E. W. FISHBURNE.

MACHINE FOR DRILLING BOLTS AND OTHER WORK.

APPLICATION FILED NOV. 4, 1911.

1,034,436. Patented Aug. 6, 1912.

4 SHEETS—SHEET 1.

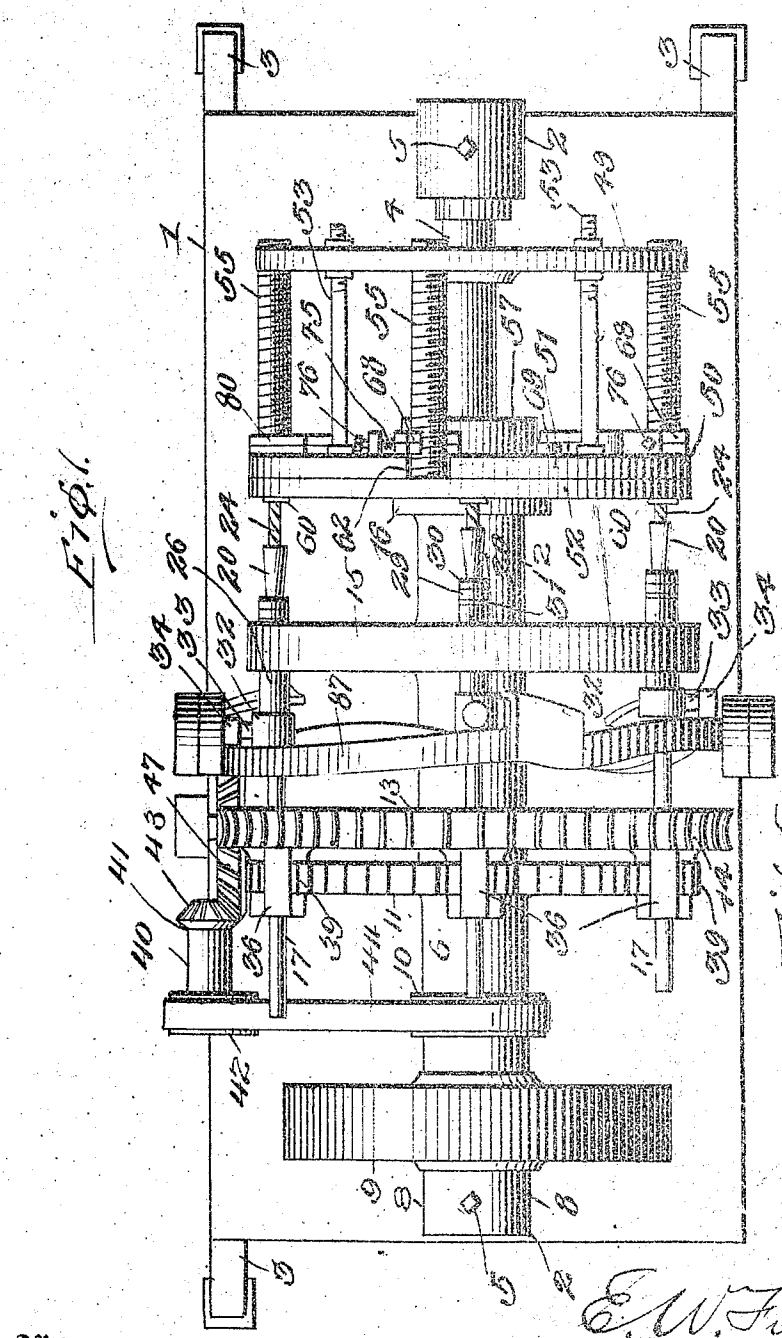

Fig. 1.

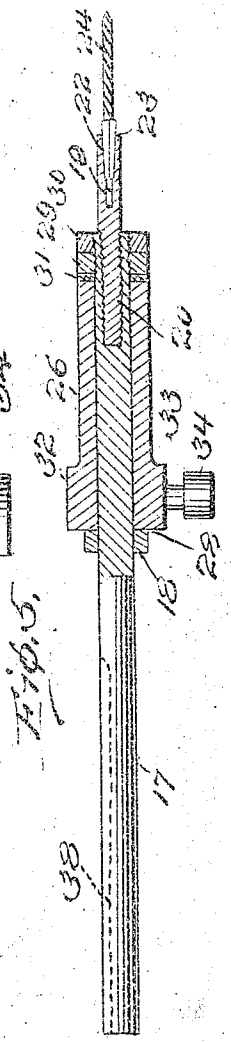

Fig. 5.

Witnesses

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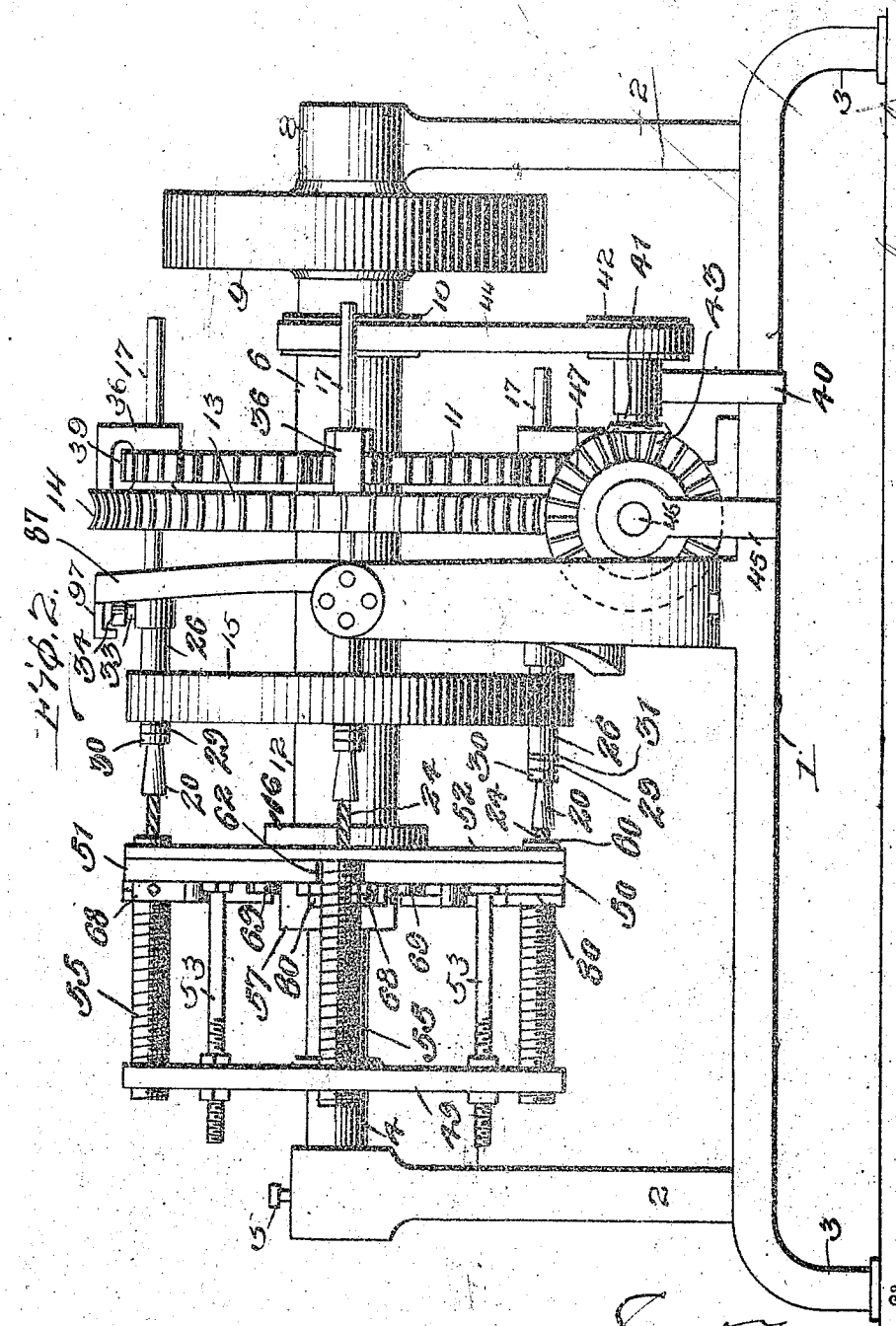

FIG. 2.

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4 SHEETS-SHEET 3.

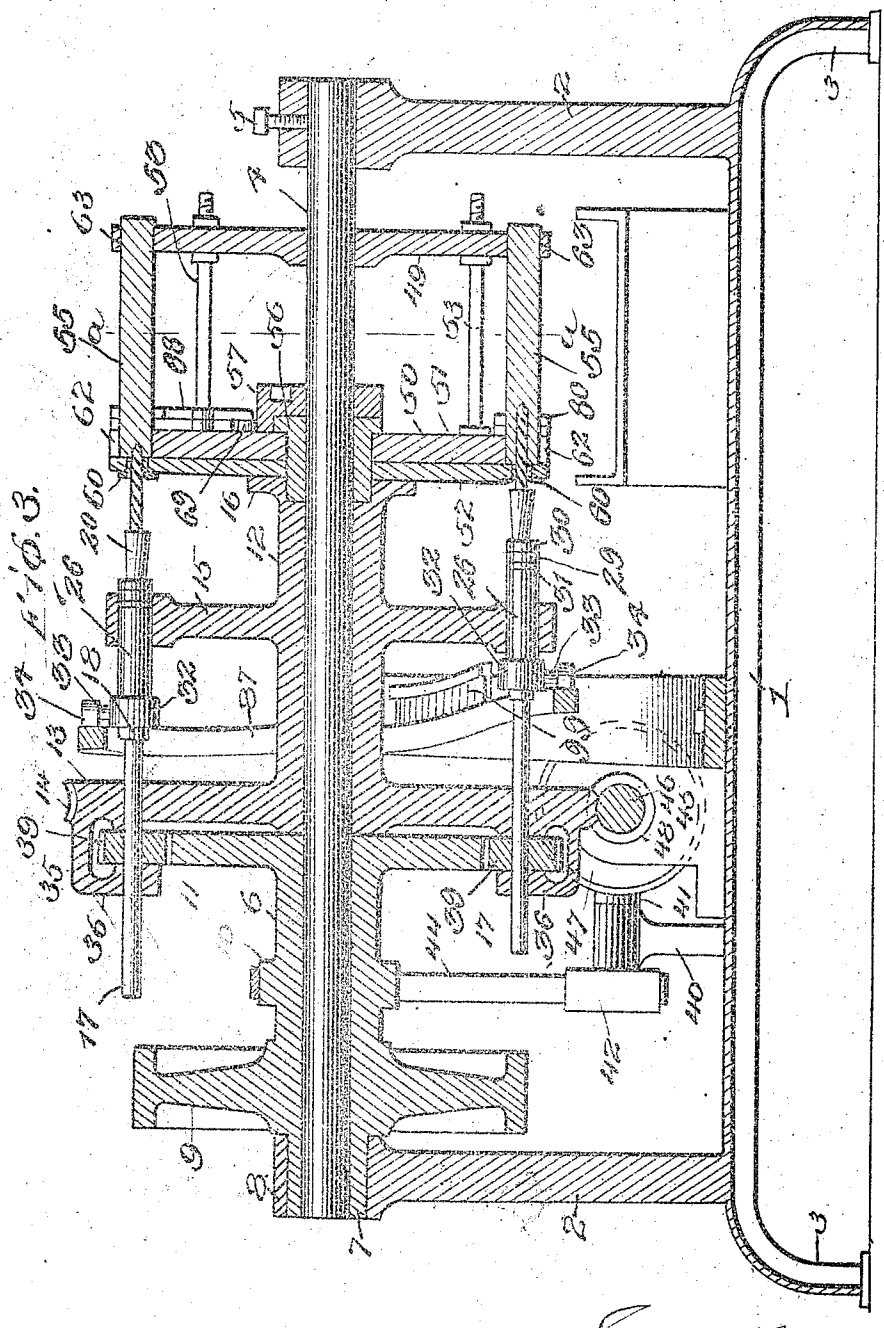

FIG. 3.

Witnesses

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4 SHEETS—SHEET 4.

Fig. 4.

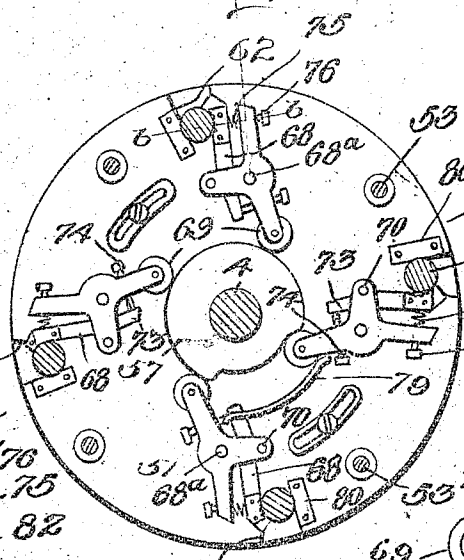


Fig. 9.

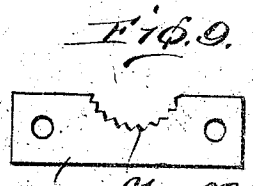


Fig. 8.

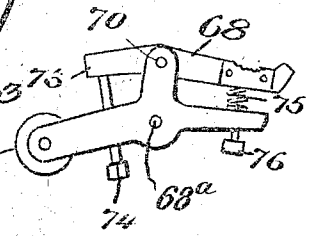


Fig. 7.

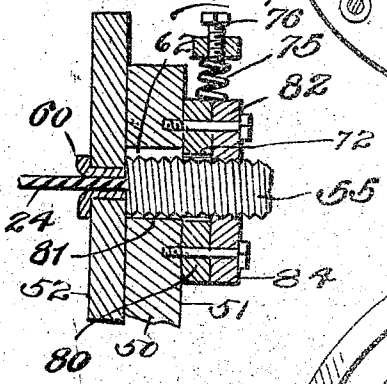
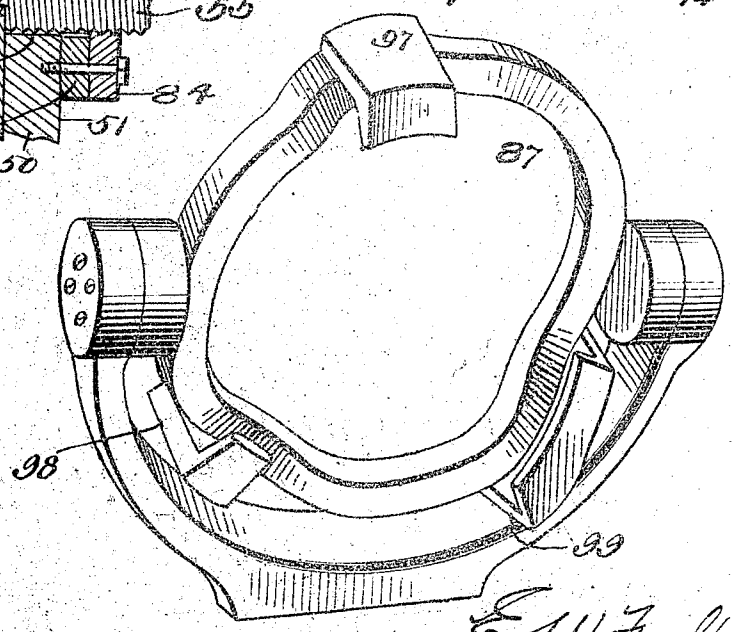


Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

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MACHINE FOR DRILLING BOLTS AND OTHER WORK.

1,034,436. Specification of Letters Patent. Patented Aug. 6, 1912.

Application filed November 4, 1911. Serial No. 658,542.

To all whom it may concern:

Be it known that I, EDWARD WINBURN FISHBURNE, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Machines for Drilling Bolts and other Work, of which the following is a specification, reference being had to the accompanying drawings.

This invention comprehends certain new and useful improvements in drilling machines for use in drilling stay-bolts for locomotive fire boxes and for drilling other analogous devices, and relates particularly to machines of the automatic type which are designed to drill the bores of the stay-bolts, for instance, while they are carried around in a revoluble work holder and to discharge the stay-bolts after their bores have been finished, the present invention being an improvement on the machine for which Letters Patent of the United States No. 1,021,242 were issued on my application March 26, 1912.

The invention has for its primary object an improved automatic drilling machine of this character, the parts of which are so arranged that the drills will be automatically withdrawn one or more times during the drilling operation, whereby to clear the bores of the shavings or borings, and subsequently by automatic means moved forward to their operative position until the bores have been entirely completed, whereupon the drills will be entirely withdrawn until a succeeding operation is commenced.

The invention also has for its object a simple, durable and efficient construction of means for securely holding the stay-bolts or the like not only as against any movement about their longitudinal axes, but also as against endwise displacement. And the invention also aims to generally improve this class of devices and to render them more useful and commercially desirable.

With these and other objects in view, as will more fully appear as the description proceeds, the invention consists in certain constructions, arrangements and combinations of the parts that I shall hereinafter fully describe and claim.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawings in which,

Figure 1 is a top plan view of a drilling machine embodying the improvements of my invention. Fig. 2 is an elevation thereof. Fig. 3 is a longitudinal sectional view of the machine. Fig. 4 is a detail sectional view on a plane indicated by the line *a*—*a*, of Fig. 3. Fig. 5 is a detail view of one of the drill shafts and its component parts partially in section and partially in side elevation. Fig. 6 is a detail perspective view of the cam member hereinafter specifically described. Fig. 7 is a detail transverse sectional view on the line *b*—*b*, of Fig. 4. Fig. 8 is a detail view of one of the bolt clamping devices, and, Fig. 9 is a detail view of one of the relatively stationary blocks designed to co-act with the bolt clamping devices to hold the bolts securely in position while being worked upon.

Referring to the drawings, the numeral 1 designates the frame-work of my improved drilling machine which is provided at its ends with standards 2 and which is, in the present instance, mounted upon feet 3. A supporting shaft 4 is mounted in openings formed for it in the upper ends of the standards 2 and is secured in said openings in any desired way, as by a set screw 5.

Mounted upon the shaft 4 at about the middle thereof, is a revoluble drill carrier which embodies a sleeve 12, and longitudinally spaced heads 13 and 15, the head 13 being formed on its periphery with worm gear teeth 14 adapted to mesh with a worm 48 on a shaft 46 which is journaled in uprights or standards 45 secured to or formed on the base of the frame-work 1. The shaft 46 also carries a bevel pinion 47 which meshes with a corresponding but smaller pinion 43 secured on one end of a longitudinally disposed shaft 41 journaled on a standard or post 40. The shaft 41 also carries a pulley 42, around which a band 44 passes, said band also passing around a pulley 10 which is formed on a sleeve 6 mounted to turn on the supporting shaft 4 and formed with a reduced hub extremity 7 journaled in the bearing 8 which is formed in one of the standards 2, as clearly illustrated in Fig. 3. The sleeve 6 is also formed

with a band wheel 9 by which power is applied to the various operating elements of the drilling machine.

At the inner end of the sleeve 6, a spur wheel 11 is formed, the teeth of said wheel being engaged by a number of relatively small spur pinions 39 that are held for rotation in annular brackets 36 projecting from one face of the head 13 at the rim or edge thereof, said pinions 39 having a groove and feather connection 38 with drill shafts 17, whereby the shafts will be permitted to move longitudinally, but will be compelled to turn as the pinions are rotated by the gear wheel 11. Any desired number of shafts 17 and component parts may be employed. Each shaft is provided intermediate of its ends with a collar 18, as best illustrated in Fig. 5, adapted to abut against one end of a sleeve 26 mounted upon the shaft and held thereon by nuts 29 and 30 and an intervening washer 31 of fiber or the like. Each shaft 17 is formed at one end with a threaded socket adapted to hold a threaded drill supporting stem 20, the latter in turn being formed with a tapering socket 22 to receive the tapered head 23 of a drill 24. The inner end of the socket 22 terminates in a transverse opening 19, whereby a suitable tool may be inserted therein to drift the drill out of its socket when it is desired to remove the drill. The sleeves 26 are mounted in and movable longitudinally through openings that are formed in the head 15 of the drill carrier and are provided at one end with laterally projecting pins 33, on which rollers 34 are journaled. These rollers are adapted to be engaged, in turn, as the drill carrier rotates about the shaft 4 as an axis, by a cam member 87 which is supported by a forked bracket 89 supported on the base of the frame-work 1. In the present embodiment of the invention, the cam member 87 is formed with angular cam sections 97, 98 and 99 adapted to co-act with the adjoining face of the cam member, whereby as the rollers 34 are carried around between one face of the cam member 87 and the co-acting angular cam sections 97, 98 and 99, the drills, after having been once fed into the work for the initial portion of the operation, will be first positively withdrawn by engagement with the angular cam section 97, will then be fed back into the work a greater distance than before, will then be again positively withdrawn to remove the borings or shavings as before, and will then be finally fed forward again by the cam face itself to complete the bore, after which the angular cam section 99 will come into play and positively and entirely withdraw the drill from the bore, while at the same time, the bolt clamping devices of the work holder will release the bolt and permit the finished bolt to drop into some suitable receptacle (not shown).

The work holder comprises longitudinally spaced heads 49 and 50 which are, respectively, formed with sockets 63 and edge opening notches 62 in which the bolts 55 or the like are adapted to be inserted and held and preferably the head 50 is formed in sections designated 51 and 52, the section 52 being formed with openings having guiding bushings 60 secured therein for the purpose of accurately guiding the drills 24 to the work. Preferably, these bushings 60 are held detachably in place, whereby different sized bushings may be used, according to the diameter of the drilling tool employed. In order to adjust the work holder in size, for bolts of different lengths, the tie bolts 53 which connect one head to the other, are relatively long and have adjustable connection with one of the heads.

The bolt clamping devices include clamping members 68 which are pivotally connected, as at 68a, to one face of the head section 51, each of said clamping members embodying three arms, one of which carries a roller 69 adapted to bear against and ride upon a cam 57 which is carried by a bushing 56 fitting in the flanged end 16 of the sleeve 12 and encircling the supporting shaft 4. Springs 79 are provided to hold the rollers 69 securely against the edge of the cam 57, said cam being provided at one point with a recessed portion, whereby when the rollers reach such portion, the clamping members will be rocked in a direction to release their hold on the bolts and permit them to drop. The clamping member 68 has connected to one of its arms at 70, a yieldable rocker bar 73 which is adjustably connected to the roller carrying the arm of the member by an adjusting screw 74 to limit the movement in one direction and which is spring pressed to yield in the opposite direction by means of a spring 75, the tension of which may be adjusted by a screw 76 carried by the other arm of the clamping member. Thus the clamping member will be permitted to yield should occasion require as, for instance, were a bolt or other object of larger diameter than that for which the machine had been adjusted, to be fed to the machine. Each rocker bar 73 is serrated on one edge to form a jaw 72 designed to co-act with a relatively stationary jaw 81 which is formed by the serrated edge of a block 80 secured to the head 50. The serrations of these two jaws extend longitudinally of the bolt and transversely as regards the threads thereof, whereby the bolt will be prevented from turning about its longitudinal axis as it is being bored. In order to prevent endwise displacement of the bolt, I provide other jaws which are

formed by blocks 82 and 84 secured to the rocker bars 73 and the blocks 80, respectively, by screws or similar fastening devices. These last named jaws are formed with grooves or corrugations that extend coincident with and are preferably about the same pitch as the threads of the bolt, whereby they will securely engage with such threads without injuring the same, and co-acting with the first named jaws, prevent the bolt from moving.

Preferably, the section 51 is connected to the section 52 by means of set screws 58, the section 51 being formed with curved slots 59 concentric with the shaft 4, through which slots the set screws extend. The heads of these set screws, by bearing against the bottoms of the slots, enable the section 51 to be rigidly secured to the section 52 in any desired angular adjustment.

From the foregoing description in connection with the accompanying drawings, the operation of my improved drilling machine will be apparent. In the practical use of the device, as the drill carrier is rotated slowly by the engagement of the worm 48 with the toothed head 13, the work carrier will also be rotated and the drill shafts 17 will be rapidly rotated about their own axes by the engagement of the pinions 39 with the gear wheel 11. During the combined rotary and revoluble movements of the drill shafts 17, they will be moved forwardly and backwardly by the co-acting angular cam sections 97, 98 and 99 and the adjoining cam surfaces of the main part of the cam member 87, whereby the tools will first partially form the bore and then be retracted therefrom a number of times so as to clear the bore from the shavings and borings, the tools being drilled farther into the bolts, after each withdrawing operation until the bores have been fully completed, at which time, the cam section 99 will act to entirely withdraw the tool from the bore, while at the same time, the corresponding clamping member 68 will release its hold on the bolt and permit the completed article to drop into the tray or other receptacle.

What I claim is:—

1. A drilling machine of the character described, including a revoluble drill carrier, a drill supporting shaft movable longitudinally therein, means for rotating the drill carrier, means to rotate the shaft in the drill carrier, and automatic means for first moving the drill shaft forwardly, then retracting it, subsequently moving it forward again a distance greater than that into which it was first moved forward and finally entirely retracting the drill from the work.

2. A drilling machine of the character described, including a revoluble drill carrier, a plurality of drill shafts mounted to rotate in said drill carrier and movable longitudinally therein, means for rotating the drill carrier, and means for automatically moving each drill shaft forwardly and rearwardly alternately a plural number of times during the revoluble movement of the drill carrier, said means comprising rollers movable longitudinally with the shafts, and a cam member formed with a cam face and co-acting cam sections spaced therefrom on opposite sides of the path of movement of said rollers.

3. In a drilling machine of the character described, a revoluble work holder, embodying longitudinally spaced heads, a support therefor, the heads being formed with bolt receiving notches, clamping members adapted to engage bolts received in said notches and formed with means for preventing the bolts from turning axially and from moving longitudinally, and blocks carried by one of the heads and formed with corresponding means adapted to co-act with the said means of the clamping members.

4. In a drilling machine of the character described, a work carrier, including a head formed with bolt receiving notches, clamping arms mounted on said head at one side of said notches and formed with transversely extending serrations adapted to engage the bolts, blocks secured to said members along side of the serrated portions thereof and formed with longitudinally extending corrugations adapted to engage the threads of the bolts to prevent longitudinal movement thereof, and blocks secured to said heads on the opposite side of said notches, for the purpose specified.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

EDWARD W. FISHBURNE.

Witnesses:
J. R. McBoyde,
C. G. Hammack.