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# The development of Swiss machine tools from 1939 to 1945.

By Ing. E. Felder, Zurich

The years 1939 to 1945, which were so unproductive for our foreign trade, necessarily led to more intense work for improvement in all branches of industry. In order to be able to cope in every respect with the expected demand of the post-war period new paths were explored and existing methods were bettered. Great advances were made in the field of machine tools and numerous new constructions bear witness to the endeavours of the Swiss machine tool industry to meet all the demands made on it.

A survey of the present state of this most important branch of industry is best presented according to machine types.

## 1. Turning and turret lathes.

The «Original Schaerer» Chuck Turret Lathe (fig. 1). This machine, specially evolved for the rational production of chuck work, is the result of long years of co-operation between constructors and practical experts. Twenty different spindle speeds between 14 and 500 r. p. m. can be adjusted by building in a «Radiax» sliding gear by setting 2 levers only. The guide ways of turret and tool slide are separate and the main slide is guided in

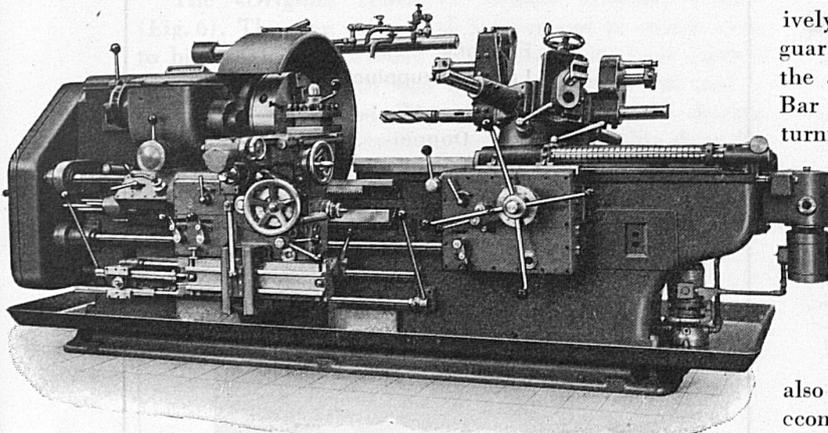


Fig. 1. «Original Schaerer» Chuck Turret Lathe.

front of the bed in such a way that it passes the chuck and is guided in its whole length even in the extreme position. The feeds of the turret and the main slide can be adjusted within wide limits independently of each other. The low headstock position makes a low construction of the turret possible. The turret head is bedded obliquely in order to bear in the best possible way cutting the pressure

The «Original Schaerer» High Speed Lathes have always taken the lead thanks to their particularly advantageous bed slide guide, the sturdy construction of the headstock and the handy attendance. The «Radiax» gears are likewise utilized on this machine and the available range of spindle speeds lies between 14 and 500 r. p. m. The oiltight headstock is automatically lubricated. The lead-screw is well-protected and provided with a micrometric stop for longitudinal motion. A high speed driving gear in both directions is provided for the main slide. The «Original Schaerer» high speed lathes with the sturdy spindle and the driving wheels mounted immediately before and behind the main spindle, are adapted for the heaviest duties.

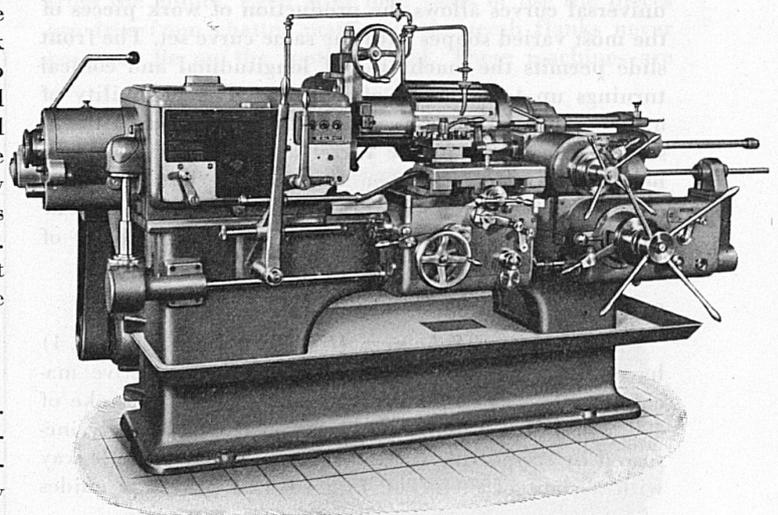


Fig. 2. «Original Schaerer» Bar Turret Lathe.

The «Original Schaerer» Bar Turret Lathes (2) are built in three sizes for a passage of 50, 75 and 120 mm respectively. The extremely rigid and compact construction guarantees the greatest accuracy with a high output due to the arrangement of the hexagonal turret aggregate. On Bar Turret Lathes there is simultaneous length and face turning as well as drilling and cutting off by independently adjustable feeds of the various tool slides. The great range of speeds and the appropriately graded feeds allow for extensive adaptability when working the most different materials. The sturdy headstock is equipped with MAAG-ground transmission gears ensuring a quiet run free from vibration even under the heaviest loads. The adjustable stops at the turret and main slide and also the drill support for automatic drill release ensure economic work. A large selection of special parts and tool holders is available.

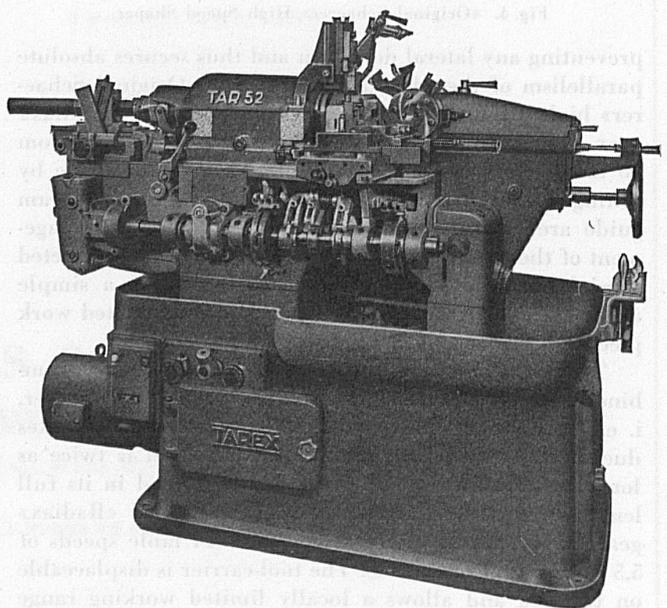


Fig. 3. TAR One Spindle Automatic Turret Lathe.

The *TAR One Spindle Automatic Turret Lathes* (fig. 3) are advantageous for rod and chuck machining on complicated work pieces. A high speed gear in connection with universal curves allows the production of work pieces of the most varied shapes with the same curve set. The front slide permits the machining of longitudinal and conical turnings up to a length of 100 mm. The possibility of utilizing universal curves reduces the times of adjustment so that the TAR spindle turret automatic machine can be used economically even for small series. Its robust construction guarantees a minimum of backlash. The times of production are very short and consequently of great advantage.

## 2. Shaping machines.

The «*Original Schaerer*» *High Speed Shapers* (fig. 4) have the reputation of being first-class productive machine tools. The available types are built for a stroke of 400, 500 and 650 mm. The precision is considerably increased by supporting the table on an enlarged guide way with a slant of 30°. The ram runs in prismatic guides

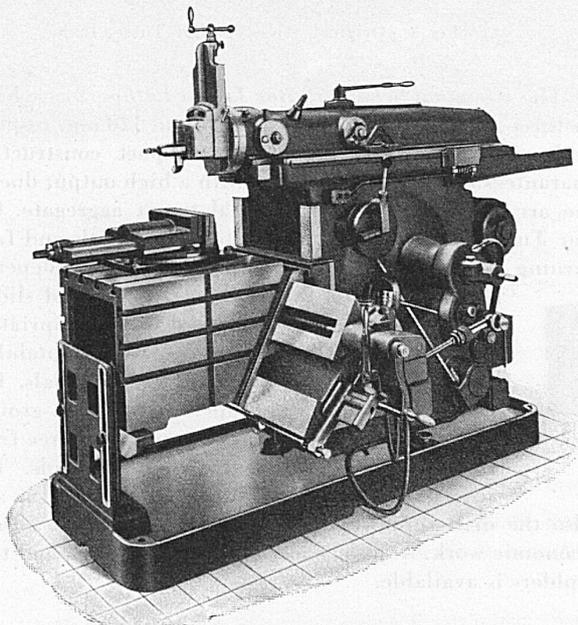
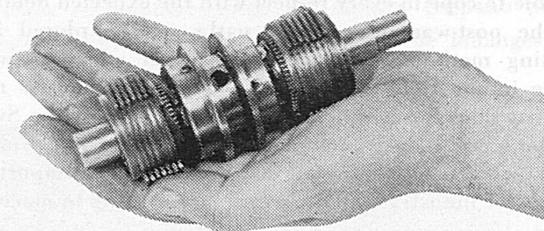


Fig. 4. «Original Schaerer» High Speed Shaper.

preventing any lateral deviation and thus secures absolute parallelism of the planed surfaces. The «Original Schaerer» high speed shapers are all provided with a «Radiax» gear drive, and 10 or 12 different strokes ranging from 10 to 117 or 9 to 98 (Model SH 650) are obtainable by setting 2 levers only. Bearings, gears, slot and crank ram guide are centrally lubricated. The convenient arrangement of the operating levers and the carefully constructed special parts contribute considerably towards a simple and serviceable machining of the most complicated work pieces.

The «Original Schaerer» *Plano Shaper* (fig. 5) combines all the outstanding features of a high grade shaper, i. e. rapid work and a quick succession of short strokes due to table drive by crank slides. The bed is twice as long as the table so that the latter is guided in its full length even at maximum stroke. The integral «Radiax» gear drive permits of the selection of 24 table speeds of 5,5 to 80 strokes a minute. The tool-carrier is displaceable on the bed and allows a locally limited working range at different spots without re-setting the work pieces. In

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Md 145 cm/kg

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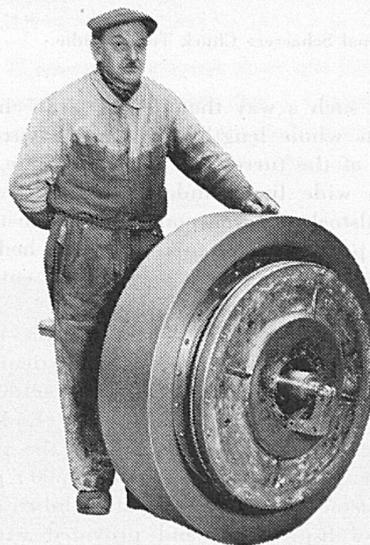
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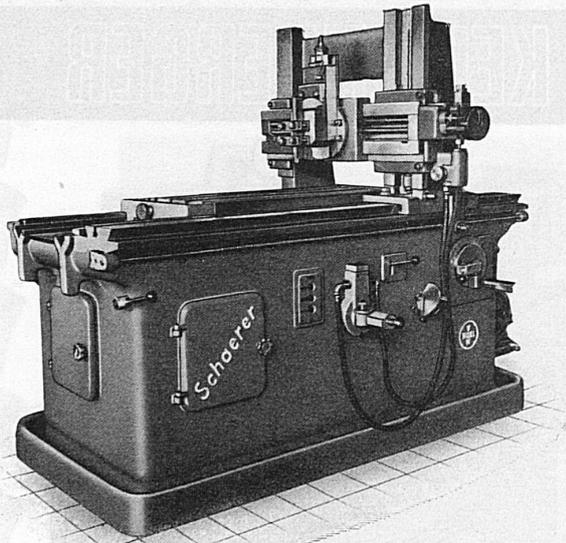


Fig. 5. «Original Schaerer» Plano Shaper.

this way the work is performed by means of short quick strokes, which is especially favourable for long work pieces having to be machined at both ends.

The «Original Schaerer» Double Housing Planer (Fig. 6). The war compelled Switzerland to switch over to big machinery. To-day it is possible to have double housing planers with bed lengths up to 10 m and a passage of 1,5×1,5 m. The «Original Schaerer» double and single housing planers possess a novel table drive by means of 2 racks with lateral teeth in which 2 MAAG-

ground hardened ratchet wheels driven by worm and worm gear engage. In this way the cutting pressure is taken up laterally so as to avoid the lifting of the table from the guides. Even after long years of use the pieces are free from chatter marks, as the teeth flanks never come to lie on the tooth ground. These machines are

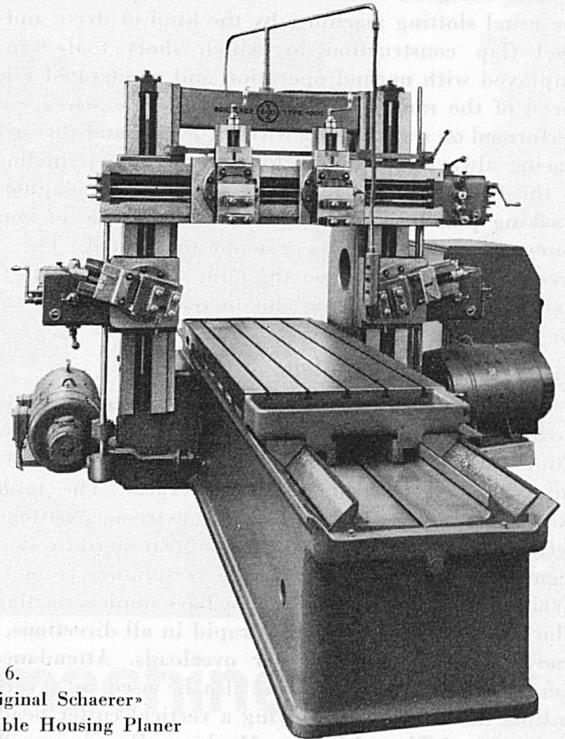
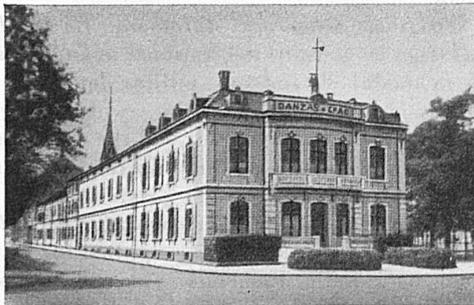


Fig. 6.  
«Original Schaerer»  
Double Housing Planer



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driven by a Leonard group and a D. C. governing motor. The table speeds can be selected between 6,5 to 60 m/min. for operation and release. A magnetic steel lifter is built to all the supports for ensuring lifting of carbide tipped tools even with inclined position of the supports.

The «Original Schaeerer» Vertical Shapers differ from the usual slotting machines by the kind of drive and the steel flap construction by which short tools can be employed with normal operation and accelerated release speed of the ram. The machining of work pieces can be performed on several sides without setting and the surface tracing always remains visible. As the ram is inclinable to the front, vertical shapers are especially adapted for making punches and dies. Straight, concave or convex outer or inner surfaces can be machined. The tool pressure acts vertically on the table and so simplifies the fixing of the work piece and increases the precision of the operation.

#### Milling and drilling machines.

The «Miniflex» Universal Milling Machine is distinguished by the rigid construction of the frame, prismatic guide surfaces of wear-resisting material and pivotable outer support for spindle and overarm. The table is excellently supported and even in extreme positions no deflection can occur. The variable gear permits stepless regulation of the milling spindle revolutions from 18 to 1000 p.m. The table feeds likewise have stepless regulation. The movement of the table is rapid in all directions, and there are safety devices for overloads. Attendance is simple and the machine can also be used as a vertical milling machine by employing a vertical cutter head.

Universal Thread Milling Machine «Benninger». With this machine inner and outer threads, conical and worm threads can be cut up to 240 mm milling diameter. Long threads can be produced up to 400 mm length. An ample selection of rapid clamping devices and special tools adapts the machine to all kinds of work. As the machine is capable of multifarious uses and is easy to attend it is possible to turn out threads more simply and economically than on expensive lathes with skilled attendance. A high speed drive is provided for light metal.

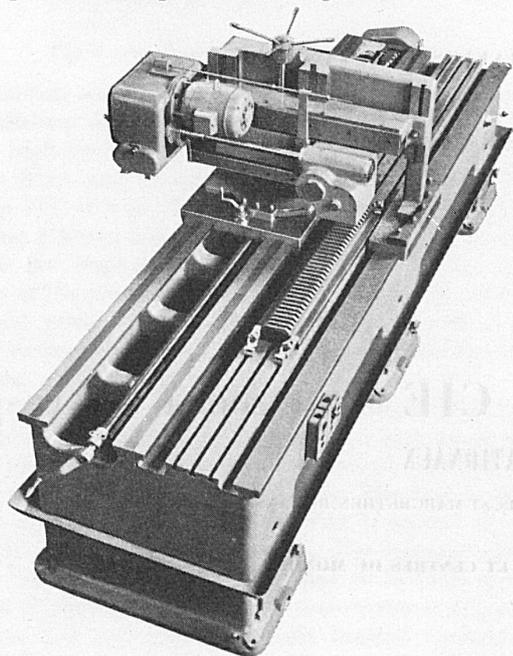
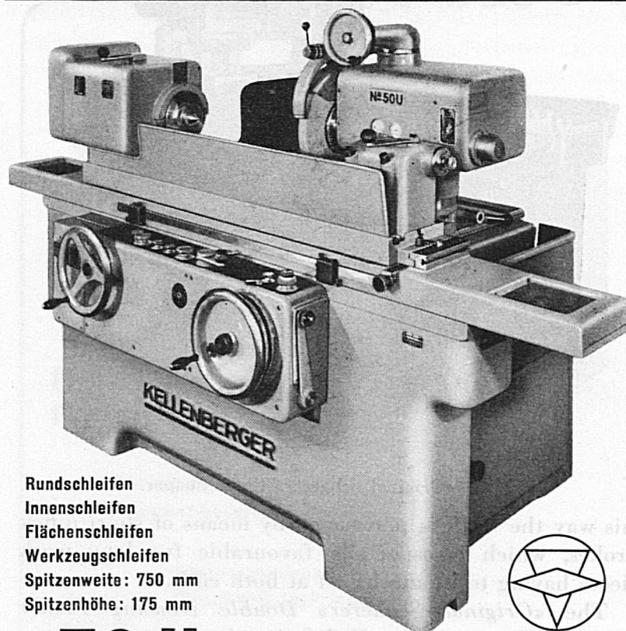


Fig. 7. «Original Schaeerer» Automatic Rack Milling Machine.

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The Universal thread milling machine is semi-automatic; several machines can be operated at the same time by one man.

The «Original Schaeerer» Automatic Rack Milling Machines (fig. 7) permit the rational manufacture of racks up to modul 30 and any milling length. A yoke sliding in broad guides is located in a wide, well-ribbed bed and bears a side milling cutter and the whole driving aggregate. With this machine both, straight racks and those with a slant up to 20° can be produced.

The «Original Schaeerer» Horizontal Boring Mills are fitted with Leonard drives and are supplied for 70, 85 or 115 mm boring spindle diameters. The spindle itself is compensated by a counterweight, and a high speed passage is provided for rapid release. In addition to the wide table, that of BHS 85 for instance measuring 900×1200 mm, an auxiliary table is available for big and unwieldy work pieces. The column carrying the spindle and the gear-box are extremely well dimensioned and the sliding parts run on broad scraped flat guides.

«Klus» Horizontal Boring Mill. Independently of «Original Schaeerer» the «Gesellschaft der Ludw. von Roll-schen Eisenwerke» has developed a horizontal boring mill, a high speed type which complies with all the demands of actual practice by the use of hard metal tools in all its parts. It is driven by a standard A. C. motor over V-belt drive on a double multiple disc coupling for rear and forward run. The range of revolutions comprises 18 geometrically graded numbers and the feed-change-gear yields 24 feeds from 0,05 to 13,8 per revolution.

High Speed «Schweiter» Drilling Machines (fig. 8) are supplied singly or up to six spindles. The simple

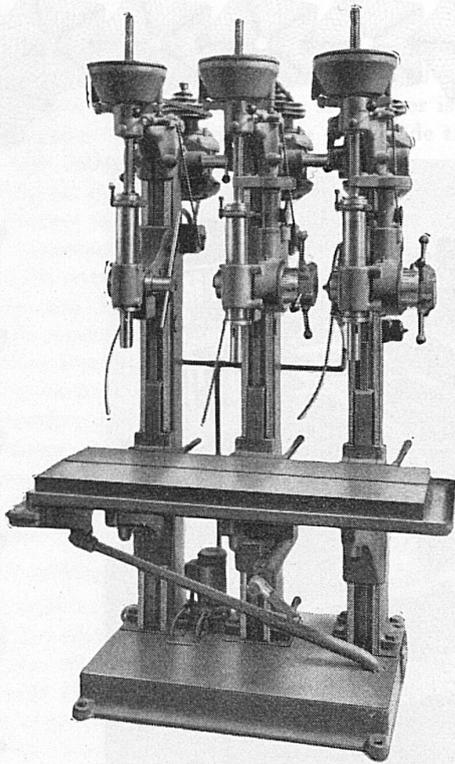


Fig. 8. High Speed «Schweiter» Drilling Machine.

machine is well adapted for serial work for which a whole set of boring spindles can be set. There is, for instance, in a factory near Zurich, a shop with over 100 spindles. The feed is either manual or automatic. The number of revolutions of the spindle is variable within broad limits and an extra reduction gear for thread-cutting and reaming can be provided. The spindle bearing support is vertically adjustable and the lengthily guided boring spindle is in ball bearings. Longitudinal struts connect the sequence drilling machines by common ground plates, table and frame connections. The «Schweiter» drilling machine has recently been supplied with a mounted gear-box, whereby the setting of a single lever permits 8 different revolutions of the spindle.

#### 4. Grinding and lapping machines.

The PH-650 Surface Grinding Machine (fig. 9) has hydraulic table movement in longitudinal and transverse direction with mechanically flawless operation. The vert-

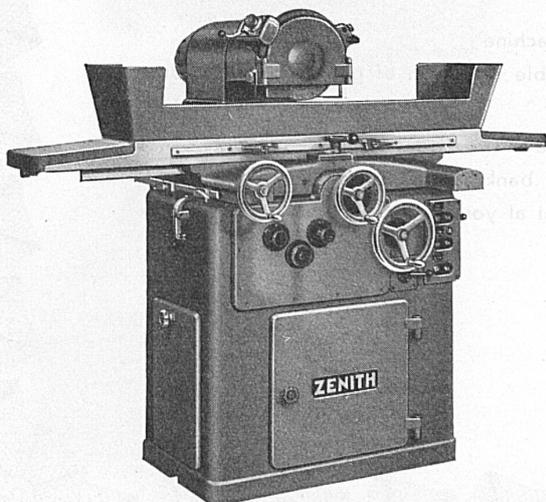


Fig. 9. PH-650 Surface Grinding Machine.

ical adjustment of the grinding headstock is performed by means of a separate motor. The grinding wheel is driven directly and the driving motor is borne threefold in the headstock. Motor and bearings are cooled by a fan located on the same shaft. The grinding spindle is sturdy and so positioned that the machine works absolutely without vibration. The structure is pleasing in shape as all the cables and air pipes are placed inside. Easy operation.

The «Die- and Surface Grinding Machine ML 1» (fig.10) has a high output due to the criss-cross cut of the large cup wheel. This wheel is driven directly by a special motor integral with the spindle. The spindle itself is held by a pivotal arm with its fulcrum in a robust bracket. All the bearings are ball or roller. For grinding dies of about 150 cm<sup>2</sup> surface only 2 to 3 minutes are required to remove 0,3 to 0,4 mm. Extremely effective cooling is provided by a novel feeding device. Permanent accuracy is guaranteed by the fact that the movable parts have been reduced to a minimum; for the same reason the cost of maintenance is minimal and the attendance most simple.

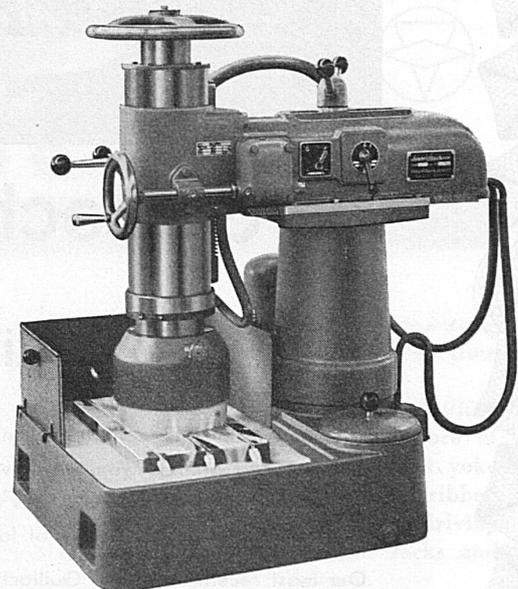


Fig. 10. Die- and Surface Grinding Machine ML 1.

The *Internal Spline Grinding Machines KS 5* are special machines developed by Saurer, Arbon, for grinding with the highest precision flanks of internal splines, especially of hardened work pieces. The grinding wheel is driven by a small hydraulic turbine actuated by the cooling water. There is a large choice of different spindles for bores between 21 and 120 mm. A special feature permits of quick and accurate setting up of the work pieces.

«SIM» *Valve cone grinding machines* are also the outcome of practical requirements. They are utilized for grinding the cones of poppet valves and are pronounced production machines. The poppet valves can be fixed between centres, in the collet chuck or in a three-pulley steady. The machine works with the greatest precision even at largest output. The short setting-up time makes this machine essentially economical.

The *Spiral Drill-Grinding «Trippel» Machines* are popular in every workshop; they grind spiral drills of 2,5 to 25 mm with absolute reliability and do not require

skilled attendance. The principle of the machines is extremely simple. A drum firmly mounted on a horizontal axis contains the necessary apertures for inserting the drill, and a pivotal disc performs the grinding of the inserted drill at the required angle.

«Saurer» Centre Grinding Machines (fig. 11) are for grinding centre holes, especially in hardened shafts. The bracket carries a strong grinding spindle carefully protected against dust. There is an automatic device with a diamond for the grinding cone. The elastic holder for the grinding cone allows sensitive work.

«ULM 3» Lapping Machine.

This lapping machine, built by the Micro-Maag Ltd., has been developed out of the requirements of their own works. It is extremely simple consisting of a pivotable headstock with a very advantageously positioned spindle, the driving aggregate and a frame. It is adapted both for lapping and polishing, but also for other work, such as chamfering, rounding edges, cleaning centres, taking off burrs and crusts, etc. It has 12 spindle revolutions from 50 to 2900 r. p. m.

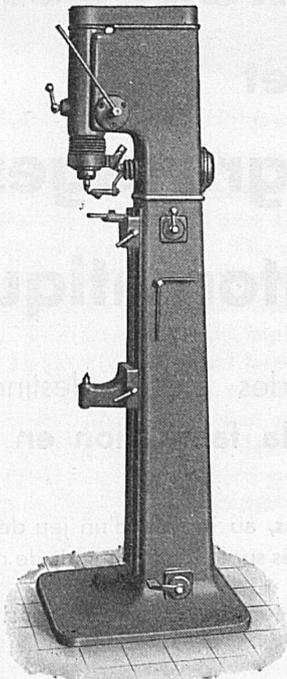


Fig. 11. «Saurer» Centre Grinding Machine.

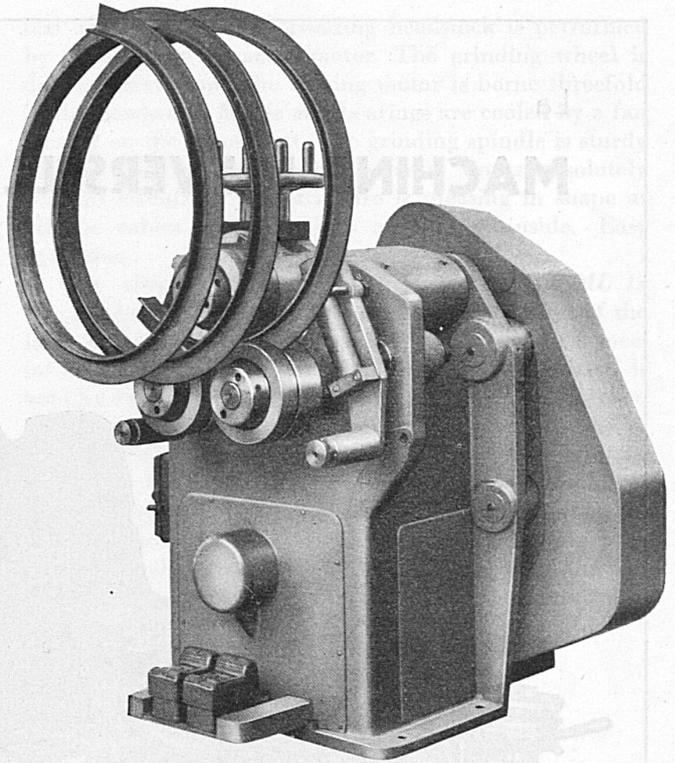


Fig. 12. Circular Bending Machine PR 1.

Bending and sheet-metal working machines.

The Circular Bending Machines PR 1 (fig. 12) permit the serial and rational production of hoops from bars of all cuts, such as sectional iron, quadratic and flat iron, pipes, etc., in their cold state. The machine has 3 bending rolls driven by a powerful motor; the rolls can be adapted to the material by means of various combinations. The output of the circular bending machines is surprisingly high, the cost of maintenance low, and the operation simple.

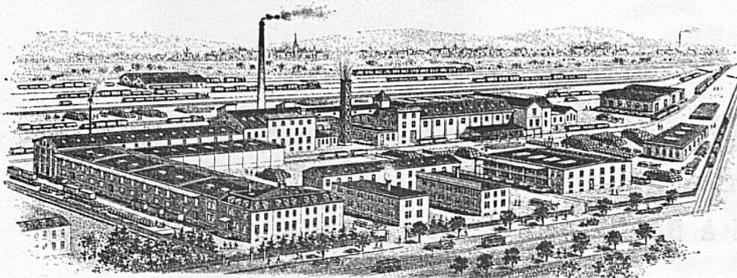
Nibbling machines have the great advantage of being able to machine flat materials of any size. They operate with a punch drawn through a die, which thrusts forward a small part of the work piece at a time. The strokes being very rapid, i. e. 1000 to 1400 p. min., the machine works economically, and as it is possible to insert the punch into a previously drilled hole without causing any deformation of the remaining or cut out parts, the saving of material is considerable as compared with the widely-used templates.

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**Tools.**

High capacity machine tools working with a precision up to  $\frac{1}{1000}$  mm require specially adapted tools such as fixing or measuring implements. During the past years considerable work has been accomplished in this domain.

The *Micro-Maag Internal Micrometer* (fig. 13) aroused great discussion among experts. The inventor of this internal micrometer by which a thousandths of a millimeter can be read and a ten thousandth accurately estimated, has

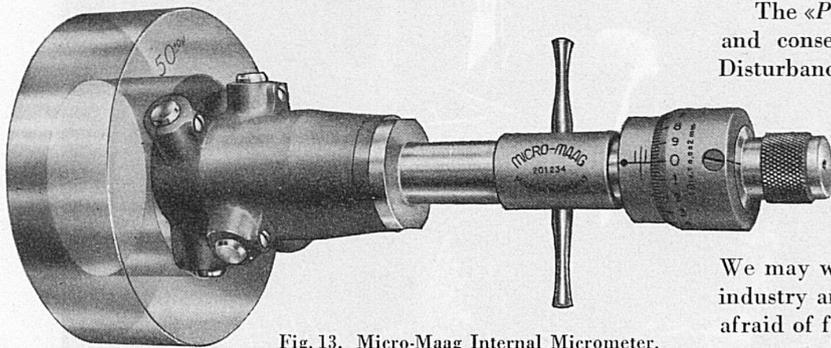
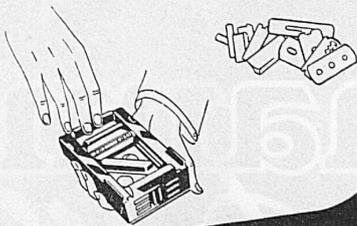


Fig. 13. Micro-Maag Internal Micrometer.

thrown down the glove to the ordinary plug gauge. The Micro-Maag internal micrometer was tested and compared and has everywhere exceeded expectation. It consists of a measuring head in which three or six caliper pins are arranged, a tapered (conical) needle which spreads the pins, when measuring, by spring pressure and a micrometer screw with stop. Measuring can be done on the machine with one hand; the needle is withdrawn and the pins can spread into the inside of the measuring head. After introduction of the implement into the bore the post is released and with it the needle, and the pins are pressed against the wall of the bore. The path of the needle can be accurately measured by turning the micrometer screw to the stop, whereby the needle cone causes a diminution of any elongation errors. Up to now implements of 5 to 100 mm are available, but special ones with a greater diameter will be supplied from case to case. Measurements with the Micro-Maag are made very quickly and surely and are certainly preferable to comparative measurements with gauges.

The «Permanent» magnetic chucks are without current and consequently require neither rectifiers nor lines. Disturbances and danger of accident are practically non-existent. The permanent magnetic force, the low structure and the simplicity of attendance are features of greatest interest to the practical man.

All the foregoing constructions are of Swiss origin and are manufactured in Switzerland. We may well gaze with pride on the Swiss machine tool industry and have the feeling that it has in no case to be afraid of foreign competition.



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