AUXILIARY MACHINES

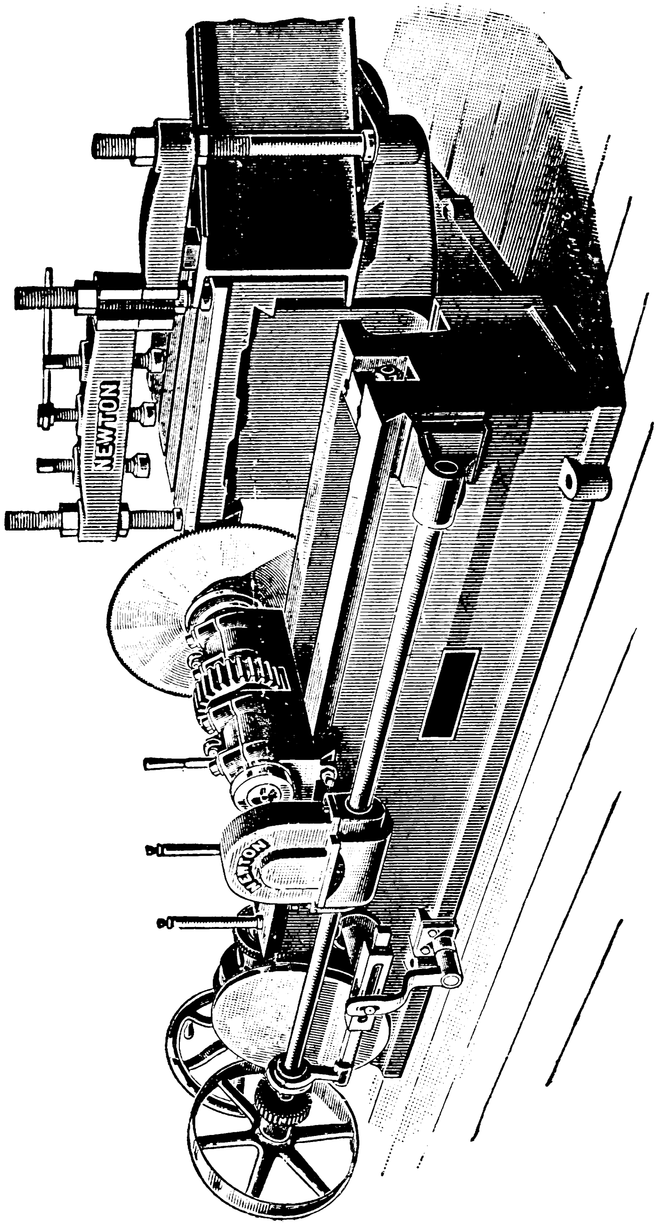


Fig. 265.

AUXILIARY MACHINES.

The introduction of a new machine or device implies the immediate employment of a whole series of auxiliary and dependent appliances.

Some of these are seemingly of more importance than the parent machine, and frequently are much more complicated and expensive to build; they are named, frequently, by their use, and largely aid in the practical success of the new machine which they are designed especially to operate with.

Thus a "cutting-off" machine is used to cut off stock to the required length before it can be operated on by the lathe, etc.; one of these machines is shown on the opposite page and described below.

CUTTING-OFF MACHINES.

When rods, etc., are required to be cut to a certain length, the operation is performed in several ways: 1, either by a special lathe designed for the purpose, or, 2, by a power saw; when executed in a lathe, the revolving spindle in the headstock is constructed hollow, the rods pass through the hole and are then cut to exact length by an ordinary "parting" or cutting-off tool fixed in the rest or carriage of the lathe.

A special cutting-off tool for the purpose is shown in fig. 266; it consists of a substantial drop-forged steel

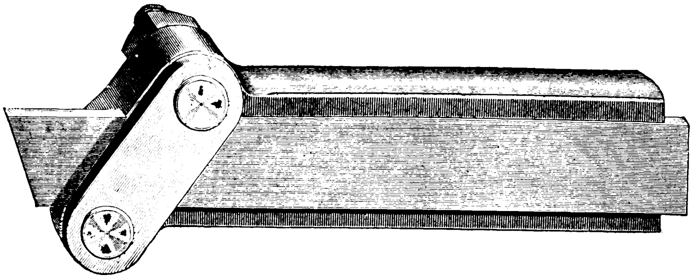


Fig. 266.

holder; the under edge is extended, giving a firm support to the blade directly under the cut; the blades are six inches long, seven-eighths inch wide, milled and ground on both sides to give proper clearance. The top, or cut-

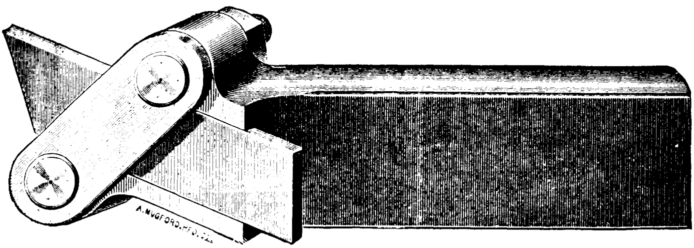


Fig. 267.

ting edge, and bottom are ground square, to gauge of slot in holder. Hence the blades used in this style of holder require grinding on the end only. In use, the blade should be set to project beyond the supporting lip of holder, or under side, a sufficient distance to cut to center of stock; on heavy stock the blade can be advanced after making a cut of one inch or so on the outside. The blade is held in position by a substantial strap, bolts and case-hardened nuts.

Fig. 267 is a similar cutting-off tool, but fitted with an offset holder for particular work which could not be executed by the straight tool holder shown in fig. 266.

A "cutting-off" saw is a machine designed for "cropping" the ends of work and cutting it to length; in the ordinary machine shop practice, a power-driven hack-saw is used, but when cutting large work, a circular, revolving saw is used to cut the work cold; this is commonly styled a cold saw cutting-off machine; the latter is shown in fig. 265.

The power hack-saw illustrated in fig. 268 is especially designed to meet all the requirements of a machine for sawing metal. The upper arm of the frame can be extended so that large work can be cut; the jaws holding the work are planed and can be set so that work on any required angle, as well as straight sawing, can be done. The machine has an 8-inch stroke with quick return; by loosening the set screw in the stud holding the connecting rod, the frame can be swung to either side; by this adjustment the saw can be made to cut perfectly straight; the lower arm of the frame passes through a hole in the sliding thimble with a projecting stud, to which the connecting rod is attached, and on which friction nuts are placed; a set screw runs through this stud and holds the frame in

---

NOTE.—It has been the custom, when cutting a piece of iron or steel, especially hard tool-steel, to send it to the blacksmith to heat the metal in the forge and cut it to the required length; this method has the disadvantage of deteriorating the steel in quality consequent on the heating, and the rod is returned in a rough shape.

any set position ; a piece of steel with concaved end is placed under the set screw to prevent the point from coming in contact with the arm. The slide in which the thimble runs is split so that any wear can readily be taken up by tightening the screws at each end. There is no drag on the saw during the backward movement.

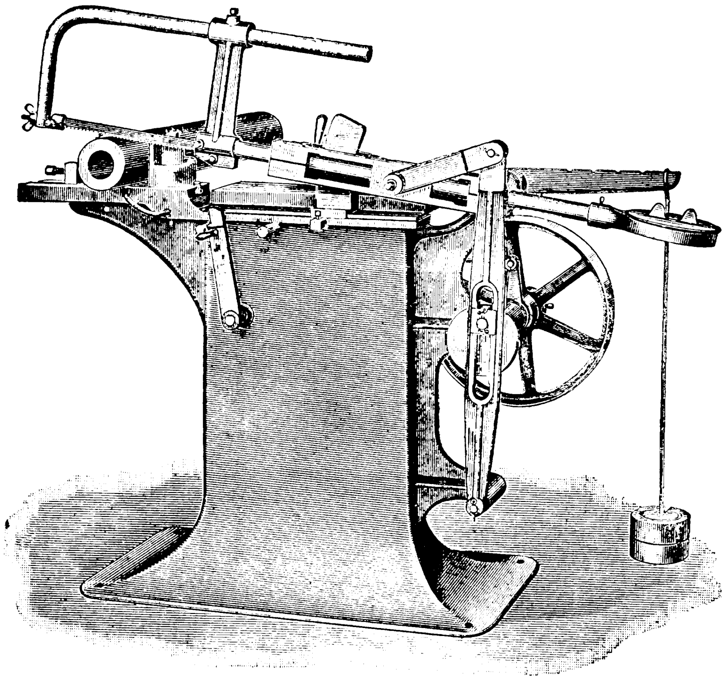


Fig 268.

By adjusting the friction on the connecting rod the saw can be made to lift gently from the work when going backward, and the pressure on the forward stroke can be increased or diminished by the same means. A coil containing twenty-five feet of saws is placed in the magazine on the rear end of the arm, and can be drawn through the proper distance for the work being sawed. By using the magazine coil principle the saws can be used their entire length. This feature alone reduces the cost of saws fully one-half, and as the saw is firmly clamped at both ends instead of being held by pins, the danger of the holes being pulled out of the ends of blades is entirely obviated. The usual speed of the blade is 40 strokes per minute. After a cut is finished, the clutch is automatically thrown out and the machine is stopped.

With flexible hack-saw blades the teeth only are hardened, the back remaining untempered; thus the blade will

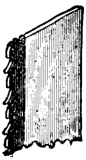


Fig. 269

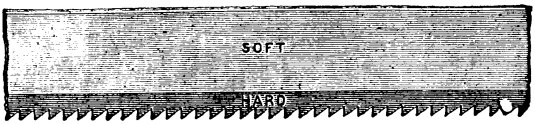


Fig. 270.

neither snap nor break, assuring full efficiency until the teeth are worn dull. Fig. 270 shows the construction of the flexible back blade; fig. 269 shows the set of the teeth. These blades for cutting iron, steel, brass, etc., are made from 23-gauge stock, and have 15 teeth to the inch; for cutting tubing and sheet metals the teeth are finer, being made 24 teeth to the inch.

Fig. 264 shows the countershaft used with the power hack-saw shown in fig. 268; the motion is stopped by shifting the driving belt from the fast on to the loose pulley; these are the pair shown in the cut, the small pulley being the driving pulley connected to the pulley on the machine.

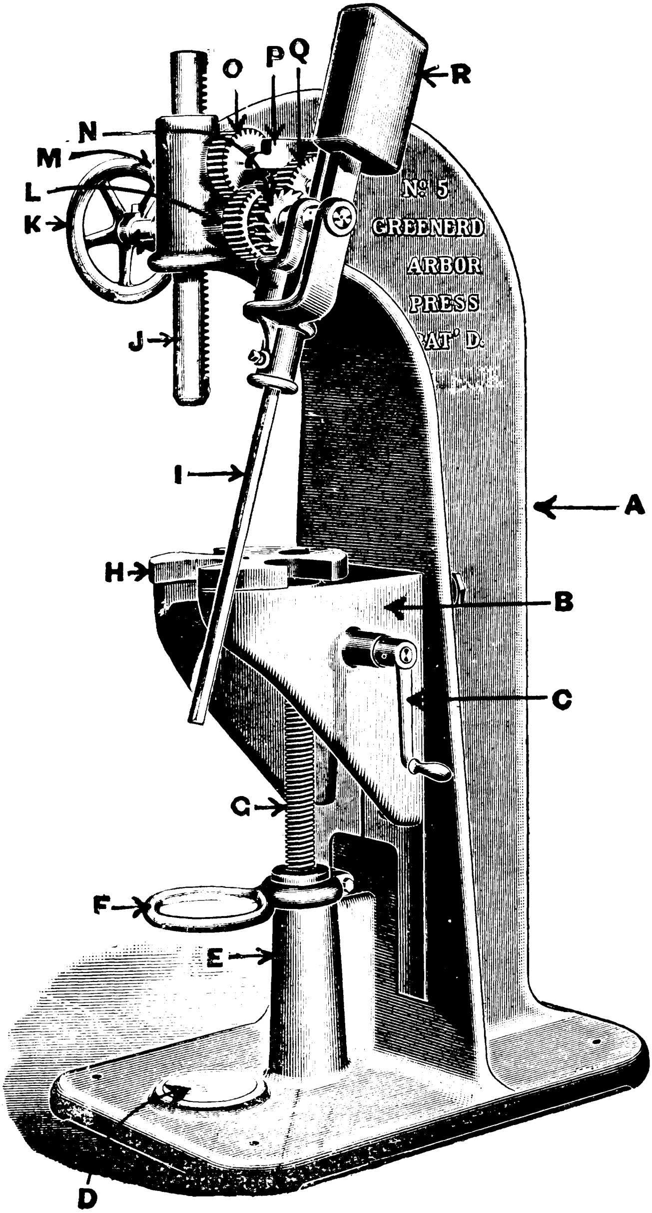


Fig. 271.

THE ARBOR PRESS.

The arbor press is a machine devised for accomplishing the work described in the note, which is ordinarily done by hand, by means of a hammer, etc. The arbor or mandrel is a spindle which is forced or driven into a bored hole in the work, such as a pulley or wheel, to enable it to revolve between the centers of a lathe, milling cutter, etc.

Fig. 271 shows such a machine, which is a very useful device, being quick in action, and which can be bolted on the end of the lathe-bed or on a separate bench, and which is always ready for use. Operated by a hand lever, a pressure of seven and a-half tons can be obtained by an ordinary man by means of the gear-wheels shown in the engraving; it is exceedingly simple in action, and consists of a massive standard *A*, which carries a sliding or adjustable knee *B*, which can be regulated to the height of the work by a square-thread screw *G*, which acts in a nut in the top of standard *E*; the handle *C* operates the screw *G*; the plate *H* is free to revolve on the knee *B*, and is provided with lateral openings of graduated sizes for various-dimensioned mandrels; when released from the work, the arbor or mandrel drops on the soft babbitted cushion *D*, and is caught or retained in the large steel ring *F*; the plunger or ram *J* has a rack cut on one side; this rack is engaged with two pinions, one on spindle *M* and one on

NOTE.—Very generally the mandrel is driven into the work with a lead-headed hammer, or an ordinary sledge is used; as a precaution, a piece of sheet-brass, copper or hard-wood is placed against the end of the mandrel to receive the force of the blow of the sledge and thus prevent the "center" in the mandrel being damaged or destroyed, as the brass strips will spread and become thin from repeated use, soon rendering it unfit for the purpose.

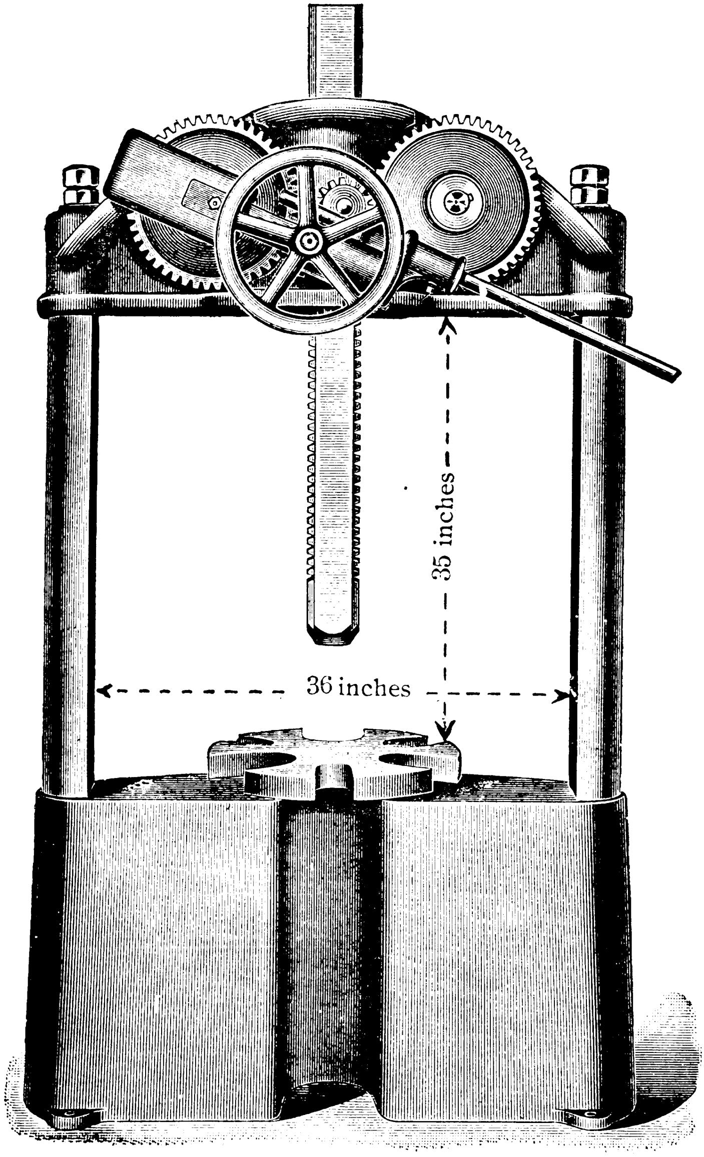


Fig. 272.

the lever spindle, and they are geared together by the spur wheels *L* and *O*; the leverage is obtained by means of wheel *Q* and a pinion hidden in the drawing by the ratchet *N*; a pawl fits into the casting, into which the lever *I* is fixed; a leverage of 135 to 1 is thus obtained. The counterweight *R* balances the lever and keeps it in an upright position when not in use; a pin projects from one side of the pawl, so that when the lever casting is upright,

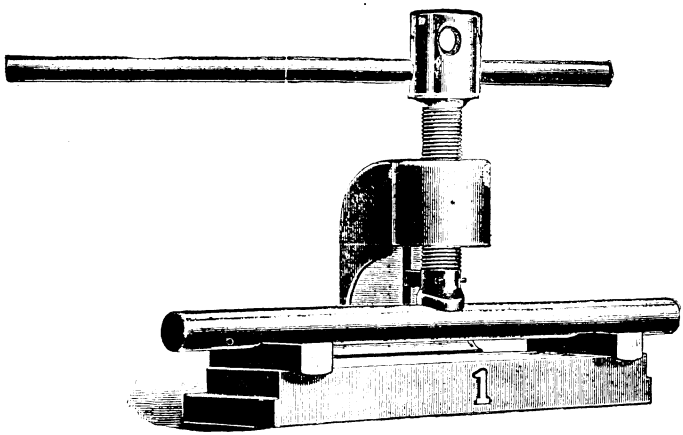


Fig. 273.

the pawl rides the "shedder" *P*, disengaging the pawl from the ratchet, thus leaving the ram *J* free to be moved up or brought down to the work by means of the hand-wheel *K*.

Fig. 272 shows a very powerful press, designed for mandrels up to 7 inches diameter; the ram is made of four-inch steel and has a rack cut on two opposite sides; the gears are steel, have a leverage of 250 to 1 and exert a pressure of about sixteen tons at the end of the ram, with a man of ordinary strength at the lever.

SHAFT-STRAIGHTENING MACHINES.

Fig. 271 shows a hand-power shaft-straightening machine intended for bench use; it has a powerful screw made of steel; the bed is planed true and has two steel blocks or vees fitted to slide upon it; these can be adjusted to suit the bend or twist in the shaft, and will accommodate work of any length.

This is but one of many devices of this nature; some of these are much more complicated and costly and operated by pneumatic and other powers; one of the most common is a machine used in railroad shops in straightening car and locomotive engine axles.

TURRET MACHINES.

These were originally named from their resemblance to the *turrets* or "little towers rising from or otherwise connected with a larger building;" the word turret was in very frequent use in the middle ages as defining *movable towers* used in military operations; at the present date turrets, in engineering practice, are always understood to mean a revolving mechanism, as the turret-gun, designed for use in "a revolving turret," and the turret lathe, which has a revolving tool-holder.

NOTE.—*The monitor, or turret lathe*, derives its name from the Ericsson's Monitor, designed and built in 1862; this carrries on its deck one or more *revolving turrets*, each containing one or more great guns, which can be successively brought into range by revolving the steel-clad turret, thus combining the maximum of gun power with the minimum of exposure. Ericsson named his newly-invented ship *The Monitor*, from its use as a caution or warning to the enemies of his adopted country.

AUXILIARY MACHINES.

In modern machine shops a turret is known as a revolving tool holder; that is, a tool holder which contains a number of cutting tools, any one of which may be used by revolving the holder, which brings the cutting tool successively into position to operate on the work; while the turret is principally used on lathes, screwing and drilling machines, it is applied to many other machines, such as the planer, and shaper, and also in wood-working machines.

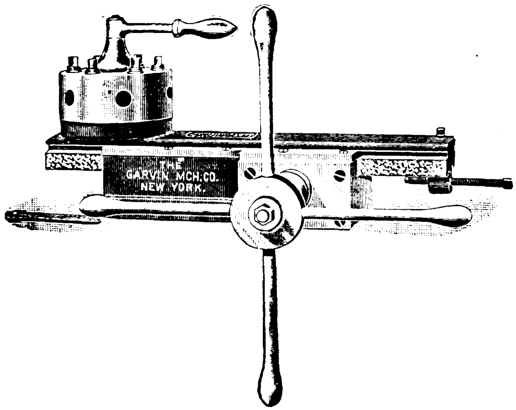


Fig. 272.

Fig. 272 shows a turret fitted on the shears or bed of a lathe; the turret is bored with holes for the reception of six tools; it has hand longitudinal and cross feeds, the turret being revolved by hand; it has at its base, a steel index ring of large diameter, hardened and ground; the locking bolts are hardened and ground, and provided with a taper gib for taking up the wear; a spiral spring forces the locking bolts into the slots, and is adjusted by a screw at the back end of the turret slide. The turret slides move in flat bearings with adjustable taper gibs to maintain correct alignment.

THE TURRET LATHE.

Fig. 273 exhibits a turret fitted on the carriage of an engine lathe, similar to that illustrated in fig. 61 ; it shows the hexagonal turret mounted on the carriage, being interchangeable with the compound rest shown in fig. 61, enabling the lathe to be used either as an engine lathe or a turret lathe.

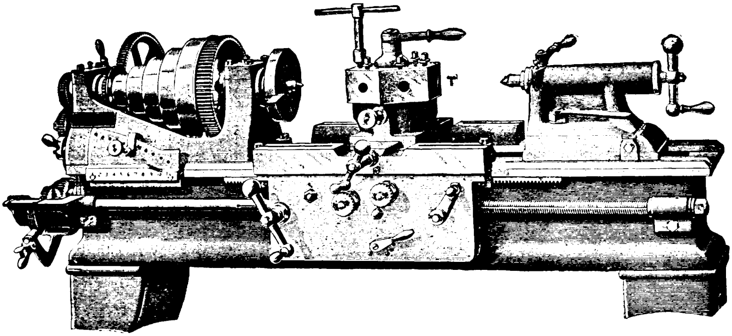
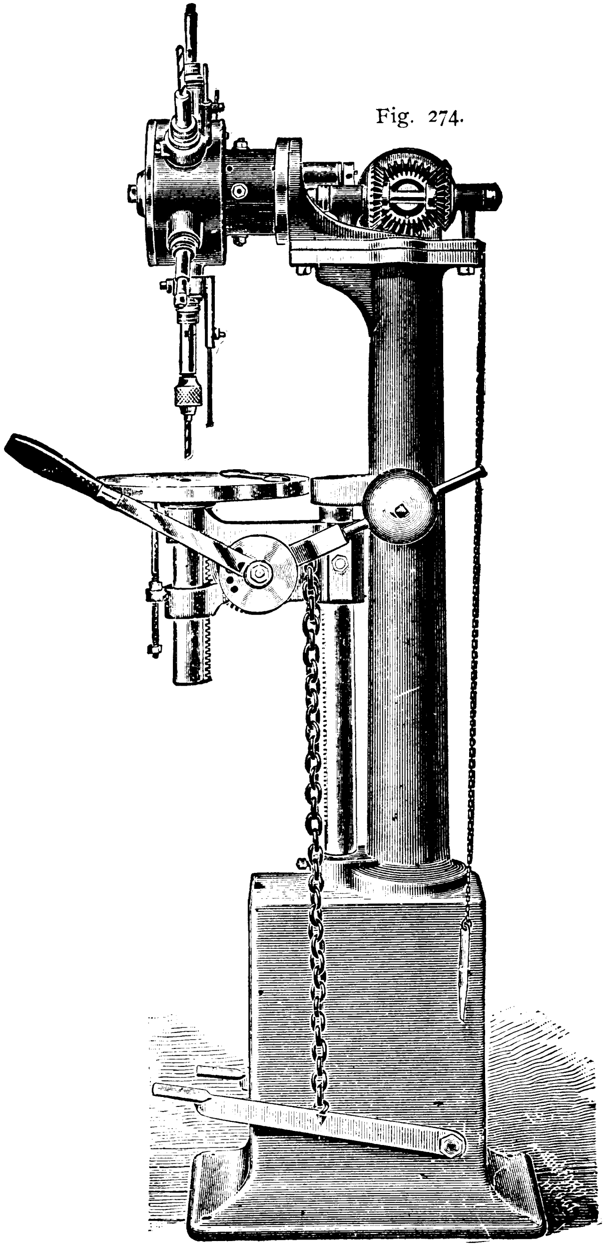


Fig. 273.

The advantages of this turret are that it has power, longitudinal and cross feeds, and is screw cutting; it has all the changes of feed that the lathe has; it may be used in connection with the half-nuts, and therefore chase a thread; it permits running in such taps as conform with the threads cut by the lathe at their proper pitch and bringing them out without danger of stripping any of the threads; it may be " set over " either way from the center and is provided with centre stops.

NOTE.—In practice, all pieces made from the continuous bar are machined as follows : A long bar of the rough iron or steel is pushed through the spindle, until the piece projects beyond the chuck long enough to make the piece desired. The various tools on the turret are set for the different diameters and cuts, and after each performs its operation, it is turned out of the way to admit the next tool. Since a number of tools are set for the various diameters, it gives this machine a great advantage over the lathe where there is but one tool.

Fig. 274.



THE TURRET DRILL.

Fig. 274 shows a turret head fitted to a drilling machine described as a turret drill. On the trunnion of the frame is mounted the turret head with any number of projecting bearings; six are shown in the illustration fig. 275, which is a front view of the turret head. These projecting bearings support and guide the drill spindles; through the frame passes the driving shaft, on the end of which, inside of the turret, is fastened a bevel gear in mesh

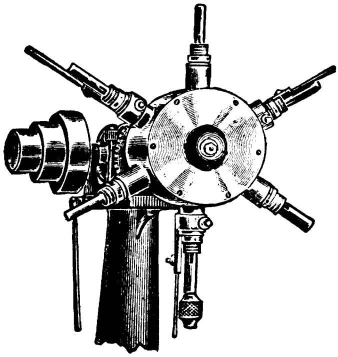


Fig. 275.

NOTE.—Pivoted on the front of the gear-case, fig. 275, in the interior of the turret head is a bell crank lever, one end of which is forked and loosely connected to the driving spindle; the other arm of this lever is connected to the locking bolt that holds the turret head in position. Fastened to the locking bolt is a rod connected to the foot-treadle shown on left-hand side of the base. When the treadle is pressed downward it moves the locking bolt outward; at the same time the driving spindle moves upward and is unlocked from the drill spindle before the locking bolt leaves its socket, thus making it impossible for the turret to be moved while the driving spindle is in contact with the drill spindle. When the turret is revolved to the tool wanted, the bolt will automatically drop in its socket, and the driving spindle moves downward and engages the drill spindle.

The feed is by hand and foot lever. The table is balanced and has a vertical feed motion. The knee that supports the table is fastened to the face of the column and balanced by a weight inside of the column. The drill spindles are of steel, hardened and ground, and reamed to fit the Morse taper; the spindles have an independent drill stop.

with another bevel gear, loosely splined to the driving spindle, which has on its lower end a clutch that engages, when in operation, with a corresponding clutch on the inner end of the drill spindle.

Fig. 276 shows a screw-cutting die-head which is self-opening and adjustable; it is designed for use on screwing machines, lathes and in turrets, being provided with an internal adjustable gauge for varying the length of the threads. It has few parts, yet admits of the finest adjust-

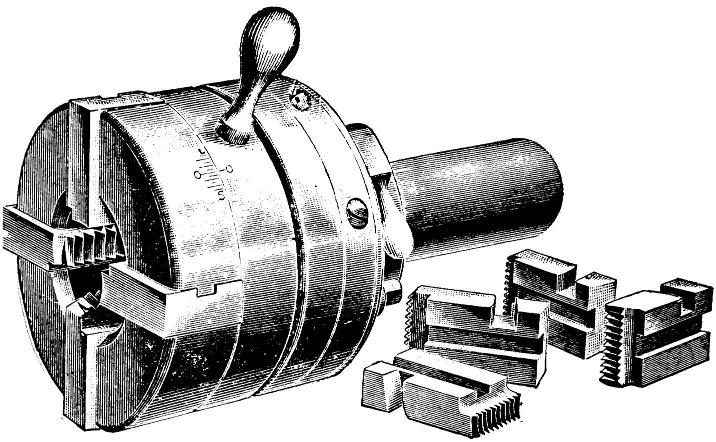


Fig. 276.

ments; being graduated upon one side of the shell and provided with an index by which quick and accurate variations in the diameter of threads may be made, and as the index is controlled by one screw, both dies are adjusted simultaneously. It is provided with four single-point dies, and also with a roughing and finishing attachment, by means of which two cuts may be taken in making a thread, and insures a more perfect quality of work than is possible to produce with one passage of dies.

SCREW-CUTTING DIE HEAD.

The roughing and finishing attachment is operated by a small handle located at one side and back of the head proper, and as shown in the illustration, so arranged that by moving it to a forward position the dies are opened slightly for the roughing cut, and when the handle is returned to its original or backward position, the dies are closed and locked at a predetermined point for the finishing cut; this handle is easily and quickly manipulated by the left hand of the operator. In regular practice the tripping of the dies is effected by the stock as it passes through the dies and comes in contact with the end of the gauge, but they may be tripped at any point on the cut by moving the handle which operates the roughing and finishing attachment to a central position, which unlocks the dies and causes them to open.

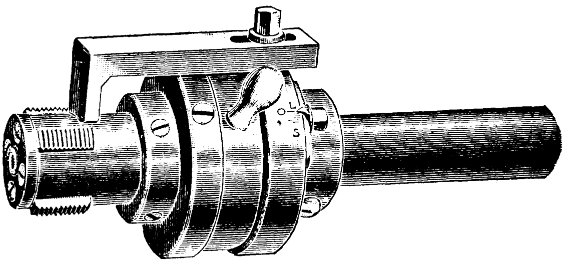


Fig. 277.

Adjustable collapsing taps, as shown in fig. 277, are designed for use in screwing machines and lathes and are held either in the turret, or in the rotary or live spindle. By reason of not requiring to be reversed, these taps retain their cutting edges longer and will cut smoother and cleaner than a solid tap; the standard size of thread can be maintained by adjusting the chasers or cutters in a similar manner to the adjustable dies described on page 259.

KEYSEATING MACHINE.

Fig. 278 shows a machine which will cut keyseats on any portion of a shaft, without removing it from its bearings; the machine being firmly fastened to the shaft by two clamps, the cutter-head is fed along the shaft and will mill a keyseat 12 inches long without resetting, and as it has a sliding support under the cutter at all times, it cuts without jar and produces keyseats with straight sides and

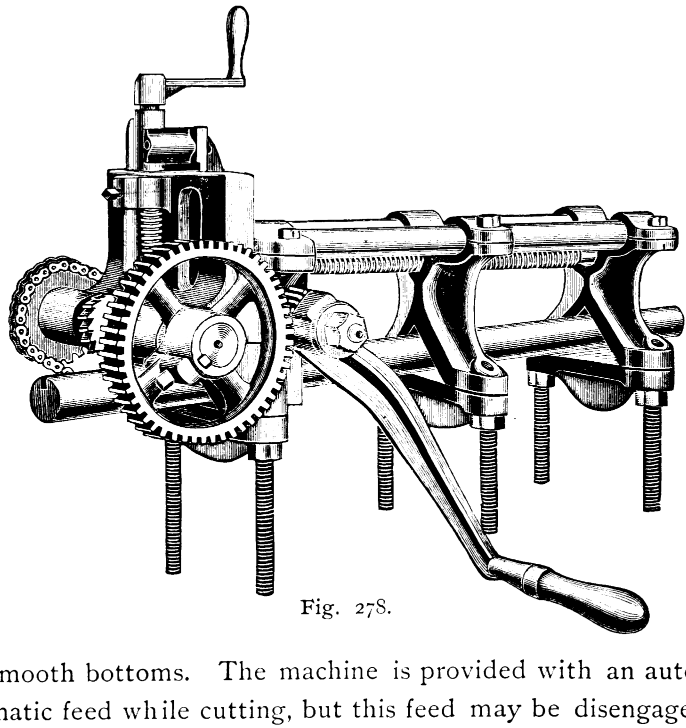


Fig. 278.

smooth bottoms. The machine is provided with an automatic feed while cutting, but this feed may be disengaged if desired, and the cutter-head fed by hand.

Five milling cutters are used with each machine; by employing one or more of which on spindle, keyseats of any of the following sizes may be milled full width at one operation: $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$, $\frac{9}{16}$, $\frac{5}{8}$, $\frac{11}{16}$, $\frac{3}{4}$, $\frac{13}{16}$, $\frac{7}{8}$, $\frac{15}{16}$, 1, $1\frac{1}{16}$, $1\frac{1}{8}$ in.

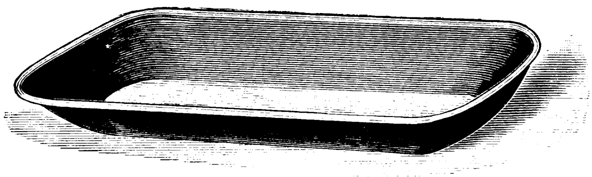


Fig. 279.