

GOVERNMENT OF INDIA
MINISTRY OF HEAVY INDUSTRIES
DEVELOPMENT WING

FINAL REPORT
OF THE
MACHINE TOOL COMMITTEE

सत्यमेव जयते

August, 1956



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INTRODUCTION

1.1 The Government of India in the Ministry of Commerce & Industry by their Resolution No. E. I. 23 (19)/55, dated 14th January 1956, announced the setting up of this Committee in order to consider the problem of the development of the Machine Tool Industry in all its aspects. The Resolution reads as follows :—

1.2 The Government of India consider that progress in the development of the Machine Tool Industry in India is far too slow in relation to the present and future requirements, and there exists an urgent need for infusing a dynamic development programme in this vital industry. In order to consider the problem in all its aspects, they have decided to constitute a Committee consisting of the following :—

MEMBERS

1. Prof. M. S. Thacker, Director, Scientific & Industrial Research (Chairman).
2. Shri M.K. Mathulla, Joint Secretary, Ministry of Production.
3. Shri S.J. Shahaney, Assistant Director-General of Ordnance Factories, Ministry of Defence.
4. Shri L. T. Madhani, Joint Director, (Mechanical Engg.) Ministry of Railways.
5. Shri K.S. Raghupati, Deputy Secretary, Ministry of Iron & Steel.
6. Shri P. N. Batra, Director of Supplies (Railway Stores), Directorate-General of Supplies & Disposals, Ministry of Works, Housing & Supply.
7. Shri N. Krishnaswamy, Development Officer, Ministry of Commerce & Industry.
8. Shri S. L. Kirloskar, c/o The Mysore Kirloskar Ltd., Harihar.
9. Shri D.S. Mulla, c/o The Investa Machine Tools & Engg. Co. Ltd., Bombay.
10. Shri R.K. Gejji, Development Officer (Tools), Ministry of Commerce & Industry (Secretary)

} Representing the Indian Machine Tool Manufacturers' Association.

*11. Mr. John D. Elliott, Technical Expert from U.S.A.

*12. Mr. A. Stradella, Technical Expert from Italy.

*13. Shri G. R. Damodaran, M.P.

* Shri G.R. Damodaran, M.P. was nominated as an additional member as from 24-3-1956. Mr. John D. Elliott and Mr. A. Stradella were assigned to the Committee as Technical Advisers from 24-1-1956 and 15-3-1956 respectively.

1.3 The Committee will examine and report *inter alia* on the following points :—

Terms of Reference

1. To review the existing capacity to manufacture machine tools in the private and public sectors and study their plans for further expansion.
2. To assess the country's requirements of machine tools in the different categories and determine the gap between requirements and present manufacturing capacity.
3. To investigate causes responsible for impeding faster development of the industry and suggest how they can be eliminated.
4. To suggest ways and means of utilising the existing capacity fully and developing it further to meet the requirements of the country for machine tools, as assessed by the Committee and to report whether, after ensuring such full utilization, there is any necessity to set up new units—and if so to indicate the size and scope of such units.
5. To review the existing capacity to design machine tools, to survey the facilities available for training machine tool designers and to suggest ways and means of helping the industry in securing training facilities at home and abroad for such staff.
6. To study the range of general purpose machine tools required by the various Departments of Government with a view to standardising to the most widely popular requirements, and to examine the feasibility of other Government Departments using similar machines and adopting them as their standards. In carrying out this examination, the Committee will take particular note of the standardisation work already completed by the Railways.
7. To suggest the machinery for laying down the standards of performance and the specifications for inspection of the final product in order to ensure that the product measures up to the required quality, and to recommend the most suitable organization for testing and certifying the products as conforming to the prescribed quality specifications.

8. To investigate and report on such other matters as the Committee may think fit regarding the development of the Machine Tool Industry in India.

WORKING OF THE COMMITTEE

2.1 Meetings The Committee held five meetings in Delhi, one in Bangalore, and one in Bombay.

2.2 Sub-Committees The Committee appointed the following Sub-Committees to facilitate work :—

1. Sub-Committee No. 1 to recommend standardisation of sizes and varieties of alloy-steels required in the manufacture of machine tools—Convener : Shri D. S. Mulla.
2. Sub-Committee No. 2 to recommend standardisation of the requirements of machine tools in the country as per term of reference No. (6)—Convener : Shri S.J. Shahaney.
3. Sub-Committee No. 3 to examine the creation of a body to supervise the development programme recommended and finally accepted by Government—Convener : Chairman.
4. Sub-Committee No. 4 to assess the installed capacity of the industry—Convener : Shri L.T. Madnani.
5. Sub-Committee No. 5 to review the question of inspection of machine tools and allied issues as per term of reference No. 7 Convener : Shri P.N. Batra.
6. Sub-Committee No. 6 to recommend the programme of manufacture of the different units and to consider additional capacity required—Convener : Shri L.T. Madnani.

2.3 Field Survey. The Committee had the benefit of the services of two Machine Tool Experts—Mr. John D. Elliott from U.S.A. and Mr. A. Stradella from Italy. Both of them have had considerable experience in the manufacture of Machine tools in their own countries. At the request of the Committee, they toured the country visiting all the manufacturers of graded machine tools, ungraded manufacturers and some small tool manufacturers. They also paid visits to a number of major units in other engineering industries including some Railway Workshops. The Secretary of the Committee accompanied the Experts during these visits. Other members of the Committee had visited different units of machine tool manufacturers in other capacities at different times.

2.4 Questionnaires. The Committee issued the following questionnaires to elicit information regarding capacity, development plans etc. of the manufacturing units :—

- (i) Questionnaire No. 1 to the manufacturers of machine tools to elicit their present production, development plans etc.

- (ii) Questionnaire No. 2 to users of machine tools regarding their projected requirements during the Second Five Year Plan period.
- (iii) Questionnaire No. 3 to the manufacturers of machine tools regarding their installed capacity.

While Questionnaires No. 1 and No. 3 were fully answered by the leading manufacturers of machine tools, and were checked against data available in the Development Wing, the response to Questionnaire No. 2 was poor.

PRELIMINARY REMARKS

3.1 A number of surveys on the manufacture of machine tools in the country had been made earlier by various Committees starting with the Stanier Mission which was then known as the Machine Tool Utilisation Committee, and the last one was the Machine Tool Panel appointed by the Engineering Capacity Survey Committee.

3.2 The Engineering Capacity Survey Committee on the basis of the report of their Panel for Machine Tools, came to the conclusion that there was some idle capacity in the machine tool industry along with similar idle capacity in the engineering industries in general. They recommended fuller utilisation by proper development and planning of these industries in the future. To achieve this, they considered that the manufacturing units in the country should have adequate data regarding the demand for machine tools. This, they envisaged, could best be accomplished by undertaking a census of machine tools in the country and collecting data of machine tools being imported. To facilitate compilation, they recommended the adoption of a code system.

3.3 The Development Wing of the Ministry of Commerce & Industry have since carried out a survey of the machine tools in the private sector installed in the steel processing industries. It is understood that the 850 odd firms covered by this survey, represent all the manufacturing units in the engineering industry employing more than one hundred men. Suitable data collected from this record has been made available to the Committee. It was understood similar data would be made available for the public sector as soon as possible but information received is not complete. The Railway Board, however, have given the total number of machines installed in the various railway establishments under broad headings. Detailed break-up as per standard code is not available. The Railway Equipment Committee have collected the Railway's estimated demands for machine tools in the Second Plan period. It has, however, been stated these figures are not final.

3.4 The Development Wing have made available to the Committee detailed break-up, as per the code, of the value and numbers of machine tools for which Import Licences have been issued by them and the Chief Controller of Imports and Exports.

3.5 It has been emphasized on more than one occasion that the machine tool industry is the most important engineering industry in the country in as much as it forms the basis of all manufacturing activity. In an emergency the first industry to be expanded would be the machine tool industry.

Similarly, for the rapid industrialisation of any country, as is now envisaged in the Second Five Year Plan, a strong well-built machine tool industry will form the back-bone of industrial expansion. In the absence of a well-developed machine tool industry, the basic machines required for industrial production will have to be imported year after year. The development of the machine tool industry should therefore be considered in its own right as a primary necessity for the nation, rather than as a part of a general engineering development. To avoid being compelled to rely largely on imported machine tools even during the Third Plan period, the Committee suggests progressive implementation of its recommendations.

RECOMMENDATIONS

Terms of Reference No. (1) *"To review the existing capacity to manufacture machine tools in the private and public sectors and study their plans for further expansion."*

4.1 The existing capacity to manufacture machine tools has been investigated by Sub Committee No. 4.

Questionnaires were circulated to ascertain the installed capacity of the various units producing machine tools. The information received was carefully analysed and the capacity of each unit was arrived at on the following basis :—

- (i) Installed machine-hour capacity.
- (ii) An improvement factor was anticipated due to technical help and collaboration reaching proportions of 48% rise in efficiency by 1961.
- (iii) The actual time required at present for the production of the different types of machine tools was projected utilising the efficiency factor as per (ii) above in order to determine the proposed manufacturing capacity in 1961.

Another questionnaire was issued to ascertain the plans for expansion of units. The plan of manufacture recommended in Table II at page 11 takes into account such programmes for expansion as were considered by the Committee to be reasonable.

Terms of Reference No. (2)

"To assess the country's requirements of machine tools in different categories and determine the gap between requirements and present manufacturing capacity"

4.2 The assessment of the requirements of machine tools,
Demand Forecast especially in an expanding economy, is very difficult. Normally, forecasts are based on past experience but when rapid industrialisation is taking place, it is difficult to rely on past statistics. In these circumstances, the Committee feels that any estimate of demand can at best be an intelligent guess.

The following documents were made available to the Committee to enable them to form their assessment :—

- (i) Report of the Railway Equipment Committee regarding the machine tools required by Railways.
- (ii) Analysis of the licences issued by the Development Officer (Tools) and the Chief Controller of Imports for machine tools during the year 1955.
- (iii) Census of machine tools, which has been referred to in paragraph 3.3.

In this connection, it has been pointed out that the licences issued during the year do not always represent the actual number of machine tools imported during that period. An alternative source, viz., figures of actual imports compiled by the Director-General of Commercial Intelligence & Statistics, and published in the "Accounts relating to the Sea, Air, Land Trade and Navigation of India" was considered but as these are not categorised in sufficient detail, it was felt that the licences issued over a period of one year would be more representative of the approximate demand.

With the information available and based on the experience of the members of the Committee, a reasonable factor has been applied to arrive at the expected increase in the demand. The demand thus estimated is given in Table I. This covers only such categories of machine tools as are expected to be manufactured during the Second Plan period. The demand for other types is comparatively less and diversified. The manufacture of these may, therefore, be taken up later :—

TABLE I
DEMAND FORECAST

Sl. No.	Code No.	Description				Estimated annual demand (1960-61)
						(Nos.)
1.	040101 to 040115	Drilling machine	Bench & Floor			2,050
2.	040120 to 040144	"	Pillar			1,135
3.	040201 to 040203	"	Radial			425
4.	060101 to 060160, 060601 to 060609, and 060701 to 060713	Grinding machine	O.D., Universal & I.D.			180
5.	060801 to 060892	Grinder	Surface			200
6.	060901 to 060999	"	Tool & Cutter			205
7.	090101 to 090103	Capstans	Upto 1"			72
8.	090104 to 090108	"	Above 1"			195
9.	090201 to 090202	Turrets				210
10.	110201 to 110203, 110301 to 110303 and 110401 to 110403	Milling machine	Plain, Vertical & Universal No. 1			105
11.	110204 to 110205, 110304 to 110305 and 110404 to 110405	"	" " " "	Nos. 2 & 3		360
12.	120101 to 120103	Planers	3' wide upto 8' stroke			20
13.	120104 to 120132	"	bigger upto 16' stroke			35

Sl. No.	Code No.	Description	Estimated annual demand (1960-61)
14.	100120 to 100123	Lathes 12" to 16" Swing	120
15.	100124 to 100129	" 16" to 20" Swing Heavy " 16" to 20" Swing Light	128 205
16.	100130 to 100133	" 20" to 24" Swing Heavy	55
17.	100201 to 100209	Surfacing and boring lathes	12
18.	040204 to 040205	Radial Drilling machine 3" capacity and above	18
19.	110206 to 110208 110306 to 110308 and 110406 to 110408	Milling machines similar to Cincinnati No. 4 and heavier	18
20.	090203 to 090220	Turrets bigger than Ward 7.	42
21.	180104 to 180105	Slotting machines 16" stroke & above	10
22.	020201 to 020228	Vertical boring machines	32
23.	020101 to 020137	Horizontal boring machines	17
24.	101100	Wheel lathes	10
25.	101201 to 101203	Axle lathes	8
26.	101400	Roll turning machines	4
27.	060400	Roll grinding machines	4
28.	120133 to 120173	Planers 20' and above	2
29.	221501 to 221550	Hammers, Power	10
30.	222501 to 222509, 130101 to 130804 and 160101 to 169900	Sheet metal machinery	Rs. 1.5 crores (in value)
31.	400101 to 549900	Wood working machine tools	Rs. 1 crore (in value)

Terms of Reference No. (3) *"To investigate causes responsible for impeding faster development of the industry and suggest how they can be eliminated."*

4.31 Although the importance of this industry to the nation has been accepted in principle, effective steps do not appear to have been taken so far to ensure a planned and rapid development. Of necessity, private enterprise has worked to meet the requirements of a fluctuating economic cycle and not as part of a national programme. This has resulted in the manufacture of machine tools most easy to sell. Absence of statistical data regarding the demand from time to time has prevented development of new designs.

Government has taken some steps to protect this industry by banning import of such of those items as are produced indigenously to graded standards. Facilities of free inspection by a third party viz., the Government are provided to ensure quality by granting a certificate of standard by an impartial agency. The Committee, however, feels that much more will have to be done to develop this industry as a national asset. It is essential that top-most priority should be accorded to its requirements.

4.32 Another important lacuna has been the lack of technical know-how. The skill developed for the manufacture of machine tools in the industrially advanced countries is the result of long experience. It is possible to close that technological gap in far less time through the willingness of many industrialised countries to share their know-how. Government realised this position and in starting two factories in the public sector collaborated with a foreign firm. It is desirable that Government encourage foreign collaboration on satisfactory terms, for further expansion of the industry.

The Committee has noted that the technical know-how imparted through foreign technical assistance has benefited certain industries. If such foreign technical assistance in the field of machine tool manufacture could be secured, the development of the industry would be accelerated. Experts who might be obtained under these technical assistance schemes should stay with the manufacturing units sufficiently long to demonstrate the results of their suggestions. It is expected that about 5 to 10 experts covering various fields of technology such as foundry, machining, tooling, designing, methods, planning, heat treatment and assembly would be required by each unit. The Committee, therefore, recommends that Government secure a team of technicians and make them available to the indigenous manufacturers at a price they can afford. The services of the experts in the various fields may be phased out as required. As this programme requires very highly specialised engineers, special attention will have to be given to their selection. The Committee is of the opinion that the manufacturers should be represented on any recruiting team which should be composed of personnel with experience of the industry.

4.33 The main raw materials required for the manufacture of machine tools are pig iron and steel, carbon and alloyed. Due to the sudden spurt of demand, there has been a general shortage of these items. Manufacturers of machine tools have found it difficult to obtain their requirements. Very often applications have to be followed up in person to expedite results. It has been brought to the notice of the Committee that similar conditions exist in the procurement of import licences for some of the essential components. It will be realised that if the senior personnel of the factories are to spend their time and energy in following up, it will be difficult for them to concentrate on their real work of manufacturing and developing machine tools. It is, therefore, requested that necessary action be taken to see that these handicaps do not stand in the way of development of industry.

4.34 With increased tempo of expansion programmes, individual firms in the private sector are bound to feel the necessity of installing additional plant and equipment to balance production. As some of them may require financial help, the Committee recommends that the Government consider such requests liberally.

"To suggest ways and means of utilising the existing capacity fully and developing it further to meet the requirements of the country for machine tools as assessed by the Committee and to report whether after ensuring such full utilisation, there is any necessity to set up new units and if so, to indicate the size and scope of such units."

4.41 The present manufacturing activity of the firms either in the private sector or in the public sector is confined to the production of only a few types of machine tools such as lathes, drilling machines and shapers. Though some attempts have been made to manufacture machine tools like hydraulic shapers, capstans and surface grinders, so far only prototypes have been produced. Organized manufacture of large milling machines, grinding machines, turrets and similar other machine tools has not been established. It is essential that the manufacture of all types of machine tools should be developed in the country as early as possible.

4.42 From the point of view of maximum utilisation of the existing capacity, the Committee has taken into account not only the capacity as represented by the capital equipment installed, but what is of greater importance, the technique and skill developed by the various units. As the Committee's main concern is the development of as many types of machine tools as possible within a short period, it recommends a broad base for the development of this industry. Different types of machine tools can be developed by different units

simultaneously to produce within two or three years such items as are required in large numbers. These include milling machines, radial drills, grinding machines, turrets, planers and lathes of modern design. The Committee feels that this broad-based development will require modernization of plant in some factories. Balancing machinery may also have to be installed which will increase individual capacity by about 30% and help to develop the industry on sound lines.

4.43 Sub-Committee No. 6 has considered a detailed plan and recommends a programme of manufacture for the various units to utilise the existing capacity in the machine tool industry. The Committee has accepted this programme, shown at Table II. It may be pointed out that an analysis of the capacity to produce machine tools is a difficult task. The numbers which can be produced by a given unit vary with the design and type of the product taken up for manufacture. A rational programme on a broad basis has, therefore, been recommended. Where surplus capacity exists, the Committee recommends the development of additional categories of machine tools. Existing activities of the firms consistent with the programme recommended will be the first priority. Machine tools to be manufactured thereafter should be in the order of priority proposed. It is expected that development of the different items can go on simultaneously depending upon the engineering resources of the individual concern, but production will follow the priority laid down. Particular attention is invited to the fact that Investas who are at present making lathes will give up their manufacture gradually. Similarly, Hindustan Machine Tools have been recommended the manufacture of a production lathe of the same dimensions as their present H. 22, as it is felt that the present lathe is over-engineered for general requirements. The programme of manufacture by Pragas will (it is recommended) be confined to lines which are at present well-established by them. At Kirloskars, the consumers' preference for modern design will cause the phasing out of cone-pulley lathes. This will also be the case with Coopers.

TABLE—II
PROGRAMME OF MANUFACTURE

Firm	Item of Manufacture	Code Range	Priority
Messrs. Cooper Engg. Ltd.	Gearred shapers upto & including 32" stroke. (Gradual changeover from cone-pulley to geared head).	150101 to 150106	I
	Planers, upto and including 6' x 6' x 16' table.	120101 to 120132	II
	Slotters, upto & including 21" stroke	180101 to 180105	III

Firm	Item of Manufacture	Code Range	Priority
Messrs. Hindustan Machine Tools (Private) Ltd.	*Lathes 17" Swing, present & allied models.	100124-100129	I
	Milling machines (No. 2 & No. 3) Plain, Vertical, Universal & Manufacturing (heavy type)	110204-110205, 110304-110305, 110404-110405 & 110504	II
	Grinding machines O.D., Universal & I D.	060101-060160, 060601-060609 & 060701-060713	III
	@Radial drilling machines 2" & above	040203-040205	IV
	*Lathes, 20" to 28" Swing	100130-100139	V
	Production jig borers	0204	VI
	*Lathes (other types) Capstans and turret lathes	(Group 10 and 09)	VII
Messrs Investa Machine Tools & Engineering Co. Ltd.	Drilling machines Pillar 1½" to 2"	040122 & 040123	I
	Drilling machines, column upto 3"	040124	
	Drilling machines, Radial below 2"	040201 & 040202	II
Machine Tool Prototype Factory	Lathes, Geared head 10" swing	100111 & 100112	I
	Lathes, Capstan ½"	090101	II
	Grinders, Surface 18" and 24"	060801	III
	Grinders-Tool & Cutter	060901 to 060921	IV
	Lathes-Capstan 1½"	090104	V
Messrs. Mysore Kirloskar Ltd.	*Lathes-12" to 28" swing	100121 to 100139	I
	Lathes-Capstan 1½"	090105	II

Firm	Item of Manufacture :	Code Range	Priority
	Lathes-Capstan 2½"	090107	III
	Lathes-Turret 3½"	090203	IV
Messrs Praga Tools Corporation Limited	Drilling Machines Bench	040101 to 040115	I
	Drilling Machines Pillar 1" & 1½"	040122	II
	Milling Machines No 1	110201 to 110203, 110301 to 110303 & 110401 to 110403	III
	Lathes, Bench	100110	IV

@Shri D. S. Mulla considered that this item be developed by Investas also.

*Shri M. K. Mathulla considered that overlapping in the programme of manufacture of lathes is not desirable.

4.44 With the programme recommended above, the existing units when modernized and equipped with balancing plant would be booked to capacity during the Second Five-Year Plan period. Detailed phased programmes should be obtained from each manufacturer and approved by Government. It is essential that the individual firms should adhere to the programme once it is approved by Government. Stringent measures should be adopted to see that the programme is implemented. Where a firm fails to take up an item on the programme, another firm doing allied work should be permitted to take it up if their capacity permits.

Additional Capacity.

4.45 Existing units in the country are not in a position to manufacture heavy machine tools. It is recommended Government take steps to create capacity for this purpose.

(i) Heavy Machine Tools

The technological advancement of the country is characterised in general by a gradual changeover from the repair shop technique to manufacturing methods. With increased industrial activity during the Second Plan period, it is expected that there will be a transformation from batch production to continuous flow

(ii) Special Machine Tools

production methods. This will mean the introduction of special purpose machine tools. The present stage is not considered advanced enough in the evolution of the industry for the introduction of such units. With the stress on increased production, the Committee expects greater utilisation of special purpose machine tools towards the end of the Second Plan period. It is, therefore, recommended that Government encourage the creation of capacity for the manufacture of such units. Special purpose machine tools required will have to be designed to suit Indian conditions. As this would involve evolution of new designs and not merely copying existing ones, it may warrant foreign collaboration.

The Committee is of the opinion that the capacity and specialised skill for the manufacture of presses and sheet metal machinery in the country is limited.

(iii) **Sheet Metal Machinery** The existing units in the field are too small and the Committee thinks that even after expansion under the development programme, they will not be able to meet the requirements for these machines during the Second Plan period. The Committee, therefore, recommends the establishment of an additional unit for the manufacture of presses and other sheet metal machinery.

The production of wood working machines has not been attempted in the country to any large extent. As the demand for this is reasonably large and is likely to increase during the Second Plan period, it is recommended that adequate capacity be created for this purpose.

(iv) **Wood working machinery**

4.46 Apart from the main manufacturers, there are in the country a few units, who are classed among steel processing industries, but they are not large enough to contribute anything substantial at present. If scope of these units is enlarged, they could make a valuable contribution to development of this industry. They should either concentrate on the manufacture of machine tools or give it up altogether. They are now dividing their energies in different fields with the result that their output is small and uncertain. These units do make graded machine tools, but their equipment has to be modernised and staff trained for the production of modern machine tools.

Other Small Units

4.47 There are also a number of units in the Small Scale Sector especially in places such as Batala, Ludhiana, Calcutta and Coimbatore. These shops, which are generally one-man shows, make ungraded machines and in the present context of shortage of machine tools sell them profitably. It will be in the interest of the country to develop the skill of these people and persuade them to make graded machine tools by giving them technical know-how and financial assistance.

Small Scale Industries

Terms of Reference No. (5)

"To review the existing capacity to design machine tools, to survey the facilities available for training machine tool designers and suggest ways and means of helping the industry in securing training facilities at home and abroad for such staff."

4.51 The greatest lacuna in the development of the machine tool industry is the absence of original design technique. The existing talent for machine tool design in the country is negligible. A beginning has been made at

Design Facilities

Machine Tool Prototype Factory, Ambarnath to develop a section for the designing of machine tools. The Hydraulic Surface Grinder now in the prototype stage and a few other machines they propose to manufacture have been designed by them. The other unit in the public sector has now formulated plans to develop gradually its own designs. In the private sector, each factory has a design office, but the development of designs is generally not original. Many firms have tried to copy the designs of foreign manufacturers. But even this takes time. By the time the copied product is ready for the market, the original design itself becomes obsolete. Messrs. Investas have evolved an original design for a radial drill. The staff available for such design work is generally not very experienced and consequently the designs developed are none too modern. It may also be mentioned that apart from designers of machine tools, the designers for jigs, fixtures and tools are few. Many of the jigs and tools are fabricated by various shops without any formal design, and could be better designed by specialists trained for the purpose.

4.52 What has been stated regarding the facilities available for machine tool design, applies equally to training facilities for design work.

4.53 It has been found that the selection of designers and their training is a difficult process. It is not always that a candidate with high academic record or otherwise brilliant makes a good designer.

Suggested Design Training

The present practice is to select a large number of men and retain such of those found suitable for design engineering, transferring the others to wherever they are better suited. These trial and error methods have many disadvantages and should be replaced by modern scientific methods of selection. Even during the initial selection of a candidate, his aptitude for design must be tested. In the opinion of the Committee the requisite tests conducted in some of the more industrialised countries could be tried with advantage.

The training of designers must include practical experience within the shop. Any attempt at centralising this training would lead to the development of a theoretical designer, requiring additional practical "indoctrination". If the designer is attached to the shop, he would know the shortcomings of the plant and his designs would take into account

the practical difficulties in production. As Indian talent in this particular line is at present meagre, it will be necessary to have well-trained foreign designers in each manufacturing unit to impart training.

Particular attention should be given to engage the services of only first-class designers from abroad. Able Indian understudies with adequate practical experience should be attached to these men, so that they could take over eventually. At the same time, carefully selected young engineers should be sent to factories abroad for necessary design training. The "design aspect" appears to have been missed in many schemes that are now in operation. It is suggested that Government should examine schemes with particular reference to training facilities for design.

Apart from training designers as stated above, designers of a higher calibre would be required to ensure proper growth of the Machine Tool Industry as well as the general Engineering Industry. Such a strata of capable designers can grow only in a healthy atmosphere of mutual exchange of ideas at their level and exchange of information with their counter-parts in other industrialised countries. A Post-Graduate Institution where regular courses of a higher standard and short term courses for specialised designers addressed by eminent international authorities on the subject are available from time to time has to be created in the country. This could be tied up with a research programme for the Machine Tool Industry. In this connection, it is understood that proposals for the establishment of a Research Institution for Mechanical Engineering, are already under consideration of the Council of Scientific and Industrial Research. The combined programme for advanced machine tool design training at post-graduate level and machine tool research referred to above could be incorporated in such an institute. A liberal exchange of students and faculty should be established with the highly industrialised countries. The machine tool manufacturers should associate themselves with the institution and help by exchange of information regarding standards etc.

Terms of Reference No. 6

"To study the range of general purpose machine tools required by the various Departments of Government with a view to standardising to the most widely popular requirements, and to examine the feasibility of other Government Departments using similar machines and adopting them as their standards. In carrying out this examination, the Committee will take particular note of the standardisation work already completed by the Railways."

4.61 The Committee considered the fact that there existed today a demand for a large number of different sizes in almost each type of machine tool and in many cases these sizes did not differ very much from each other.

4.62 It also noted the fact that whilst the overall number of machine tools of each of the types required was relatively high, if manufacture had to be undertaken of each of the sizes now demanded the quantities in each size would be too small to manufacture economically.

4.63 It was therefore felt that if the number of sizes in each type of machine tool was limited it would be possible to increase the batches to quantities where economic manufacture could be undertaken.

4.64 In consequence the Committee decided to appoint a Sub-Committee No. 2 to prepare such a rationalised list of machine tools by type and sizes using for their guidance the list of Standard Machine Tools prepared by the Railway Equipment Committee.

4.65 The Committee endorses the report of Sub-Committee No. 2 standardising the sizes and the types of machine tools to be manufactured in the country in the Second Plan period and since the country is switching on to the metric system the standardised sizes are given in both the British and Metric systems. It is understood that the Railways will also fall in line with the Metric system.

4.66 The Committee would like to point out that the list of standardised machine tools is only indicative in a general way of the sizes and number of different sizes in each type of machine tool and does not take into account overall design consideration.

4.67 It agrees with the Sub-Committee's view that the preparation of detailed specifications covering all essential dimensions would involve considerable research work and it is only after such investigation that it would be possible to draw up comprehensive working specification for each type and size of machine. This work, it was felt, should be undertaken as early as possible by such an authority as is being recommended to be created in the Machine Tool Board.

TABLE—III

1. Drilling Machines :

A. Bench type :

	Capacity	
	Inch	M.M.
i) Sensitive	1/4	6
	3/8	9
	1/2	12
ii) Production	1/2	12
	3/4	20

B. Pillar type :

Production	1-1/4	32
	1-3/4	45

C. Column type :

i) Sensitive	1	25
ii) Production	1-1/4	32
	1-3/4	45
	2-1/2	60/63
	3	75

D. Radials :

<i>Radials :</i>			<i>Arm Length</i>	
			<i>Inch</i>	<i>M. M.</i>
i) Sensitive	1	25	42,60	1000,1500
ii) Production	1-1/4	32	42,60	1000,1500
	1-3/4	45	54,66	1300,1600
	2-1/2	60/63	60,72,84	1500,1800,2000
	3	75	72,96	1800,2500

2. Grinding Machines :

(Single headed or double headed, with or without Twist Drill Grinding attachment)

A. Bench type

<i>Wheel diameter</i>	
<i>Inch</i>	<i>M.M.</i>
6	150
8	200

B. Floor type

14	350
24	630
32	800

C. Cylindrical, Plain/Universal

<i>Swing</i>		<i>Admits between centres</i>	
<i>Inch</i>	<i>M.M.</i>	<i>Inch</i>	<i>M.M.</i>
6	150	18,36	450,900
12	300	18,36,48	450,900,1200
14	350	36,48,72	900,1200,1800
20	500	72,96,120	1800,2400,3000

D. Surface

<i>Table sizes</i>	
<i>Inch</i>	<i>M.M.</i>
18×6	450×150
24×8	600×200

E. Tool & Cutter

<i>Swing</i>		<i>Admits between centres</i>	
<i>Inch</i>	<i>M.M.</i>	<i>Inch</i>	<i>M.M.</i>
10	250	24	600
12	300	24	600

3. Hack Saw Machines

Capacity	
Inch	M.M.
6×6	150×150
9×9	225×225
12×12	300×300

4. Lathes :

A. (i) Capstans & Turrets.

Bar capacity	
Inch	M.M.
1/2	12
1	25
1-1/4	32
1-1/2	38
2	50
2-1/2	52 Combination turrets
3-1/2	68 similar to Herbert
	No. 7 Senior or Ward
	No. 8

B. Lathes : Centre

(Sliding, Surfacing & Screw Cutting ; Standardization is done on the basis of Swing)

Swing				Admits between centres			
Inch	M.M.	Inch	M.M.	Inch	M.M.	Inch	M.M.
10	250	22	560	32	800	45	1250
12	300	28	710	40	1000	56	1400
16	400	36	900	50	1250	71	1800
20	500	45	1250	63	1600	90	2240
28	620	56	1400	80	2000	112	2800

5. Milling Machines :

It is recommended that the standardisation should be effected in terms of traverses, weight and H.P. of the machine (Metric equivalents are given in brackets).

A. Plain Milling Machines :

	No. 1	No. 2	No. 3
Weight in lbs.	3,000	6,000	8,000
H. P.	3	7-1/2	10
Longitudinal traverse	20" (500)	28" (700)	34" (850)
Cross traverse	6" (150)	10" (250)	12" (300)
Vertical traverse	14" (350)	16" (400)	18" (450)

B. Universal Milling Machines :

Weight in lbs.	3,100	6,200	8,200
H. P.	3	7-1/2	10
Longitudinal traverse	20" (500)	28" (700)	34" (850)
Cross traverse	6" (150)	10" (250)	12" (300)
Vertical traverse	14" (350)	16" (400)	18" (450)

C. Vertical Milling Machines :

Weight in lbs.	...	6,500	8,500
H. P.	...	7-1/2	10
Longitudinal traverse	...	28" (700)	34" (850)
Cross traverse	...	12" (300)	14" (350)
Vertical traverse	...	14" (350)	16" (400)

6. Planing Machines :

(Double column/open sided)

Table travel		Width		Height	
Feet	M.M.	Inch	M.M.	Inch	M.M.
6	1800	30	750	30	750
8	2400	36	900	32	800
10	3000	36	900	32	800
12	3500	48	1200	40	1000
16	4500	60	1500	50	1250
		72	1800	72	1800

7. Shaping Machines :*Stroke*

Inch	M.M.
12	300
18	450
24	600
32	800

8. Slotting Machines :

8	200
12	300
16	400
20	500

Terms of Reference No. (7)

"To suggest the machinery for laying down the standards of performance and the specifications for inspection of the final product in order to ensure that the product measures upto the required quality, and to recommend the most suitable organisation for testing and certifying the products as conforming to the prescribed quality specifications."

4.7 Sub-Committee No. 5 investigated this question and their recommendations are fully endorsed by this Committee. These recommendations are :

- (a) The Indian Standards Institution is the appropriate authority for laying down standards of performance and specifications for inspection of the final product in order to ensure that the product measures upto the required quality.

- (b) In cases where the Indian Standards Institution's specifications and standards of performance are not available Schlesinger's standards should be accepted.
- (c) The Committee strongly emphasizes the necessity of continuing the D.G.S. & D. Inspection to ensure that the machine tool industry maintains the quality of its product. It is imperative that all machine tools manufactured by graded manufacturers should be inspected by a third party (at present D.G.S. & D. Inspection Wing), unless the customer specifically states that he does not require this. Government purchases will continue to be inspected by the Inspection Wing of D.G.S. & D.

The Committee commends the action of Government in offering this free inspection and strongly emphasizes the necessity for its continuance. It further recommends that Government make available inspection facilities on a larger scale than hitherto in view of the expected increase of activity in this industry.

- (d) The Committee recommends that the Indian Standards Institution should extend their quality marking scheme to machine tools as early as possible. The Committee suggests that all machine tools produced for export must have either a quality certification mark from the Indian Standards Institution or the D.G.S. & D. Inspection Certificate.
- (e) The Committee recommends the creation of a Central Registry for the maintenance of inspection records of machine tools and periodical inspection of some of the machine tools installed at works for a period of three years, at six-monthly intervals. This, the Committee envisages, will enable an analysis of performance data under different workshop conditions and show up the deficiencies of design, material and other factors further enabling corrective measures to be taken in future designs.
- (f) In order to ensure uniformity of inspection all over the country refresher courses should be arranged for the inspection staff at appropriate places.

Terms of Reference No. (8) *"To investigate and report on such other matters as the Committee may think fit regarding the development of the machine tool industry in India."*

4.81 The Committee has recommended a broad-based programme so that existing manufacturers could produce the machine tools in general demand in a short period. When Government accept these recommendations; the individual manufacturers may be asked to submit their phased programme for approval. For the adequate supervision of such plans and the consideration of technical details, it is recommended

Machine Tool Board

that Government create a Machine Tool Board. The Board which should include representatives of the manufacturers and users of machine tools has to be a small one to be effective. It should have as its chairman an engineer of high standing and eminence who is conversant with the Machine Tool Industry. This Board should amongst other things scrutinize schemes submitted, examine designs, recommend fair prices for indigenously manufactured machine tools, watch the performance of manufacturing units vis-a-vis the phased programme and recommend to Government action to be taken on these and allied matters. The machine tool industry suffers in general from many shortcomings including shortage of essential raw materials, technical aid, proper financing, etc. The necessity for giving top priority to this industry has already been stressed. The Committee would like to reiterate this.

4.82 The programme recommended gives a monopolistic position to some firms which can lead to certain abuses. These can be overcome by exercising stricter control on the industry. One of the means of exercising such control would be through the Machine Tool Board.

The Committee accepts in principle that an element of competition in this industry is desirable for its healthy growth. However, as the total demand envisaged for 1960-61 for different types of machine tools is not large, a limited competition in certain machine tools like shapers, milling machines, radial drilling machines might be possible at that stage. Until then in view of the restricted demand for machine tools in different types and sizes, it is considered necessary that the manufacture for each product is allotted to only one unit - lathes being the exception. As regards lathes, where the demand is relatively large, greater competition is possible.

4.83 The (late) Tariff Board which had enquired into the machine tool industry had come to certain conclusions regarding the methods by which indigenous industry could be protected. One of these was to increase the rate of import duty on the type of machine tools manufactured in the country and to restrict the import of machine tools to the extent necessary to meet the demand after taking into account indigenous production. Since a general increase in the tariff is likely to hamper the industrial growth of the country, Government thought it advisable not to raise the import duty. It was accepted that import of such types of machine tools as are manufactured in the country should be totally banned. This policy has been adhered to ever since. During the Second Five Year Plan, it is envisaged that it will be possible to manufacture many more types of machine tools. It may be pointed out that it will not be possible for indigenous manufacturers to compete with their foreign counterparts in the initial stages mainly due to "consumer preference". It will, therefore, be necessary to afford protection to indigenous manufacturers against competition from abroad. The argument advanced earlier by the Government against general raising of import duty on machine tools continues to apply. The only course

open to protect the indigenous products from similar imported products is by exercising import control. However, to safeguard the interests of consumers of machine tools, fair selling prices should be based on prices they would have to pay for a technically equivalent imported product. If necessary, certain weightage to cover development charges may be allowed. Where import of any banned category of machines has to be permitted for special reasons, a deterrent in the form of a high duty for these may be considered:

4.84 With the total ban on the import of the types of machines produced in the country, Government purchases will also be restricted to the machine tools manufactured indigenously. In this connection the Stores Purchase Committee has already recommended a price preference up to 25%. It is recommended that this proposal be accepted in so far as it relates to machine tools.

4.85 It has been brought to the notice of the Committee that generally funds are made available to Government indentors only from year to year and these funds lapse in case they are not utilised within the financial year for which they are sanctioned. This results in a rush of orders with the indigenous manufacturers, for the machine tools produced by them, at the end of the financial year. In order to enable the manufacturers to plan their production programme suitably, it is suggested that such of those indentors as cannot carry funds to the subsequent years be advised to plan their purchase programme for machine tools well in advance, instead of all approaching the manufacturers almost at the end of the financial year. It is also recommended that as the manufacture of machine tools has been allocated to specified units, there should be an approved rate contract system for these machine tools.

4.86 The Engineering Capacity Survey Committee had recommended that with a view to obtain statistics of the different types of machine tools required, these machine tools be classified according to a standard code. The Development Wing has already published a code of this nature and it is essential that all statistics compiled for this trade be kept in terms of that code. The licences issued by the Development Officer (Tools) already bear the code numbers of the various items imported. However, licences issued under the capital goods scheme are not classified in this manner. The Committee recommends such classification be insisted upon or in the alternative the licensing of machine tools be centralised so that satisfactory statistical data could be maintained. The Machine Tool Panel of the Engineering Capacity Survey Committee had recommended a comprehensive procedure for collecting data on machine tools imported. It is recommended that the procedure suggested be adopted without delay.

4.87 It is also noted that certain industries have been given "blanket" licences for import of machine tools.

Blanket Licences

In such cases returns as regards the exact types and specifications of machine tools are not available. It is, therefore, recommended that it be insisted at the time of the issue of such "blanket" licences that a return showing the full details of the machine tools be filed with the competent authority before they are cleared by the Customs authorities.

4.88 The Committee has investigated through Sub-Committee

Steel

No. 1 the standardisation of the types and sizes of alloy steel required in the machine tool industry. Preliminary talks with the representative of Ministry of Defence have indicated that it will be possible to manufacture these indigenously if the requirements of the machine tool industry are pooled and made known to them. The sizes and types as rationalised by the Sub-Committee and adopted by this Committee are given in Table IV.



TABLE—IV

List of Standardised Steels

Steel Specified	Steel Equivalent to EN	Type of Steel	To be used instead of—					Special Conditions	Remarks
			MPF	HMT	Kirloskar	Investa	Cooper	Praga	
MSF III/1	ENS/EN9	Medium Carbon.	In use	C.1.	EN 8	EN 8	.4/.5C	EN 8	
MSF XIV/6	EN 24	1.5% Ni Cr	x	C3S*	EN 24	EN 24	x	x	C 0.4 to 0.45 *may use instead of
MSF XII/3	EN 36	3% Ni Cr	In use	C.2	x	x	50/60 Ni Cr	EN 36	C 0.12 to 0.18
MSF XIV/12	EN 30	4.5 Ni Cr	XII/1*	C.3	x	x	x	x	C 0.3-0.4 *also instead of

Limiting Conditions

MSF III/1	upto 4" dia & in special cases 6"	in rolled condition	Minimum economic quantities 10 tons.	—Allowance $\frac{1}{8}$ " on dia on finished size.
over 4" dia.	...	in forged condition		—Allowance $\frac{1}{4}$ " on dia.
MSF XIV/6 XII/3—XIV/12	upto 6" dia.	in rolled condition		—Allowance upto $2\frac{1}{2}$ " or finished dia size. Over $2\frac{1}{2}$ " on finished dia size (in case extra clean surface is require otherwise $\frac{1}{8}$ " will do.
over 6" dia.	...	in forged condition		—Allowance $\frac{1}{4}$ " on finished size.

Sizes of rolled stock :—Strips of $\frac{1}{8}$ " on dia could be rolled, but where the quantities after bulking of orders are less than the minimum economic quantities then the nearest higher size should be ordered.

Forgings. ... :—In case of forging—Forging drawing showing finished size and allowances required should be submitted.

Drop Stamp forgings:—7 to 8 lbs. stampings on 15 cwt. drop hammer Minimum Wt. of stamping 1 lb. on 7 cwt. drop stamp.

ACKNOWLEDGEMENTS

5.1 The Committee wishes to place on record the excellent work done by Mr. John D. Elliott, formerly of the Cross Company U.S.A., and by Mr. A. Stradella, of Olivetti Company whose services were placed at the disposal of the Committee by the Italian Government.

5.2 The Committee also thanks all the manufacturers of machine tools who co-operated in giving full information to the Committee, and the users of machine tools who readily responded to the questionnaires issued.

5.3 Finally, the Committee wishes to place on record its appreciation of the excellent work done by the Secretary.

Sd/-R.K. Gejji

Secretary

Sd/-M.S. Thacker

Chairman

Members :

- (1) Sd/-P.N. Batra
- (2) Sd/-K.S. Raghupati
- (3) Sd/-L.T. Madnani
- (4) Sd/-S.J. Shahaney
- (5) Sd/-D.S. Mulla
- (6) Sd/-S L. Kirloskar
- (7) Sd/-G. Damodaran
- (8) Sd/-M.K. Mathulla
(subject to notes (i) & (ii) below).
- (9) Sd/-N. Krishnaswami
(subject to notes (iii) & (iv) below).

Note (i) "In my view, the standardization of machine tools should be on the pattern prevailing in countries that have adopted metric system, as indicated in the Appendix attached, but the matter may be referred to the Indian Standards Institution for finalisation."

Note (ii) "In my view, the Machine Tool Board referred to at paragraph 4.81 should be purely advisory in character."

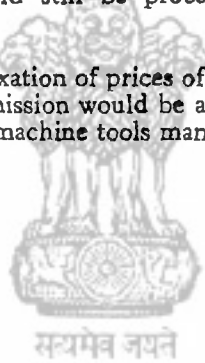
Sd/-M.K. Mathulla

Note (iii) "I am not in a position to endorse these demand figures as I had, in the capacity of the basic officer responsible for collecting and preparation of the report on the census of machine tools installed in the large industrial undertakings, worked out separate sets of figures on the demand of machine tools."

Note (iv) "I feel that, while the advisory board could indicate in general the development programme that has to be undertaken in the country the detailed programme, scrutiny of various phased manufacturing programmes and their implementation, should still be processed by the Development Wing.

In regard to fixation of prices of machine tools I feel that the Tariff Commission would be a more appropriate body to fix up prices of machine tools manufactured in the country."

Sd/-N. Krishnaswami.



APPENDIX

(Referred to in note (i) at page 26)

I Drilling Machine

<i>Bench Sensitive</i> M.M.	<i>Bench Production</i> M.M.
6	10
10	16
16	(25)
<i>Pillar Production</i> M.M.	<i>Column</i> M.M.
32	25 (Sensitive)
40	32 (Production)
(50)	40 "
	50 "
	63 "
	80 "
<i>Radials</i> M.M.	<i>Arm Length</i> M.M.
25 (Sensitive)	800
32 (Production)	1000
40 "	1250
50 "	1600
63 "	2000
80 "	2500

II Floor Grinders

(Single headed or double headed, with or without Twist Drill Grinding attachment).

(a) Bench

<i>Wheel diameter</i>	<i>M.M.</i>
	150
	200

(b) Floor

"	
	350
	500

III Grinding Machines

(a) Cylindrical, Plain/Universal.

<i>Swing</i>	<i>Admits between Centres</i>
M.M.	M.M.
150	750
250	1000
350	1500
500	2000

(b) Surface

<i>Table size</i>	<i>M.M.</i>
	450 mm × 150 mm
	600 mm × 200 mm

(c) Tool & Cutter

<i>Swing over table</i>	<i>Length between centres</i>
M.M.	M.M.
200	400
300	650

IV Hack Saw Machines

<i>M.M.</i>
150 × 150
225 × 225
300 × 300

V Lathes—Capstans & Turrets

20 mm
25 "
32 "
40 "
50 "
63 "
80 "

VI Lathes : Centre

(Sliding, Surfacing and Screw-cutting)

Standardisation is done on the basis of Swing

<i>Swing</i>	<i>Admits between centres</i>
250 mm	750 mm
355 mm	1000 mm
450 mm	1500 mm
560 mm	2000 mm
650 mm	2500/3000 mm

VII—Milling Machines**A—Plain Milling Machines**

	No. 1	No. 2	No. 3
Table size	800/225	1200/300	1600/400

B—Universal Milling Machine

Table size	800/225	1200/300	1600/400
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C—Vertical Milling Machine

Table size	1200/300	1600/400
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VIII—Planing Machines

(Double column—open sided)

Planing width between columns

Table Travel M.M.	Width M.M.
1500	750
2500	1000
4000	1250
6000	1800

IX—Shaping Machines

Stroke

M.M.

315

450

630

800

X—Slotting Machines

Stroke

M.M.

160

350

500