

angle to the faces of the plates, as is necessary in setting jewels in a watch movement.

In holes of such small diameters as are used in watch work, it is manifestly very difficult to set them true by the ordinary methods of chucking and it is tedious to test if they are true, and it is to obviate these difficulties that the pump centre head is designed. Its operation is as follows.

There are in this case three spindles A, B, and C, in Fig. 667; A corresponds to spindle A in Fig. 651, driving the chuck D which screws on A as shown; B simply holds the work against the face  $d$  of D, and C holds the work true by means of the centre  $e$ , which enters the hole or centre in the work and is withdrawn when the work is secured by spindle B.

The chuck D is open on two sides as shown at E E in Fig. 668, which is an end face view of the chuck, and through these openings the work is admitted to the chuck. The rod or spindle C is then pushed, by hand, endwise, its centre  $e$  entering the hole or

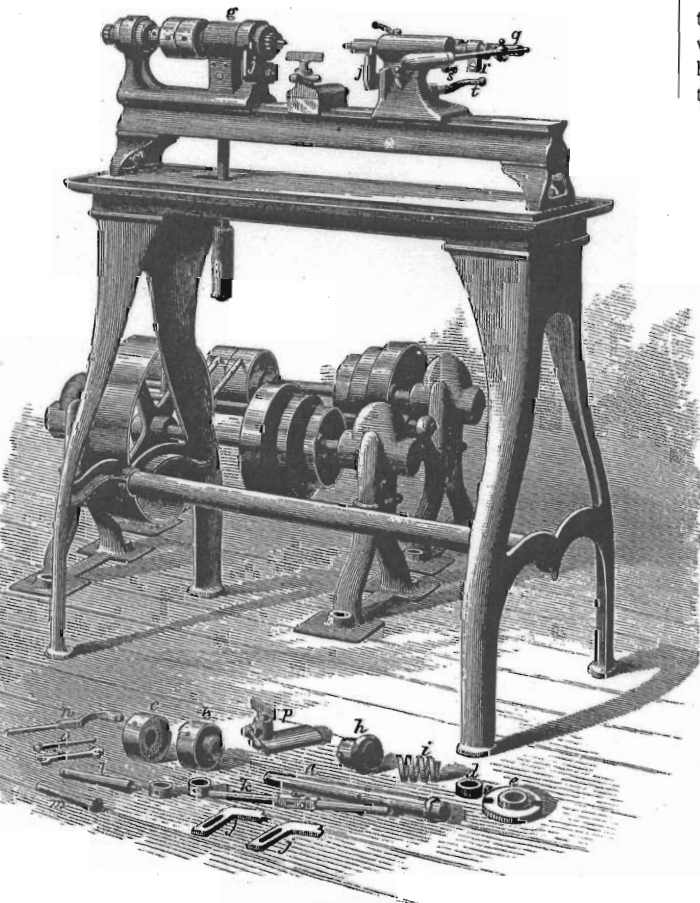


Fig. 669.

centre in the work (so as to hold the same axially true) and forcing the work against the inside faces  $d$ , spindle B is then operated, the face  $p$  forcing the work against face  $d$ , and between these two faces  $d$  the work is held and driven by friction. The spindle C and its centre  $e$  is then withdrawn by hand, leaving the hole in the work free to be operated upon.

The journal bearings for spindle A are constructed as described for A in Fig. 666; spindle B is operated endways within A as follows. A is threaded at G to receive the hub H of wheel I, at the end of B is a collar which is held to and prevented from end motion within the hub H: hence when wheel I is rotated and A is held stationary (by means of the band pulley), H traverses on G and carries B with it. Operating I in one direction, therefore moves  $p$  against the work, while operating it in the other direction releases face  $p$  from contact with the work.

It is obviously of the first importance that the spindle C be held and maintained axially true, notwithstanding any wear, and that it be a close fit within B so as to remain in any position when the

lathe is running, and thus obviate requiring to remove it. To maintain this closeness of fit the following construction is designed. Between spindle A and spindle B, at the chuck end of the two, is a steel bush which can be replaced by a new one when any appreciable wear has taken place. Between B and C are two inverted conical steel bushes, which can also be replaced by new ones, to take up any wear that may have taken place.

Fig. 669 represents an improved hand lathe by the Brown and Sharpe Manufacturing Company, of Providence, R. I. It is specially designed for the rapid production of such cylindrical work as may be held in a chuck, or cut from a rod of metal passing through the live spindle, which is hollow, so that the rod may pass through it. Short pieces may be driven by the chuck or between the centres of a face plate (shown on the floor at  $e$ ) screwing on in the ordinary manner. When, however, this face plate is removed a nut  $d$  screws on in its stead, to protect the thread on the live spindle.

The chuck for driving work in the absence of face plate  $e$  (as when the rod from which the work is to be made is passed through the live spindle) may be actuated to grip or release the work without stopping the lathe. The pieces  $j$   $j$  are to support the hand tool shown in Figs. 1313 and 1314, in connection with hand turning, the tool stock or handle being shown at  $k$  on the floor.

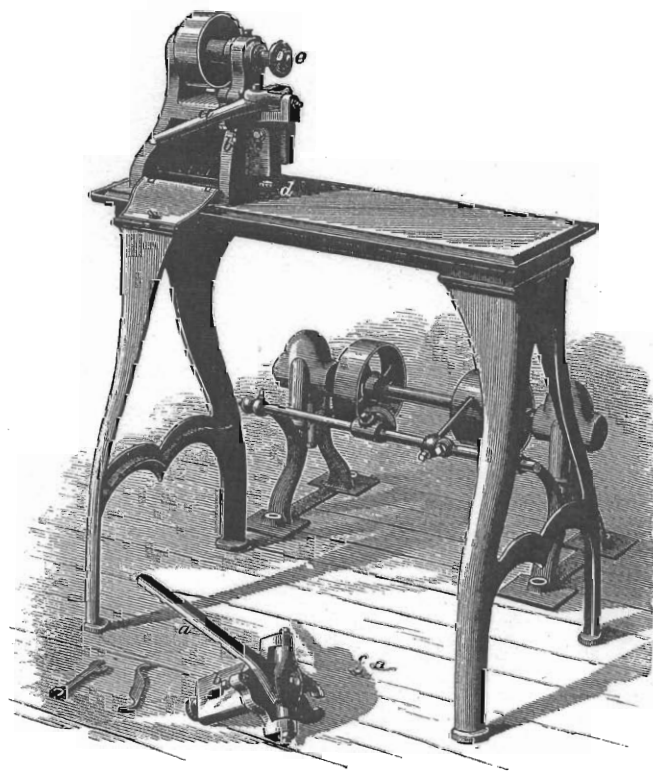


Fig. 670.

The lever for securing the tailstock to or releasing it from the shears is shown at  $l$ . The tail spindle is operated by a lever pivoted at  $g$  so that it may be operated quickly and easily, while the force with which the tail spindle is fed may be more sensitively felt than would be the case with the ordinary wheel and screw, this being a great advantage in small work. The tail spindle is also provided with a collar  $r$ , that may be set at any desired location on the spindle to act as a stop, determining how far the tail spindle can be fed forward, thus enabling it to drill holes, &c., of a uniform depth, in successive pieces of work.

The live spindle is of steel and will receive rods up to  $\frac{1}{2}$  inch in diameter. Its journals are hardened and ground cylindrically true after the hardening. It runs in bearings which are split and are coned externally, fitting into correspondingly coned holes in the headstock. These bearings are provided with a nut by means of which they may be drawn through the headstock to take up such wear in the journal and bearing fit, as may from time to time occur.