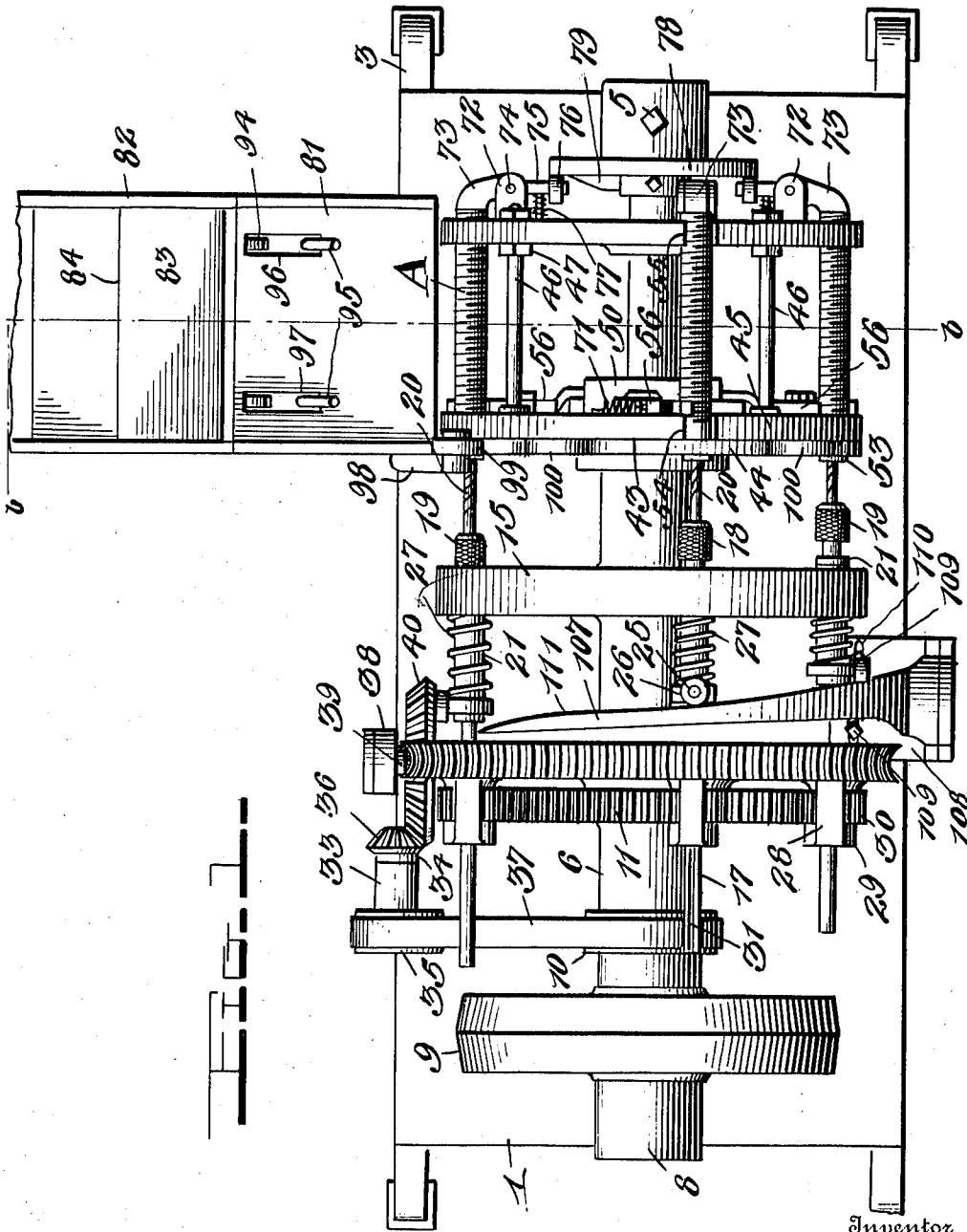


E. W. FISHBURNE.
MACHINE FOR DRILLING BOLTS AND OTHER WORK.
APPLICATION FILED MAY 6, 1911.

1,021,242.

Patented Mar. 26, 1912.

5 SHEETS-SHEET 1.



Inventor

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Witnesses

Chas. L. Griesbauer.
L. H. Ellis.

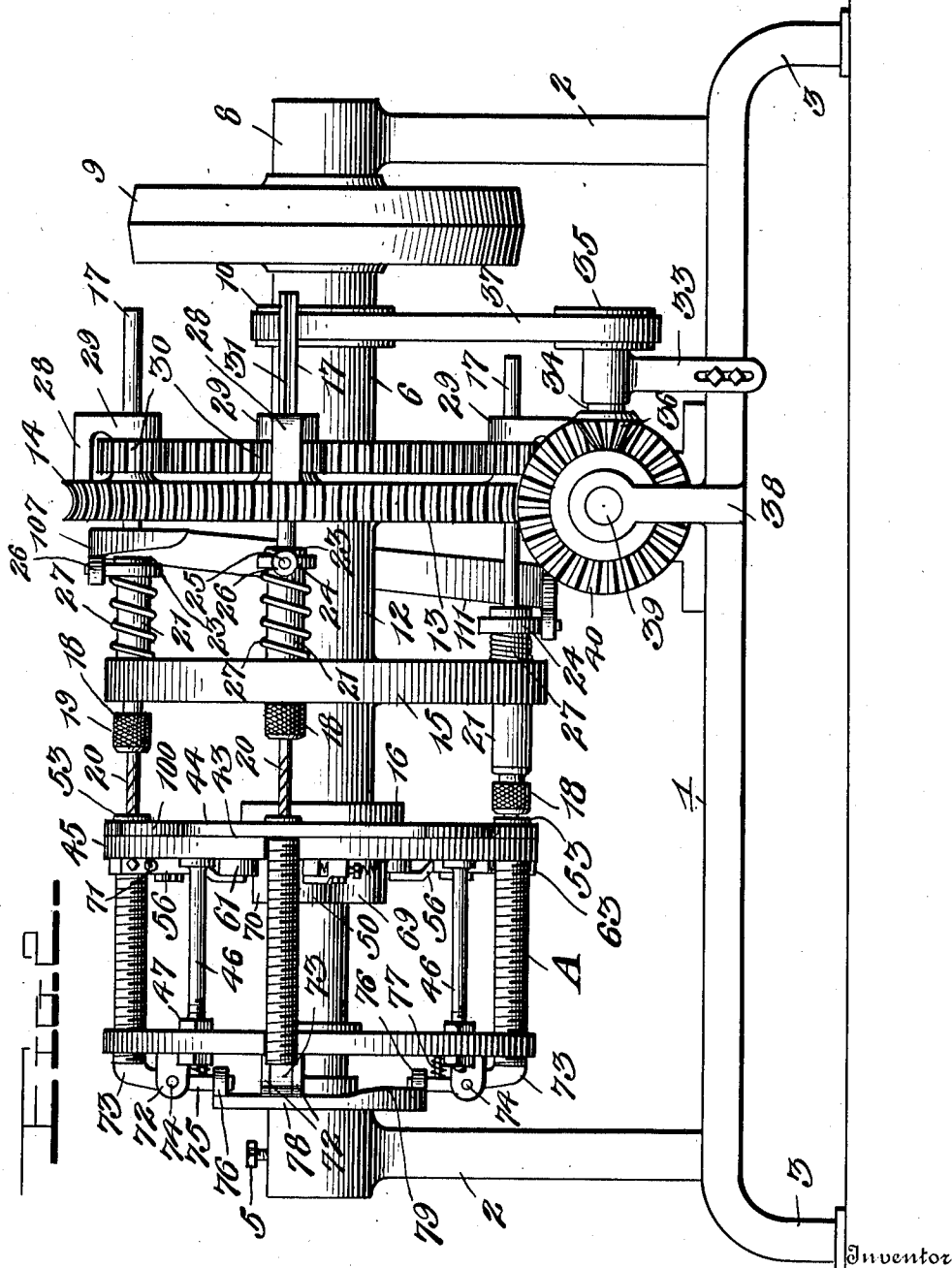
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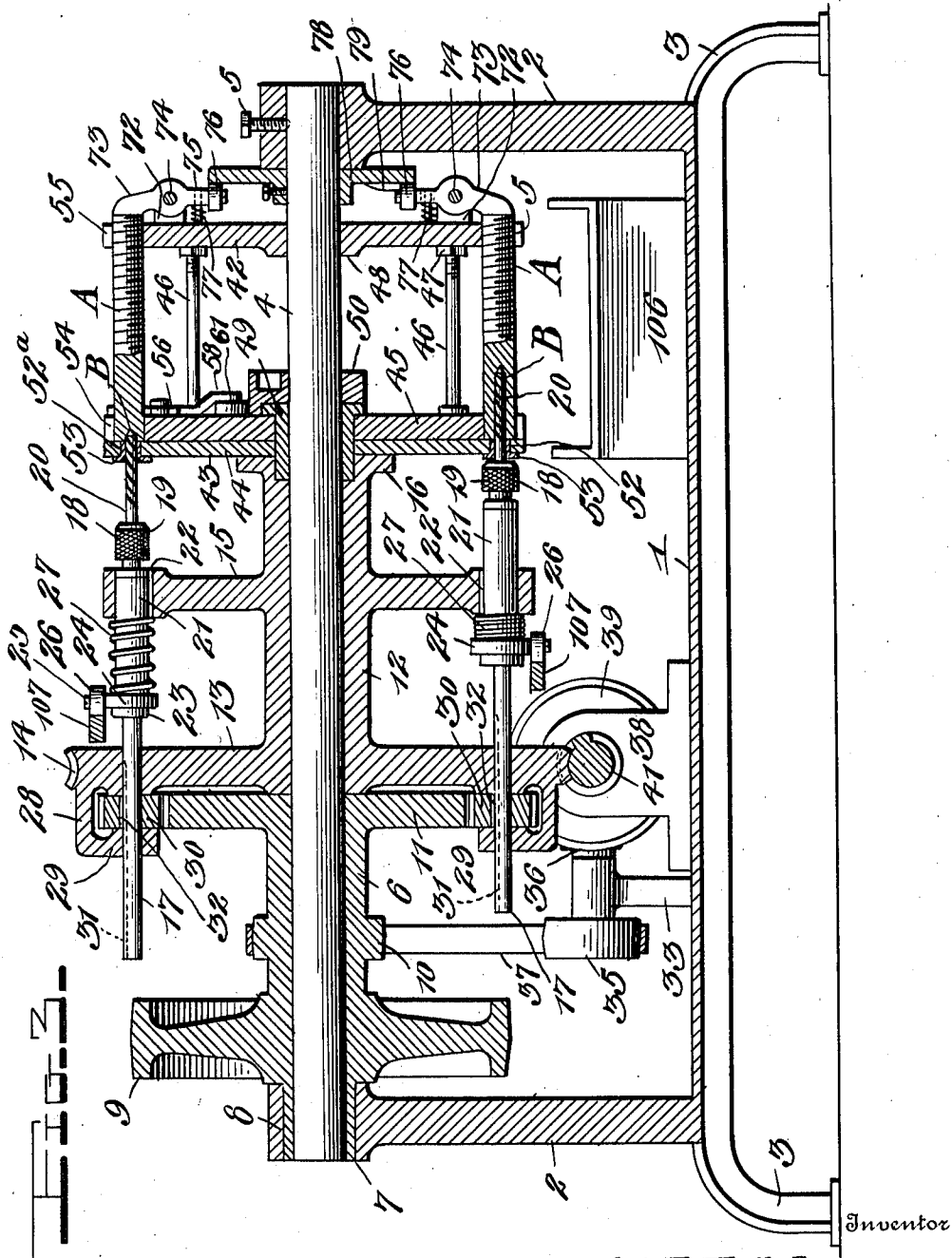
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5 SHEETS—SHEET 3.



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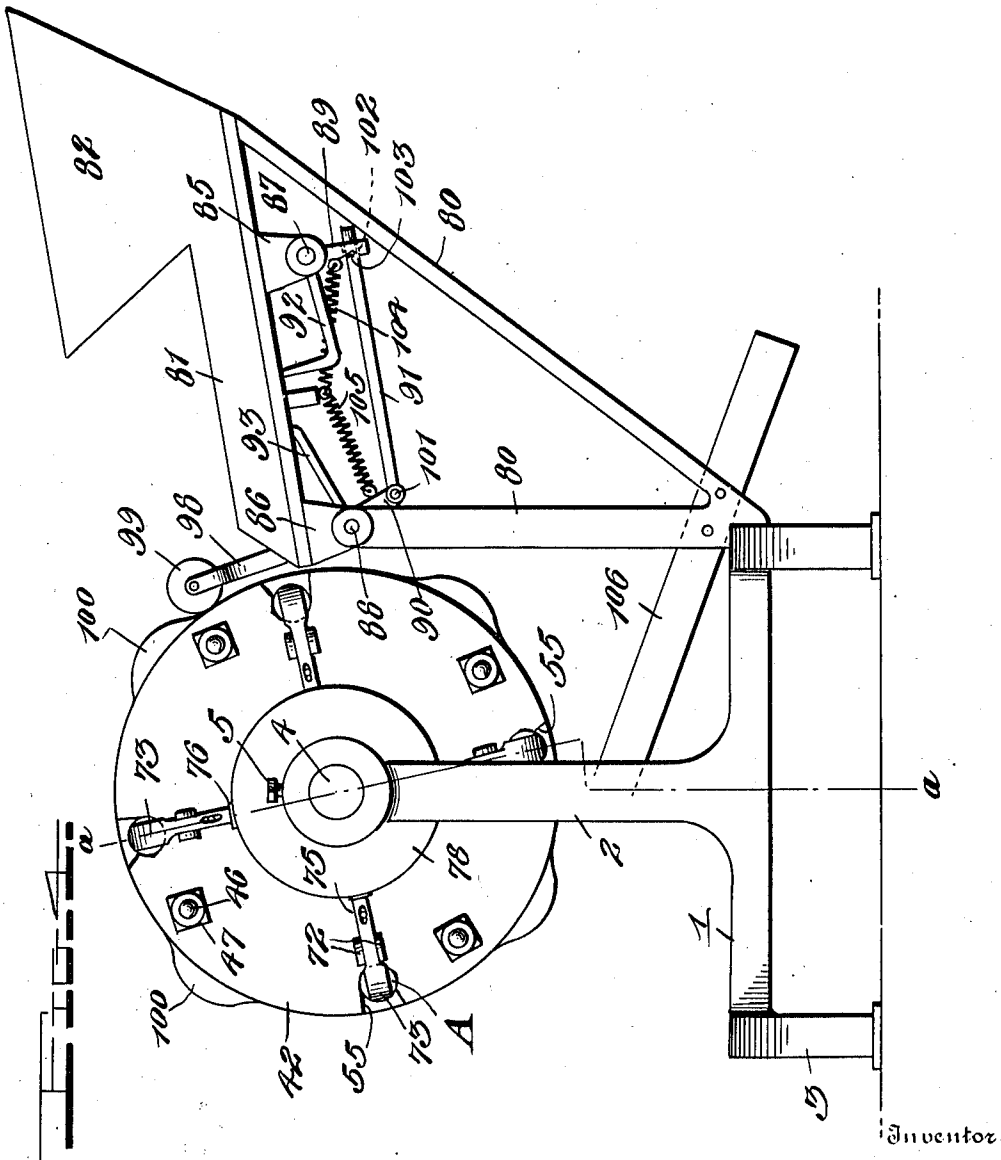
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5 SHEETS—SHEET 4.



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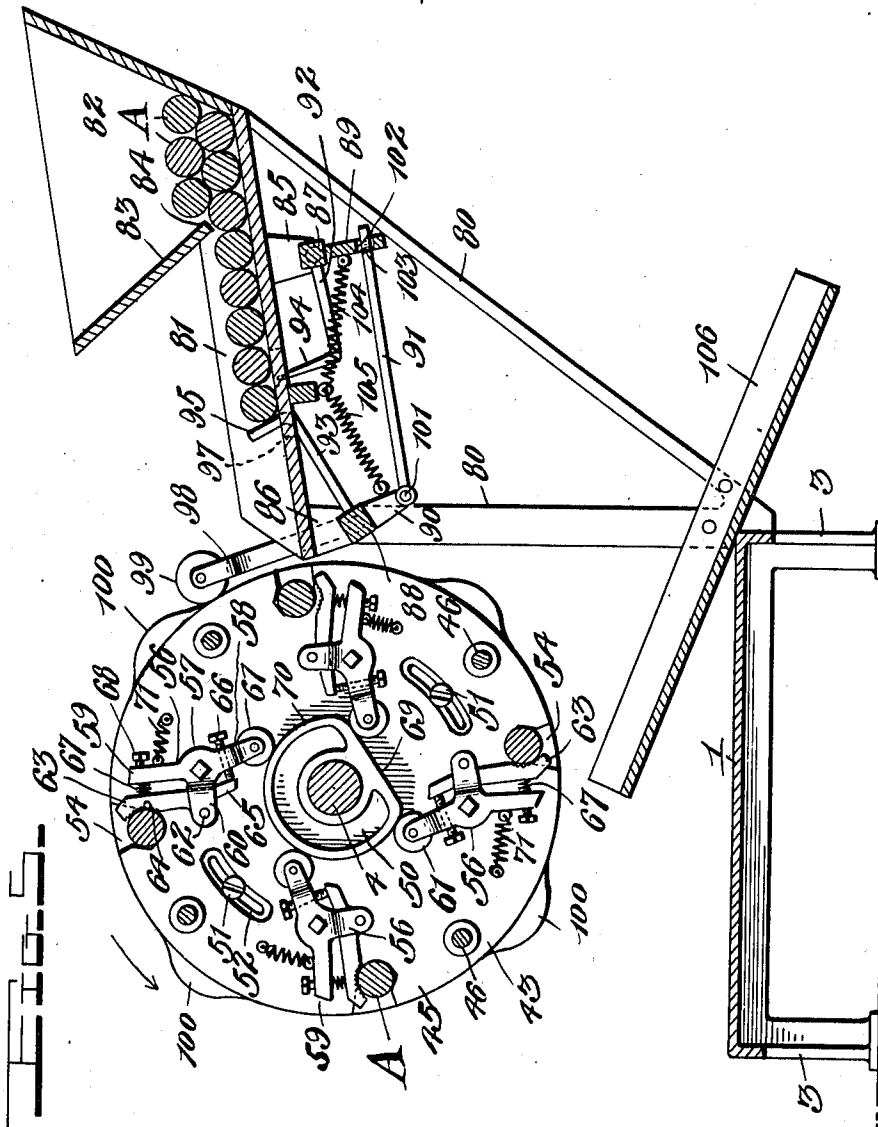
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5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

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MACHINE FOR DRILLING BOLTS AND OTHER WORK.

1,021,242.

Specification of Letters Patent.

Patented Mar. 26, 1912.

Application filed May 6, 1911. Serial No. 625,533.

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.

My invention relates to improvements in drilling machines, especially adapted for use in drilling the bores in the staybolts used in locomotive fire boxes and also adapted for drilling other cylindrical objects, the object of my invention being to provide a compact, strong, simple and effective means of this character which operates automatically to drill the bores of the staybolts and to discharge the staybolts after their bores have been finished, the invention consisting in the construction, combination and arrangement of devices hereinafter described and claimed.

In the accompanying drawings: Figure 1 is a plan of a drilling machine constructed in accordance with my invention; Fig. 2 is a side elevation of the same; Fig. 3 is a vertical longitudinal central sectional view of the same on the plane indicated by the line *a-a* of Fig. 4; Fig. 4 is an end elevation of the same; and Fig. 5 is a vertical transverse sectional view of the same on the plane indicated by the line *b-b* of Fig. 1.

The base 1 may be of the form here shown or of any other suitable form and is provided at its ends with a pair of vertical standards 2. It is also shown as provided with supporting feet 3. A longitudinally disposed shaft 4 extends through openings near the upper ends of the standards and is secured to one of the standards by means of a set screw 5. A sleeve 6 is mounted for revolution on the shaft at one end thereof and has a reduced extension 7 at its outer end which revolves in a bearing 8 with which one of the standards is provided, the shaft 4 extending through the said sleeve and also through the extension 7 thereof. A power pulley 9, which, in practice is driven by a belt, is secured on the sleeve 6 and a smaller pulley 10 is also secured to the sleeve. To the inner end of the sleeve 6 is secured a spur gear 11. A sleeve 12 is

also mounted for revolution on the shaft 4 and is provided at the end next to the sleeve 6 with a circular head 13 which is provided with peripheral worm teeth 14. Near the center of the sleeve 12 is a disk 15 and at the end thereof opposite the head 13, is a flange 16. The sleeve 12 together with the head 13 and the disk 15 constitutes the drill carrier. A series of drill shafts 17 which are concentric and parallel with the shaft 4 have their bearings in the head 13 and the disk 15, each of the drill shafts having a diametrically enlarged portion 18 at one end which is provided with a suitable chuck 19 to engage and secure the drill-bit 20. Each drill shaft is also mounted for revolution in a sleeve 21 which extends through an opening in the disk 15 and is secured therein by a spline 22 so that the sleeve is permitted to move endwise but is prevented from rotating. Each drill shaft has collars 23 which bear against the ends of the sleeve 21 so that the drill shaft, in addition to being mounted for revolution in the sleeve, is connected thereto for longitudinal movement therewith. Each sleeve is provided at the end farthest from its drill with an annular circumferential flange 24, from the outer end of which projects a radial stub 25 on which is mounted a roller 26. A coil extensible spring 27 is placed on each sleeve 21 and bears between the disk 15 and the flange 24, the said spring acting to move the drill shaft and its sleeve rearwardly, away from the work. The head 13 is provided on its rear or outer side with projections 28, each of which has an inwardly extending radial arm 29. On each drill shaft is a spur pinion 30, each drill shaft being provided with a longitudinal groove 31 and each pinion having a spline 32 which operates in the said groove. The pinions engage the gear wheel 11 and are held between the head 13 and the arms 29, on the drill shafts, as clearly shown in Fig. 3, and the drill shafts, while being connected to the pinions to revolve therewith, are free to move longitudinally through the pinions.

For the purposes of this specification I have shown the drill carrier provided with four drills disposed at 90° apart but I would have it understood that any suitable number of drills may be employed according to the size and capacity of the machine.

At one side of the base is a standard 33 in which is mounted a short, longitudinally disposed shaft 34 which is provided at its rear end with a pulley 35 and at its front end with a beveled gear 36. The pulley 35 is connected to the pulley 10 by means of an endless belt 37. The base 1 is also provided with standards 38 which are provided with bearings for a transversely disposed shaft 39. The said shaft has a beveled gear 40 which is engaged by the gear 36 and is also provided with a worm 41 which engages the worm toothed periphery 14 of the drill carrier head 13.

It will be understood from the foregoing description that the gear 11 which is rotated, together with the pulley 10; by the pulley 9, by engagement with the pinions 30 on the drill shafts causes the drill shafts to be continuously revolved while the machine is in operation. The worm 41 which is driven through the connections 10, 35, 37, 34, 36, 40 and 39 hereinbefore described, by its engagement with the worm toothed periphery of the head 13 of the drill carrier also causes the drill carrier to be slowly revolved so that each drill shaft not only has axial rotation but also has orbital movement.

I will now describe the work carrier which carries, holds and discharges the stay-bolts or other articles which are drilled by the machine and which bolts or articles constitute the work. This work carrier comprises a pair of circular heads 42 and 43, the head 43 comprising a pair of circular members 44 and 45. The head 42 and the member 45 are connected together by a series of longitudinally disposed bolts 46 which are concentric with the shaft 4. Adjusting nuts 47, with which the bolts 46 are provided which nuts are on opposite sides of the head 42, enable the said head to be adjusted toward and from the head 43 as may be required by the length of the work. The head 42 has a central bearing 48 and revolves directly on the shaft 4. The members of the head 43 revolve on a sleeve 49 which is secured on the shaft and to one end of which is secured a cam 50 for a purpose presently described. The member 44 of the head 43 is secured to the flange 16 of the sleeve 12 of the drill carrier for rotation therewith. The member 45, which, together with the head 42, also rotates with the member 44 and the drill carrier is secured adjustably to the member 44 by means of set screws 51, the said member 45 being provided with curved slots 52, concentric with the shaft 4, through which the set screws extend. The heads of these set screws, by bearing against the bottoms of the slots, enable the member 45 to be rigidly secured to the member 44 at any desired angular adjustment. The member

44 of the head 43 is provided with openings 52^a which are concentric with the drill-bits and in which openings are guide sleeves 53 for the drill-bits. The bores of these guide sleeves correspond with the diameter of the drill bits and, in practice, the machine will be provided with interchangeable guide sleeves of various sizes to correspond with the various sizes of drill-bits which it may be desired to use, according to the nature of the work. The member 45 of the head 43 is provided at points coincident with the openings 52^a, with peripheral work receiving notches 54 which are open at the periphery of the member 45 and are oblique to the radii of said member. Said member 44 by closing against the outer ends of the work receiving notches 54 forms an abutment at said end of said notches. The head 42 of the work carrier is also provided with similar work-receiving notches 55. On the front side of the member 45 of the head 43 are work clamps 56 which co-act with the notches 54 in securing one end of the bolts or other work in place. Each work clamp is here shown as a pivoted member 57 having an inwardly extending arm 58, an upwardly extending arm 59 and a laterally extending arm 60. The arm 58 of each work clamp carries a tappet roller 61 for operation by the cam 50 which is fixed on the shaft 4. To the arm 60 of each member 56 is pivoted, as at 62, a jaw 63 which is provided on one side near its outer end with a recessed serrated face 64. Each jaw 63 has an arm 65 which is engaged by a set screw 66 carried by the arm 58. A spring 67 is disposed between each jaw and the arm 59 of each clamp so that the spring forms a cushion for the jaw, and the latter, while movable to a slight extent, with respect to the member 56, is permitted to yield somewhat as would be required in the event that a bolt or other object of larger diameter should be fed to the machine and get in one of the notches 54 and be engaged by the jaw. By thus pivotally mounting the jaw of each work clamp and providing a cushioning spring therefor, injury to the clamps is avoided in the event that objects larger than those for which the machine is designed should be fed to the machine in lieu of the proper work. The screw 66, as will be understood, admits of angular adjustment of the jaw of the work clamp. The tension of the spring 67 may be varied as may be required by means of a screw 68 which is carried by the arm 59.

It will be understood from the inspection of Fig. 5 that as the head which carries the work revolves in the direction indicated by the arrow each work clamp, by the action of its tappet roller 61 on the cam 50, causes the work clamp to be closed against the bolt or other work in the notch 54 as the

roller 61 passes the flattened side 69 of the cam and reaches the concentric side or rim 70 thereof. The concentric rim or tread of the cam holds the work clamps in engaged position throughout the major portion of the revolution of the work carrying head. As each clamp passes under the cam and its roller 61 reaches the flattened side 69 of the cam the clamp releases the bolt or other work and the same is permitted to drop from the notch 54 in which it is located. To thus open the work clamps and cause them to release the work I provide springs 71 which are connected to the member 45 and each spring is also connected to one of the work clamps to turn the latter to opened position or releasing position for the purpose before described.

The member 42 of the work carrier is provided on its outer side with pairs of lugs 72 which are in radial alinement with the work receiving notches 55. Work clamps 73, for engaging the outer ends of the bolts or other work, are radially disposed with reference to the head 42 and each is pivoted as at 74 between one pair of the lugs 72. These clamps 73 are each provided with an inwardly extending arm 75 which has a roller 76 mounted thereon. A spring 77 is provided for each clamp 73 to normally hold the latter in engaged position with the outer end of one of the bolts or other pieces of work, which, for the purposes of this specification, are here indicated at A. The clamp 73 by bearing against the outer ends of the bolts A keep the inner ends of the bolts pressed against the abutments formed by the member 44 at the ends of the notches 54 nearest the tool carrier. On the shaft 4 is secured a cam disk 78 which is provided on its rear side, and at its underside with a cam projection 79. The rollers 76 of the clamps 73 run on the inner side of the cam disk 78 and as each of said rollers passes the cam projection 79 it is caused thereby to open the clamp against the tension of its spring 77 so as to cause the clamp to disengage the end of the bolt or work and thereby release the same, and the cam 79 is so timed with respect to the cam 50 that the end clamps are released just after the clamps 56 are released and it will be understood that each bolt or other article of work is thus released by the clamps while it is on the underside of the work carrier.

I will now describe the means for automatically feeding the work to the work carrier as the latter revolves with the drill carrier.

At one side of the base 1 are standards or supports 80 which carry an inclined feed trough 81, the outer portion of the bottom of which also forms the bottom of a feed hopper 82. The said feed trough is dis-

posed opposite the space between the heads of the work carrier. The inner side wall 83 of the feed hopper is provided at its lower side with an opening 84 through which the bolts or other work pass from the hopper to the feed trough; the said bolts or other work being placed in the hopper at right angles to the feed trough so that they remain transverse of the feed trough and roll, by gravity, down upon the same. On the underside of the feed trough are supports 85 and 86 which are respectively provided with bearings for rock shafts 87 and 88, the said rock shafts being respectively provided with rock arms 89 and 90. These rock arms are connected together by a rod 91 for simultaneous movement. The said rock shafts are respectively provided with feed arms 92 and 93 which extend in opposite directions and toward each other and are respectively provided at their free ends with upwardly projecting feed teeth 94 and 95 which operate through openings 96 and 97 with which the bottom of the feed trough is provided. Owing to the fact that the feed arms which are carried by the rock shafts extend in opposite directions and that the rock arms of said rock shafts are connected together for simultaneous movement by the rod 91, when the feed teeth of one set of arms are below the bottom of the trough those of the other set of arms extend up above the bottom of the trough. Hence, when the teeth 94 are in elevated position they hold all of the bolts in place on the upper portion of the feed trough and in the feed hopper. When the said feed teeth 94 descend, the bolts roll downwardly on the feed trough until the lowermost is stopped by the feed teeth 95. As the teeth 94 reascend the teeth 95 descend so as to release the lowermost bolt and permit the latter, by gravity, to roll down the feed trough and be discharged therefrom into one pair of the work receiving notches of the work carrier and, hence, the bolts or other work may be fed singly and in succession to the work carrier. To operate the work feeding means automatically I provide the rock shaft 88 with an operating arm 98 at the outer end of which is a tappet roller 99. The periphery of the member 44 of the work carrier head 43 is provided, at points adjacent to the work receiving notches 54, with cam projections 100. As each cam projection, by the rotation of the work carrier, passes the roller 99, which is during the ascent of each pair of work receiving notches of the heads of the work carrier, and after the finished work has been discharged and dropped from said notches, the said cam, by co-action with the tappet roller, turns the arm 98 in the required direction to cause the feed fingers 95 to release the lowermost bolt and permit it to roll down the feed trough and be fed to the work receiving notches, and at the same

time the fingers 94 engage the next bolt in succession and hold it in place on the feed trough. The rod 91 which is pivotally connected to the rock 90 as at 101, has its
 5 opposite end adapted for longitudinal movement in an opening 102 of the rock arm 89 and is also provided with a stop shoulder 103 for engagement with said rock arm. Springs 104 and 105 are respectively connected to the rock arms 89 and 90, said
 10 springs exerting their tension to elevate the feed fingers when permitted to do so by the co-action of the operating arm 98 with its roller 99 and the cam projections 100 of the
 15 work carrier element.

An inclined discharge trough 106 is mounted at one side of the base 1 and with its upper end below the work carrier so that as each bolt, after being drilled, reaches the lower side of the work carrier and is released therefrom as hereinbefore described, it drops into the said discharge trough and is carried thereby to a suitable receptacle.

The drill shafts and drill-bits, which are
 25 normally retracted or held in withdrawn position from the work by the springs 27, are fed upwardly so as to cause the drill-bits to drill bores B in the bolts or work A by means of a segmental cam 107 which is
 30 mounted on and supported by a bracket 108 which is adjustably secured in place on the base 1 by bolts 109, the lower portion of the bracket, which bears on the base, being provided with adjusting slots 110 in which the
 35 said bolts operate. The cam 107 presents a working face 111 which is oblique to the head 13 of the drill carrier. As each drill shaft, after a bolt has been placed in the notches 54 and 55 and after the clamps have
 40 engaged the said bolt to hold it in place while drilling, reaches the cam, the latter by engagement with the roller 26 of said drill shaft moves the latter forwardly, against the tension of the spring 27, so as to feed
 45 the drill-bit to the work and cause the drill-bit to drill the required bore B in the bolt or work. The cam is disposed at the required pitch with respect to the head 13 to move the drill shafts the required distance, according to the desired depth of the bores in
 50 the work and to permit the withdrawal of the drill-bits from the bores. Thus while the drills are being operated and the bolts are being carried by the rotation of the drill
 55 and work carriers the co-acting cam 107 and springs 27 cause the drill-bits to be first fed to the work and then withdrawn and released therefrom so that as each bolt is carried through part of a revolution of the
 60 work carrier its bore is drilled and as the bolt reaches the lower side of the work carrier, it is released by the means and in the manner hereinbefore described. Hence, the operation of the machine is automatic and
 65 continuous and the machine is adapted for

drilling a large number of bolts in a short time. Moreover, the machine requires little or no attention while in operation and is not likely to get out of order.

While I have herein shown and described
 70 what I now consider a preferred form of my invention I would have it understood that minor changes may be made in the form, proportion and construction of the several parts without departing from the spirit of
 75 my invention and within the scope of the appended claims.

Having thus described my invention I claim:

1. In a machine of the class described, the
 80 combination of a work carrier and a tool carrier mounted for simultaneous rotation, said tool carrier comprising heads, one of which is also a worm gear and is provided on its outer side with an arm, a sleeve
 85 mounted in the other head for longitudinal movement, a spring to move the sleeve longitudinally in one direction, a tappet carried by the sleeve, a tool shaft mounted for rotation in the sleeve, connected thereto for
 90 longitudinal movement therewith, and also extending through and movable in the worm gear and the arm of said worm gear, a pinion splined on the tool shaft and bearing between the worm gear and its arm, a master
 95 gear engaging the pinion of the tool shaft, a shaft having a worm engaging said worm gear to rotate the carrier, connections between the master gear and the worm shaft to rotate the latter and hence also the worm
 100 gear and tool carrier, a cam to act on said tappet to move the tool shaft longitudinally in one direction against the tension of the spring, and during a part of the rotation of the tool carrier.

2. In a machine of the class herein described, the combination of a work carrier and a tool carrier mounted for rotation together and means to rotate the said carriers, said work carrier having heads provided
 110 with outwardly opening peripheral work receiving notches, and the head nearest the tool carrier having abutments at one end of its notches, work engaging clamps to grasp the work transversely and hold the work
 115 in said notches, work engaging clamps to press longitudinally on the outer end of the work and hold the work in the notches of the other head and also against the abutments of the said head nearest the tool carrier,
 120 said clamps being carried by the work carrier, and means to automatically operate the said clamps and cause them to release the work at a predetermined point in the rotation of the carriers.

3. In a machine of the class described, the combination of a work carrier mounted for rotation and comprising heads having peripheral work receiving notches, a clamp
 125 carried by one of the heads to engage one

side of the work, a clamp carried by the other head to engage one end of the work, and means to operate the clamps.

4. In a machine of the class described, the
5 combination of a fixed shaft, a work carrier mounted for rotation on the said shaft and having a head provided with a work receiving notch, a work engaging clamp pivoted on said head, a jaw pivotally connected to
10 and movable with the clamp to engage the work and press the latter against one side of the notch, a cushioning spring for the jaw, between the latter and the clamp, a tappet carried by the clamp, a cam fixed on
15 the shaft and engaged by the tappet to co-act therewith and automatically operate the clamp, a tensioning screw for the said cushioning spring and extending through the clamp, and an adjusting screw for the jaw,
20 the said adjusting screw being carried by the clamp.

5. In combination with a work carrier and a tool carrier mounted for simultaneous rotation, said work carrier comprising heads
25 having peripheral work receiving notches,

one of said heads comprising a pair of members, one of which is adjustable angularly with respect to the other, the last mentioned member having a centering opening for the bit of the tool, and a work engaging clamp
30 carried by said angularly adjustable member.

6. In a machine of the class described, the combination of a work carrier and a tool carrier mounted for simultaneous rotation, 35 a tool mounted in the tool carrier, means to rotate said carriers, means to operate the tool during the rotation of the carriers, and work feeding and work releasing means co-acting with the work carrier during the rotation of the latter, said work feeding means
40 having an operating lever and the said tool carrier having a cam to actuate said lever.

In testimony whereof I hereunto affix my
signature in the presence of two witnesses. 45

EDWARD WINBURN FISHBURNE.

Witnesses:

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C. A. STRAIN.