(Model.) 4 Sheets—Sheet 1.

E. F. SPAULDING.

Screw Cutting or Tapping Machine.

No. 239,875. Patented April 5, 1881.

Fig. 3.

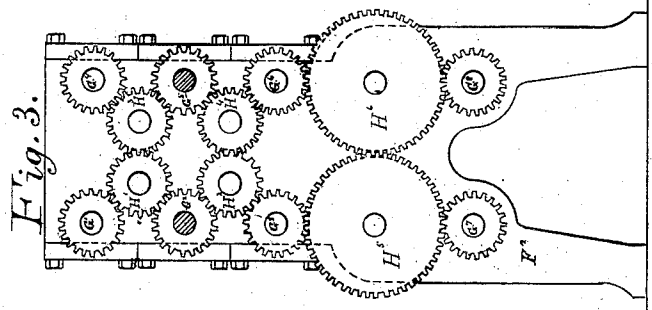


Fig. 2.

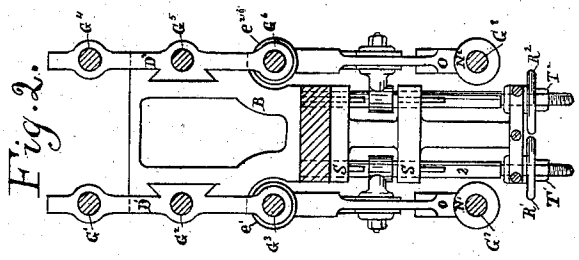


Fig. 8. Fig. 9.

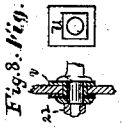


Fig. 7. Fig. 6.

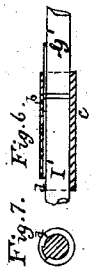
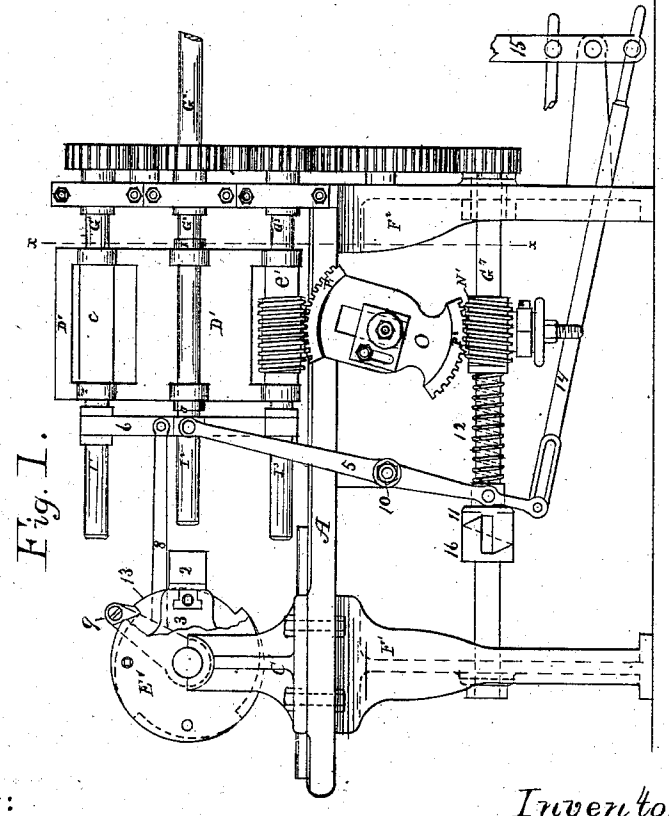


Fig. 1.



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E. F. SPAULDING.

Screw Cutting or Tapping Machine.

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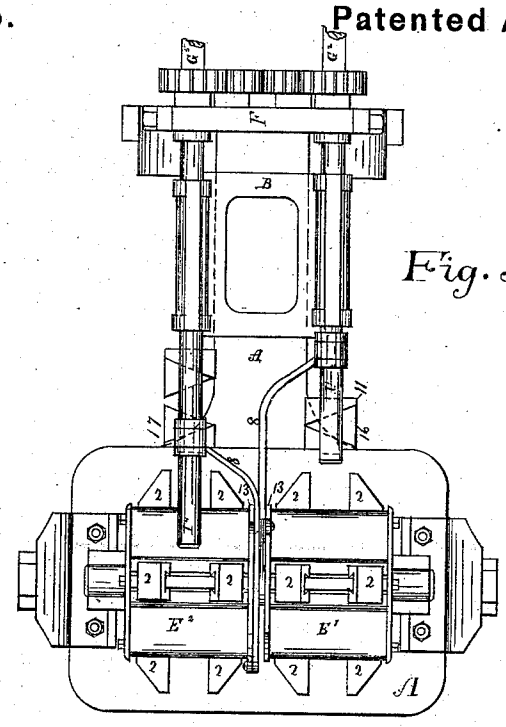
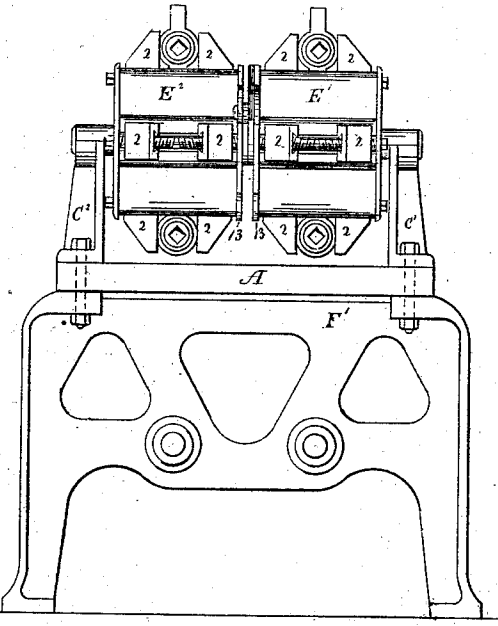


Fig. 5.

Fig. 4.



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4 Sheets—Sheet 3

E. F. SPAULDING.

Screw Cutting or Tapping Machine.

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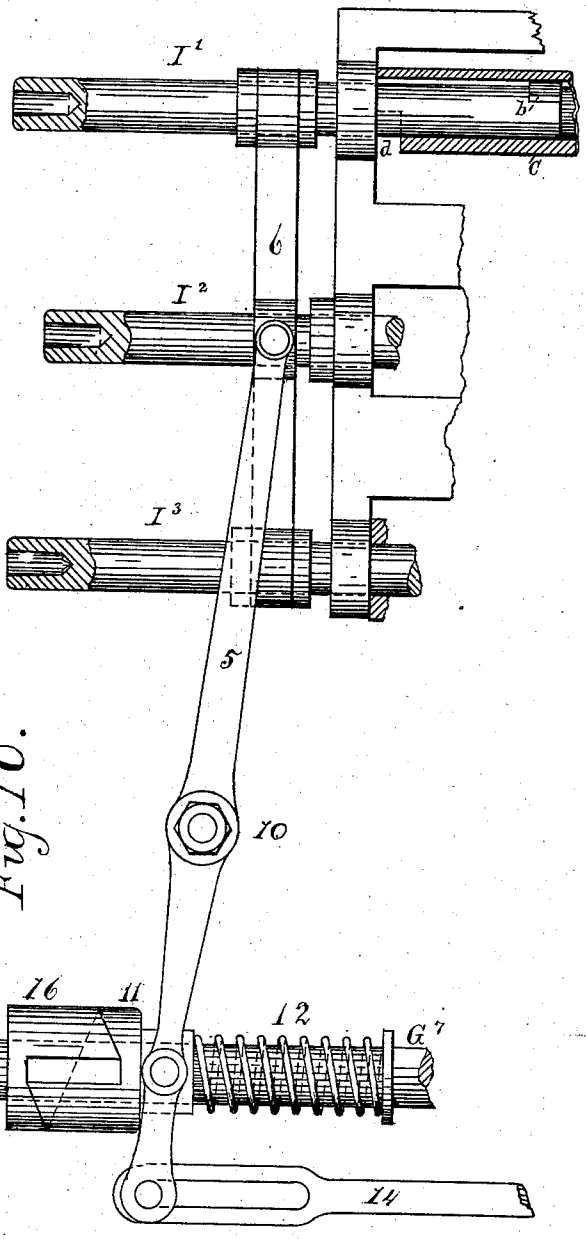


Fig. 10.

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(Model.) 4 Sheets—Sheet 4

E. F. SPAULDING.

Screw Cutting or Tapping Machine.

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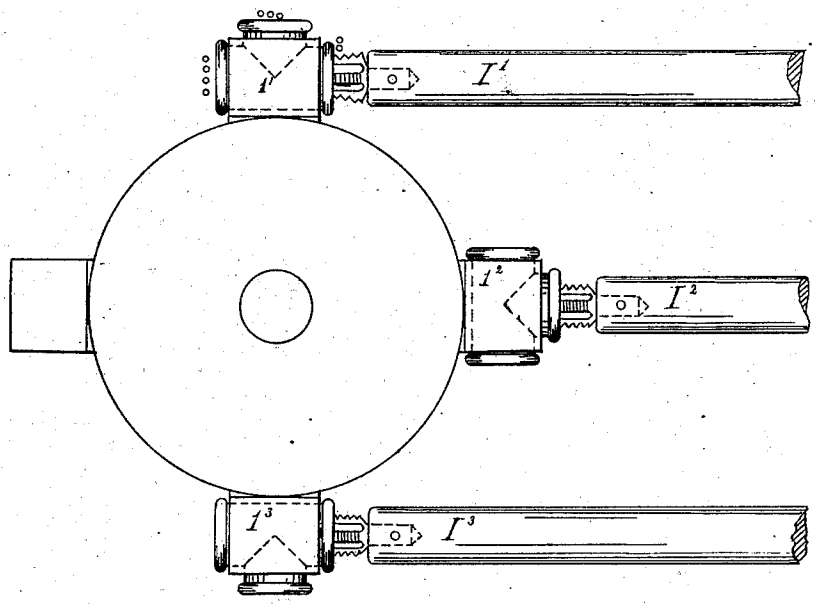


Fig 11

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UNITED STATES PATENT OFFICE.

ELIJAH F. SPAULDING, OF ERIE, PENNSYLVANIA.

SCREW CUTTING OR TAPPING MACHINE.

SPECIFICATION forming part of Letters Patent No. 239,875, dated April 5, 1881.

Application filed July 22, 1880. (Model.)

To all whom it may concern:

Be it known that I, ELIJAH F. SPAULDING, of the city and county of Erie, and State of Pennsylvania, have invented a new and useful Screw-Cutting Machine, of which the following is a specification.

My invention relates to improvements in that class of screw cutting or tapping machines designed particularly for screw-threading pipe-fittings; and the objects of my improvements are, first, to operate upon several fittings at the same time with the mechanism for driving the taps or screw-cutting tools, so arranged as to drive half of the taps forward into the fittings while the other half are being withdrawn, this arrangement admitting of a smaller power than if all the taps were cutting simultaneously; second, to the peculiar mechanism for automatically feeding the taps to their work, the said mechanism being capable of easy adjustment, so as to feed taps cutting a different number of threads to the inch; third, to the combination of the mechanism for revolving the chucks, at the same time carrying back the tap-spindles, to allow the jaws of the chucks to pass the taps, and also for reversing the machine; fourth, to the peculiar arrangement for revolving the tap-spindles and securing them from any lateral motion when the taps are cutting beyond that given to them by the feeding devices, while allowing of their being carried back as soon as the taps are withdrawn from the fittings, for the purpose of allowing the jaws of the chucks to pass the taps while being revolved. I attain my purpose by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the machine, showing only one set of taps and the mechanism to operate the same. Fig. 2 is a vertical cross-section on line *x x*, looking toward the chucks. Fig. 3 is an end elevation, showing the train of gears. Fig. 4 is an end elevation of the opposite end, showing the chucks. Fig. 5 is a plan or top view. Figs. 6, 7, 8, 9, and 10 are views of details. Fig. 11 is a side view of the chuck with three-way fittings, called "T's," shown in three of the four jaws, the fourth jaw being ready to receive a fitting while the taps enter the three fittings shown and cut a thread simultaneously in each one.

The tap in spindle I′ cuts a thread in the end *o o* of the fitting 1′, while the other taps enter their respective fittings. As soon as the threads are completed the motion of the spindles is reversed, causing the taps to back out of the fittings, and as soon as they clear the fittings the spindles I′ I³ are carried back, so the jaws of the chuck will not come into contact with the taps as the chuck revolves. The central spindle, I², remains stationary, as the jaws will always swing clear of it when the tap is not in a fitting, as will be seen from reference to the drawings. The chuck makes a quarter-revolution while the spindles move back, which brings the fitting 1′ in place of the fitting 1², and carries the fitting 1³ to the place where the empty jaws are now shown. These jaws, having been supplied with a fitting by the attendant, take it to the place of fitting 1′. The taps are now forced forward, and the tap in spindle I² enters the fitting 1′ in the center or branch *o o o*, while the tap in spindle I′ cuts the first thread in a fresh fitting. As soon as the threads are completed the motion is again reversed, and as soon as the taps clear the fittings spindles I′ I³ move back. The chuck makes a quarter-turn, as before, which changes the position of the fittings, 1′ this time taking the place of 1³. The taps now come up to their work, and the tap in spindle I³ enters the last end *o o o o* of fitting 1′. This completes the threads in fitting 1′, and the next quarter-turn of the chuck will carry this fitting to the position of the empty jaws (shown on drawings) for the attendant to remove this fitting and fill its place in the jaws with a fresh fitting. All the taps are cutting simultaneously, while only one is in a fitting at a time. Every quarter-turn of the chuck brings a finished fitting to the attendant.

Similar letters refer to similar parts throughout the several views.

The table or plate A, on which is bolted the stand B, and also the brackets C′ C², supporting the shaft on which are placed the chucks E′ E², is supported by the legs or standards F′ F². The standard F² is carried up beyond the plate A, for the purpose of furnishing bearings to the shafts G′ G² G³ and G⁴ G⁵ G⁶, and on said shafts are fixed gears, as shown. Power

is applied through pulleys located on shafts G^2 G^5. Said pulleys are friction-pulleys in common use—therefore not shown in the drawings. Shafts G' G^3 are connected by the intermediate gears, H' H^2, with the power-shaft G^2, and the shafts G^4 G^6 are connected with the power-shaft G^5 by the intermediate gears, H^3 H^4, and the whole train of gears is connected by the intermediate gears, as shown. Power is conveyed from shafts G^3 G^6 to the reversing-shafts G^7 G^8 by the intermediate gears, H^5 H^6. There are two sets of friction-pulleys on each power-shaft, one on each shaft being driven by a cross-belt and the other by a straight belt, so the machine will run in one direction when driven by the cross-belt, and the reverse when driven by the straight belt.

From the arrangement of the gears it will be seen that the shafts G' G^2 G^3 will revolve in one direction, while the shafts G^4 G^5 G^6 revolve in the opposite direction, so that the taps connected with one set of shafts will be fed into the fittings, while those connected with the other set will be withdrawn. The tap-spindles I' I^2 I^3, which carry the taps, are connected with and driven by the two sets of shafts G' G^2 G^3, G^4 G^5 G^6 in the following manner, reference being had to Figs. 6 and 10, which are longitudinal sections of one of the upper quills, which forms the connection between the tap-spindle I' and shaft G'. The spindle I' has a lug, *b*, which slides in a groove cut from end to end of the quill *c*. The said quill is caused to revolve by the shaft G', which has a feather fitted to the groove in the quill *c*, which, in turn, revolves the spindle I'. The quill *c* is also cut away on the end at *d*, so that when the spindle is carried forward to bring the tap to the chuck it engages the lug *b*, thereby securing the spindle from a backward movement while the tap is being fed into the fitting.

It will also be seen that as the machine is reversed the groove in quill *c* is again brought in line with lug *b*, which disconnects the spindle from control of the feeding mechanism. This relieves the taps from any strain while being withdrawn from the fittings, and also allows of the spindles being moved back clear of the revolving chuck as soon as the taps clear the fittings. The quills *c*, carrying the spindles, as just explained, are supported in frames D' D^2, which frames have a dovetail sliding in a corresponding dovetailed groove in the stand B. These frames are fed forward and back at a speed corresponding to the number of threads on the taps in use, the speed being readily changed to suit different taps. The central spindle, I^2, may be connected with the shaft G^2 and driven in the same way; or the quills may be dispensed with, as shown in the drawings, the spindle I^2 extending into the shaft G^2, and having a feather fitted to slide in a groove cut in the shaft and made to move with the frame D' by the collars J. The two lower spindles are connected and driven in and out after the same manner as the upper ones, the quills being the same in construction as those just explained, with the exception of a screw cut on their outer surfaces, which meshes with the segment screw-gear O.

The reversing-shafts G^7 G^8 carry screws N' N^2, of the same pitch as quills *e'*, but cut in the opposite direction. The said screws also mesh with the segment screw-gear O, and are driven at the same speed as the quills *e'*, as will be seen in Fig. 3. Now, with the journal of the segment-gear O located at its center, the travel of the segment P' will be the same as that of the segment P^2; but if the journal is carried above the center the travel of segment P' will be less than that of segment P^2, and as the screw N' is secured to the shaft G^7, and has no lateral movement, the quill *e'* takes up the difference of travel in the segments and moves forward or back, according to the direction in which the machine is acting.

It will be readily seen, from the foregoing explanation, that the travel of the frames D' D^2 may be regulated to suit taps of any number of threads to the inch, and that the farther the journal is carried from the center of the gear O the greater or less travel the segment P' will have, compared to that of the segment P^2, and the greater or less will be the travel of the frames D' D^2. The said journal of the gear O carries a box, U, Figs. 8 and 9, which slides in the slot in gear O. The box is cast with a flange, V, on one side, and has a loose flange on the opposite side. The said flanges are to give a broad bearing on either side of the gear O, to hold it steady. One flange may be slotted, as shown in Fig. 1, to receive a stud set into the gear to secure the box to the gear, and so prevent any possibility of variation in the feed from the gear moving on the box. A flanged nut, 21, screws onto the end of the journal and secures the gear to the journal. The position of the journal is changed to any distance from the center of the gear and securely held in that position in the following manner: The journal extends horizontally from an upright shaft, Q, Fig. 2. Said shaft has a thread cut on one end, which works in a female thread cut through the hub of the hand-wheel R. Revolving the hand-wheel to the right or left will move the journal to or from the center of the gear O. The shafts Q have grooved bearings S' S^2, with feathers fitted to grooves, which prevent any rotary motion of the shafts.

T' T^2 are lock-nuts, to take up any lost motion between the threads, and to secure the hand-wheels from accidental movement.

The machine has two chucks, E' E^2, with four wings each. In Fig. 1 the end plate is broken away to show one of these wings, 3. Each wing is grooved, as shown, to receive the tails of the jaws 2, and each wing carries one set of two jaws with a right-and-left-hand-threaded screw to open and close the same. The chucks revolve intermittingly, being stationary while the threads are being cut, one set of taps being fed into the fittings in one

chuck while the other set of taps is being withdrawn from the fittings in the other chuck.

The revolving of the chucks is accomplished in the following manner: The lever 5 is connected at one end with a sliding cross-head, 6, which slides on the central tap-spindle, I^2. To this cross-head is attached a rod, 8, which is hinged to the pawl-carrier 9. The lever 5 has its fulcrum at 10, and the opposite end is connected with a loose cam, 11, on shaft G^7. The said cam is carried to the left on shaft G^7 by the spring 12 as soon as the taps connected therewith are withdrawn from the fittings. This movement carries back the opposite end of lever 5, and with it the cross-head 6, which slides along the central tap-spindle, I^2, but carries the spindle above and the one below with it. The connecting-rod 8 brings forward the pawl until it engages with the notched plate 13, which is secured to the chuck. Sufficient travel is given to the spindles before the pawl engages the notch to allow the jaws to pass the taps in spindles I' I^3. The whole travel given is sufficient to make a quarter-revolution of the chuck. A pin in the cam end of lever 5 draws forward the rod 14 and throws the reverse-lever 15, which connects with the friction-wheels on the power-shafts, from connection with one into connection with the other friction-wheel. This action reverses the machine. The connecting-rod 14 is slotted to allow proper travel of the lever 5 to revolve the chuck before the pin engages with the rod 14 to reverse the machine. The shaft G^7 now revolves in the opposite direction, and the fixed cam 16 forces back the loose cam 11 along the shaft G^7, bringing the taps forward to the chuck and carrying back the pawl, ready for another movement of the chuck. The tap-spindles are now connected with the feed mechanism, as previously explained, and it is impossible for the machine to be reversed at every rotation of the shaft G^7, as might at first appear to be the case, for the following reasons, reference being had to Fig. 10, which is a side elevation of a portion of the tap-spindles, feed-shaft, and connections which control the reversing of the machine. The machine is reversed by the spring 12 forcing the loose cam 11 forward on the shaft G^7 until the pin in the end of lever 5 engages the connecting-rod 14. This rod, in moving forward, operates through suitable mechanism, previously explained, to reverse the machine. The shaft G^7 now revolves in the opposite direction, and the fixed cam 16 forces the loose cam 11 back along the shaft G^7, compressing the spring 12, and the lever 5 being pivoted to the hub of the cam 11, it is also carried back, and having its fulcrum at 10, the end connected with the cross-head 6 is moved forward, bringing the tap-spindles I' I^3 forward to their work, the cross-head to which they are attached sliding upon the central spindle, I^2. The spring 12 is prevented from expanding and again reversing the machine by the lug *b* on the spindle I', which is engaged at *d* by the revolving quill *c*, and a backward movement of the tap-spindles is thereby prevented. The spindles now move forward with the frames which carry the quills, the frames being moved by the segment-gear and screws, as explained. The taps are now fed into the fittings while the opposite set of taps is being withdrawn, and as soon as they clear the fittings on that side (the mechanism connected being and operating the same as that just explained) this mechanism will reverse the machine, revolving the chuck on that side.

The operation of my improved tapping or screw-cutting machine is as follows: The attendant stands at the end of the machine, in front of the chucks, Fig. 4. A fitting to be tapped is placed in the jaws before him, and the jaws made to grasp it by revolving the right-and-left-hand screw, which passes through the tails of the jaws. To do this a wrench is placed on the end of the screw, which is squared for that purpose. The machine is now started, and, taking the position of the parts as shown in the drawings, the fixed cam 16 forces back the loose cam 11, which operates the lever 5 to bring the tap-spindles forward to the chuck. The lugs move along the grooves in the quills, and are secured from a backward movement, as previously explained, and are made to travel forward with the frame D', the speed of which has been regulated to suit the taps. The machine continues in this direction until the other set of taps is withdrawn from the fittings held by the chuck on that side of the machine. Then the cam on shaft G^8 will operate through its connections to throw back the spindles connected with it and revolve the chuck on that side of the machine and reverse the motion of the machine. The attendant now places a fitting to be tapped in the jaws before him, and awaits the action of the machine to revolve the first-mentioned chuck, and so the operation is repeated. Every quarter-turn of each chuck brings a finished fitting to the attendant after the jaws have all been filled.

It will be seen that only one tap is in a fitting at a time, so a greatly superior and more finely finished cutting end can be given to the taps than in three-way machines, where three taps enter a fitting at a time, in which case the taps must be ground square on the ends, to prevent their coming in contact before the threads are finished. The operation is not only much more rapid—each set of taps turning out a fitting for every one turned out by three-way machines—but also perfectly accurate, effecting the most delicate threading with the nicest mathematical exactness, the taps being securely held in the spindles, and thereby tending to secure this end. The taps, also, thus require no adjustment, as in other machines.

I would here allude to the superiority of the feeding devices in this machine over the methods known to me as regards ease of adjustment, no change of parts or additions to the machine being necessary. Another point of

superiority over other machines using leaders located upon the spindles and having threads of the same pitch as the tap is, that I am enabled to use coarse heavy threads on my screws, with teeth in the segment-gear to correspond, making the feed as durable as any part of the machine.

My machine is automatic, effecting a great saving of time by its use, as there is no interruption of its action, as is the case with some other machines. Being automatic, it relieves the attendant from all labor but that of removing the fittings and replacing them with fresh ones to be tapped, thereby accomplishing twice the work in a given time that would be possible with other machines.

Having described my improved screw cutting or tapping machine, what I claim therein as new and of my invention, and desire to secure by Letters Patent, is—

1. The segment screw-gear O, mounted on a movable journal, substantially as shown, and for the purpose specified.

2. The tap-spindle I′, with its quill *e* and shaft G′, substantially as shown, and for the purpose specified.

3. The combination of the series of shafts G′ G^2 G^3, G^4 G^5 G^6 and their gears with the intermediate gears, H′ H^2 H^3 H^4, the quills *e* and *e*′, and tap-spindles I′, I^2, and I^3, substantially as shown and described.

4. The combination of the intermediate gears, H^5 H^6, with gears on reversing-shafts G^7 G^8, the screws N′ N^2, segment screw-gears O, and quills *e*′ e^2, arranged substantially as shown and described.

5. The combination, with the journal of the slotted gear O, of the sliding journal-box U, shafts Q, hand-wheel R, and lock-nut T, arranged substantially as shown and described.

6. The combination of the shafts G^7, spring 12, loose cam 11, fixed cam 16, lever 5, lever 14, and shipper-lever 15, arranged substantially as shown and described, and operating upon friction-pulleys, or their equivalent, on shaft G^2, for reversing the machine.

7. The combination, with the shaft G^7, spring 12, cams 11 and 16, and lever 5, of the cross-head 6, lever 8, and pawl and pawl-carrier 9, and plate 13, for automatically effecting the slide movement of the tap-spindles and revolving the chucks.

8. The combination, with the chucks E and E^2, mounted on a horizontal shaft, of the pawl, pawl-carrier 9, and rod 8, substantially as described, and for the purpose specified.

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