission, Bangladesh, 1978.
- (3) Azim , M. A. : Modified Manufacturing System Theory, Proceedings of Symposium on Industrial Engineering and Management, BUET, Dacca, 1976.
- (4) Beitz W : Systemtechnik in Ingenieurbereich, VDI—Berichte Nr. 173, 1971, PP. 5—12.
- (5) CIDA : Machine Timings for spare Parts Production at, Galfra Habib Ltd, 1977 .