K. H. CARPER.

STAY BOLT DRILLING MACHINE.

APPLICATION FILED JUNE 30, 1913.

1,099,425.

Patented June 9, 1914.

4 SHEETS—SHEET 1.

Fig. 1

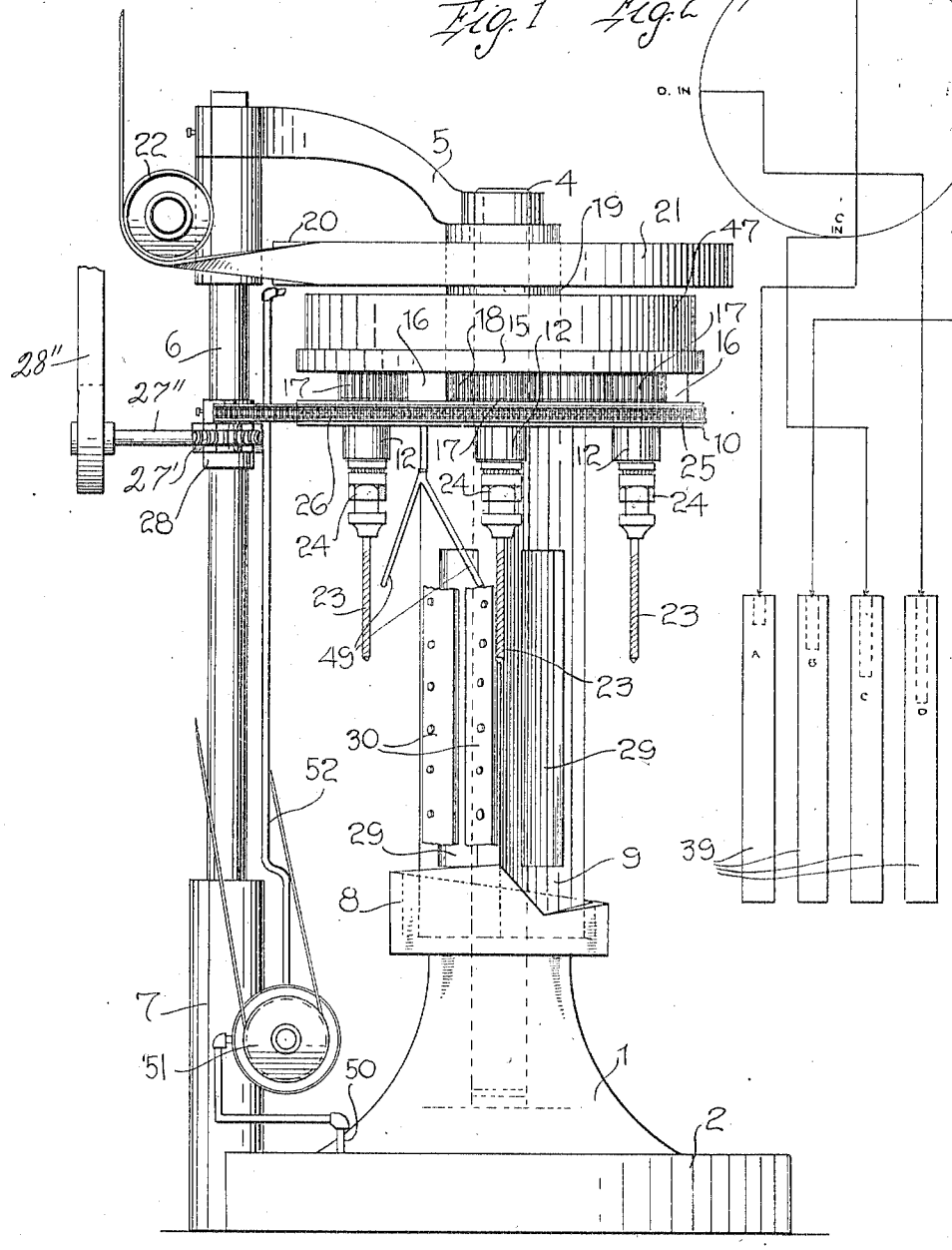


Fig. 2

Inventor

K. H. CARPER.

Witnesses

Robert M. Sutphen.

A. L. Hind.

By Watson E. Coleman

Attorney

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4 SHEETS—SHEET 2.

Fig. 3

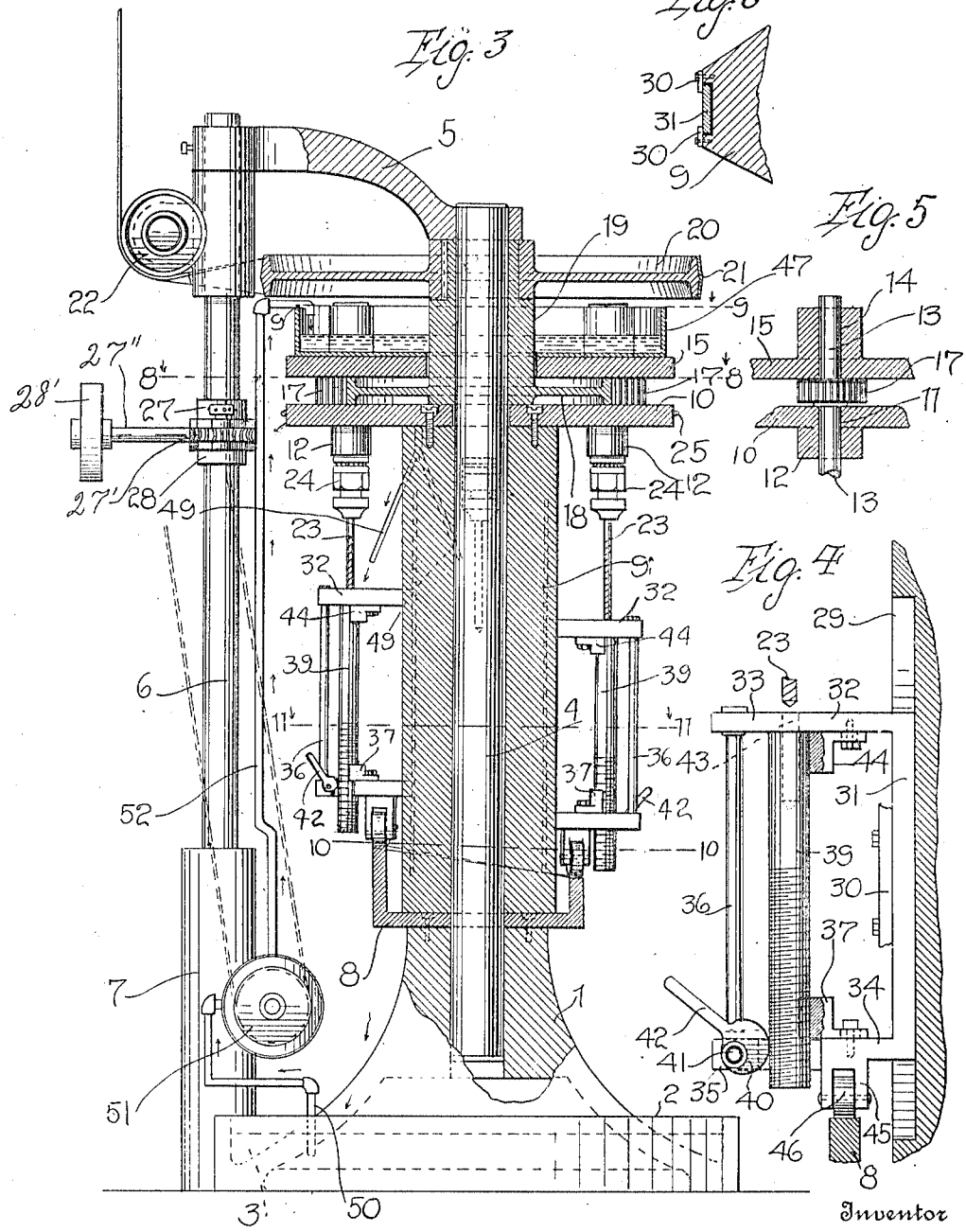


Fig. 6

Fig. 5

Fig. 4

Inventor

K. H. CARPER.

Witnesses
Robert M. Sutphen.
A. L. Hind.

By Watson E. Coleman
Attorney

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4 SHEETS—SHEET 3.

Fig. 9.

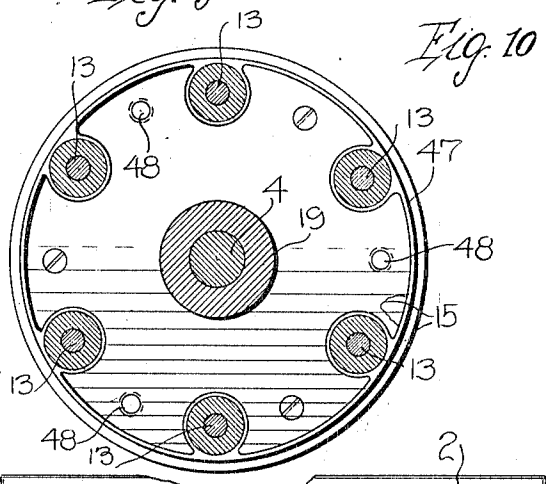


Fig. 10.

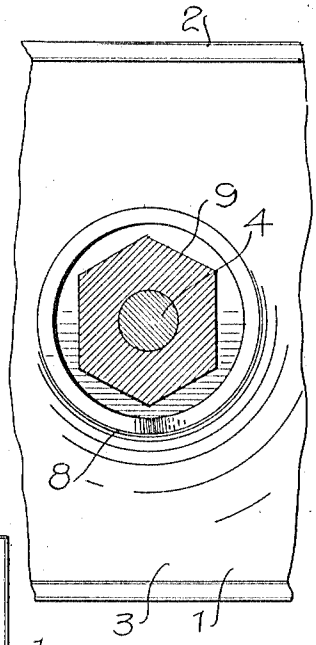


Fig. 7.

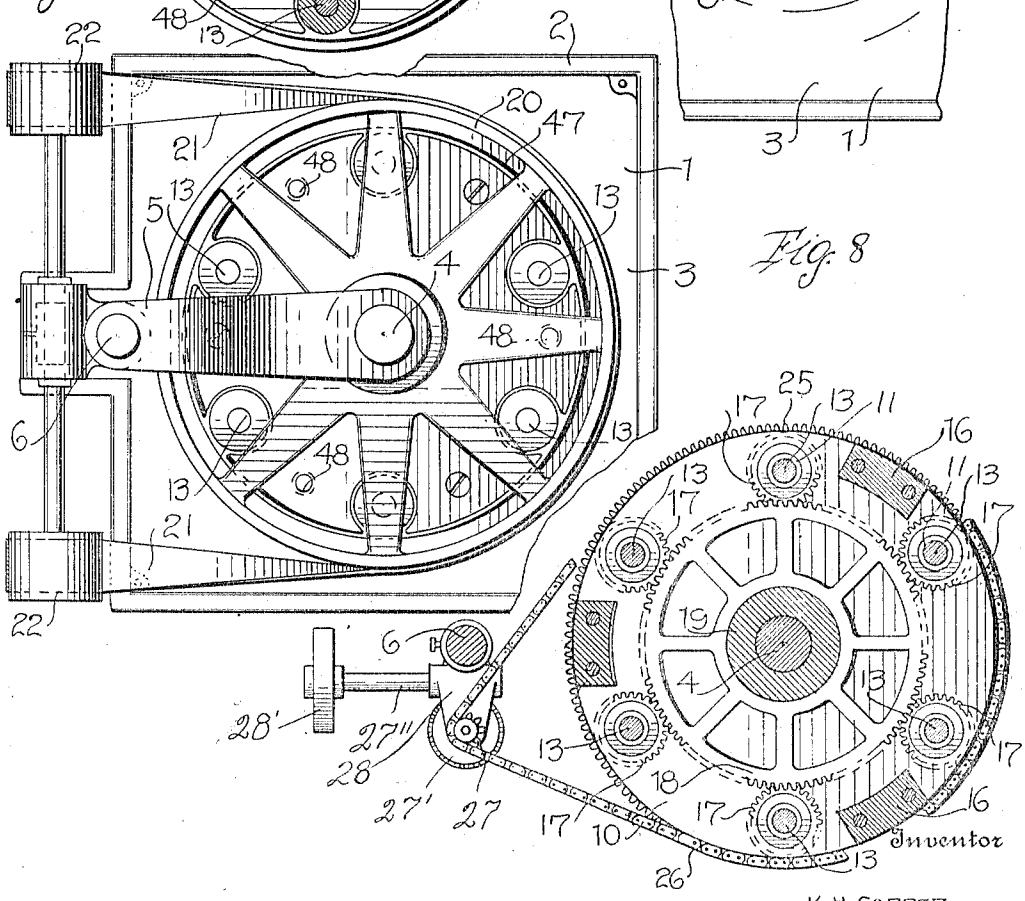


Fig. 8.

Witnesses
Robert M. Sutphen.
A. D. Hurd.

Inventor
K. H. CARPER.

By Watson E. Coleman
Attorney

K. H. CARPER.

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4 SHEETS—SHEET 4.

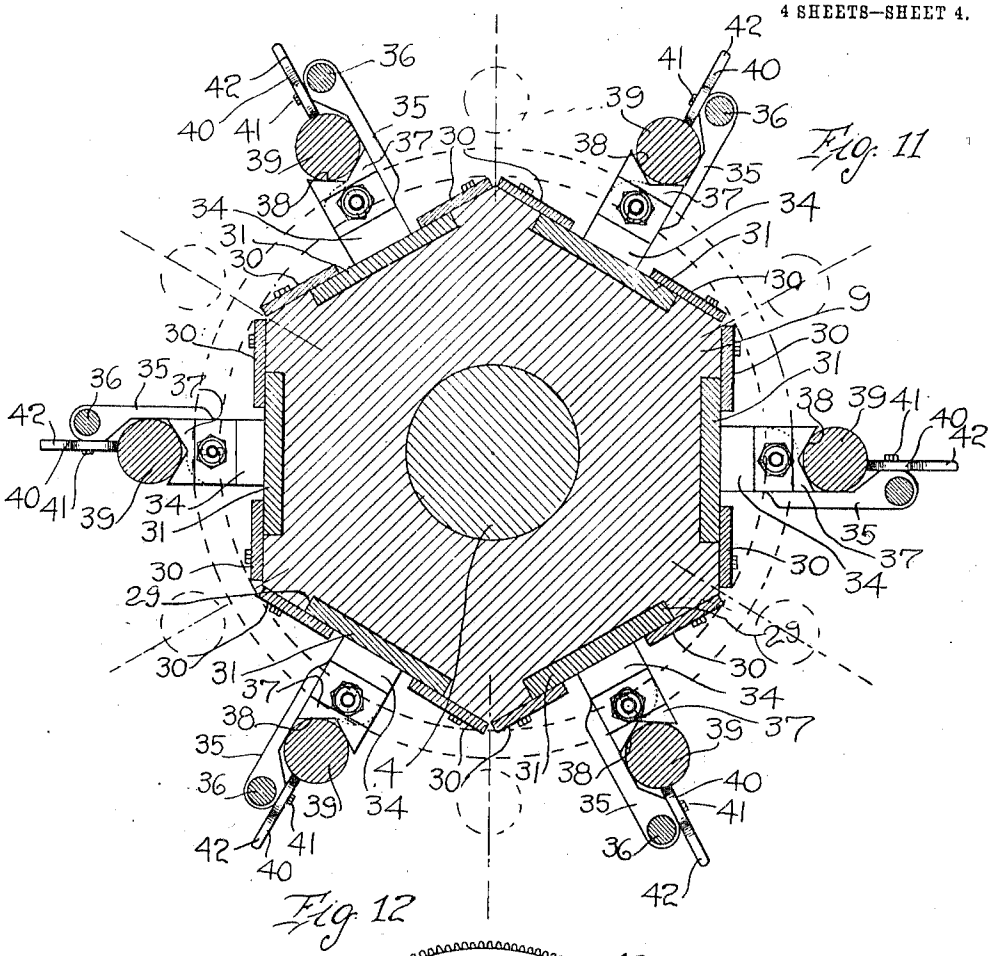
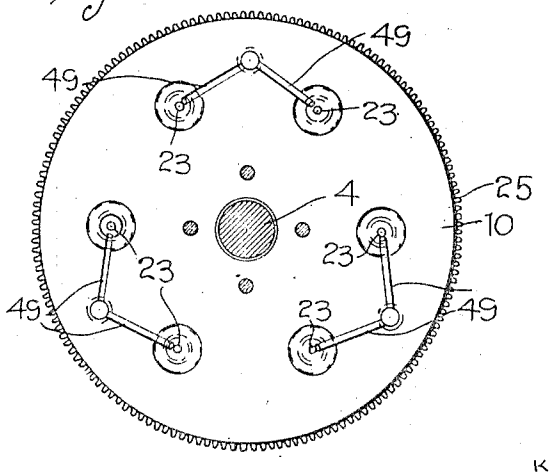


Fig. 11

Fig. 12



Witnesses
Robert M. Sutphen
A. J. Friend.

Inventor
K. H. CARPER.

By Watson E. Coleman
Attorney

UNITED STATES PATENT OFFICE.

KENT H. CARPER, OF RICHMOND, VIRGINIA, ASSIGNOR TO RICHMOND STAY-BOLT DRILLING MACHINE MANUFACTURING CO., INC., OF RICHMOND, VIRGINIA, A CORPORATION OF VIRGINIA.

STAY-BOLT-DRILLING MACHINE.

1,099,425. Specification of Letters Patent. Patented June 9, 1914.

Application filed June 30, 1913. Serial No. 776,625.

To all whom it may concern:

Be it known that I, KENT H. CARPER, 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 Stay-Bolt-Drilling Machines, 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 and relates particularly to machines for drilling stay-bolts for steam boilers and the like, the present invention being of the type wherein the drill bits and spindles are designed, in the operation of the machine, to be continuously rotated about their own axes and as a whole or gang, revoluble about the vertical central axis of the machine.

The present invention has for its primary object a simple, durable and efficient construction of machine of this character in which the drill holder is rotated about a vertical axis while the work holders are carried around along with the drills and caused to move one after another upwardly into operative engagement with the depending, vertically disposed drills, through the instrumentality of a cam which engages the work holders and on which the latter ride and which is so formed that at the completion of the drilling operation, the bolt which has been fully drilled, will be abruptly lowered and released from the drill, whereupon it may be removed and another undrilled bolt applied.

The invention has for its further object a machine of this class which will be compact and take up comparatively little floor space; which will be composed of comparatively few and simple parts that may be easily removed and not liable to get out of order, while at the same time being susceptible of ready detachment should any part become broken or otherwise need repair or replacement; which will embody a plurality of bolt-holding frames, each of which is independently removable relative to the others, whenever required; and which will hold the bolts securely in operative relation to the continuously rotating and revolving drills, the drills being designed to revolve at all times in a horizontal plane, while the bolt-holding frames are successively raised one after the other into gradually increasing engagement with the drills until the openings in the bolts are at the required depth, whereupon each bolt will be lowered with its supporting or carrying frame completely out of engagement with the drill above it and can be removed and easily replaced by another undrilled bolt.

A still further object of the invention is a machine of this character embodying improved means for rotating the entire series or gang of drills combined with improved means for continuously rotating the drills about their own axes. And the invention also aims to generally improve devices of this class so as 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 side elevation of a vertical bolt drilling machine embodying the principles and improvements of my present invention, some parts being omitted and others partly broken away. Fig. 2 is a diagrammatic view of the cam action hereinafter specifically described. Fig. 3 is a central vertical longitudinal section of the machine with parts in side elevation. Fig. 4 is a side elevation of one of the bolt holders, parts being partly in section and broken out. Fig. 5 is a fragmentary detail sectional view of one of the drill spindles and its surrounding parts. Fig. 6 is a fragmentary horizontal section through a portion of the revoluble column which carries the bolt holders and supports and carries the drills. Fig. 7 is a top plan view partly broken out. Fig. 8 is a horizontal sectional view on the line 8—8, of Fig. 3. Fig. 9 is a similar view on the line 9—9, of Fig. 3. Fig. 10 is a horizontal sectional view on the line 10—10, of Fig. 3. Fig. 11 is an enlarged horizontal section on the line 11—11, of Fig. 3, showing the bolts and bolt holders in position, and, Fig. 12 is a bottom plan view of the lower plate which constitutes part of the revoluble drill carrier showing the arrangement of branched pipes for conveying a drill-cooling fluid to the drill.

Corresponding and like parts are referred to in the following description and designated in the accompanying drawings by like reference characters.

Referring to the drawings, the numeral 1 designates the base of my improved bolt drilling machine, the same being formed with an upstanding rim 2 which produces within the base, a shallow drip trough 3, and 4 designates the main centrally disposed post or pillar of the machine, the lower end of which is mounted within the base 1 and the upper end of which is stayed and strengthened by a brace 5 which is secured upon the upper end of a standard 6, the lower end of which is mounted within a pedestal 7, as clearly indicated in Figs. 1 and 3.

Secured upon the upper end of the base 1 is a preferably hollow cam 8 which is fixed in position and within which is received, the lower end of a tubular supporting column 9 which is polygonal in cross section, as clearly illustrated in Figs. 10 and 11, having six sides or faces in the present instance, as there are six drills and bolt holders in this embodiment of my invention, although it is to be understood that the invention is not limited in this regard. This supporting column is intended to have a revoluble movement around the post 4, and in the present instance is supported at its lower end upon the base of the cam 8, but it is to be understood that antifriction bearings of any character may be supplied at any desired points to reduce the friction of this revoluble movement to a minimum.

A horizontally disposed disk 10 is secured in any desired way as by stud bolts to the upper end of the column 9 to turn therewith around the post 4, said disk being formed with openings 11 extending therethrough and defined on the lower side of the disk by bosses 12. The drill spindles 13 are mounted for rotation within the openings 11 and extend upwardly through corresponding openings 14 that are formed (in registry with the openings 11) in bossed portions of another disk 15 which is arranged superjacent to and in spaced relation with the disk 10, the spaced relation between these two disks being maintained by spacer blocks 16, as best illustrated in Fig. 1.

Interposed between the disks 10 and 15, are spur pinions 17 that are secured to the respective spindles 13 and that are designed for engagement with a gear wheel 18 that is mounted within the circle of the plurality of pinions 17 between the disks 15 and 10. The gear wheel 18 is formed on the lower end of a hub 19 which surrounds the upper end of the post 4 with its upper end in contact with the lower side of the inner end of the brace 5 hereinbefore referred to, and a band wheel 20 or similar driving element is keyed or otherwise secured to the upper end of the tubular hub 19, a belt 21 passing around said wheel and around idlers 22, thence passing to and from a driving shaft or pulley (not shown) which receives its motion from any suitable source of power.

The disks 10 and 15 constitute the main portions of the drill carrier, the drills 23 projecting downwardly from chucks 24 which are ball bearing, as best illustrated in Figs. 1 and 3, and which are secured to the lower ends of the spindles 13. The spindles receive a rotary movement about their own axes through the instrumentality of the gear wheel 18 meshing with the pinions 17, and the gang or series of drills and drill spindles receives a revoluble movement about the post 4 as an axis by means of the lower disk 10 which is formed on its periphery, as best illustrated in Fig. 8, with sprocket teeth 25, around which a driving chain 26 passes, said chain also at one point of its traverse passing around a sprocket wheel 27. The sprocket wheel 27 is mounted on the upper end of a vertically disposed shaft which is journaled in a bracket 28 secured to the standard 6, as clearly illustrated in the drawings, and the said shaft also carries a worm gear wheel 27′ which meshes with a worm (not shown) on a horizontally disposed shaft 27″ which carries a pulley 28′ around which a driving belt 28″ passes, as illustrated in Fig. 1.

Each face of the revoluble column 9 is formed with a vertically elongated way or recess 29, the side walls of which are overlapped by retaining and guide plates 30 that are secured in place by stud bolts or similar fastening devices and that engage over the outer faces of vertically disposed bars 31 which form parts of substantially rectangular bolt-holding frames 32. Each of these frames 32 comprises, in addition to the bar 31, an upper laterally projecting and horizontally disposed bar 33 and a lower bar 34 which is formed with a substantially radial and outwardly projecting offset extension 35 connected at its outer end by a spacer or tie rod 36 with the outer end of the upper bar 33. The lower bar 34 has adjustably secured to it by a slot and bolt connection, a dog 37 which is formed at its outer end with a preferably angular or V-shaped notch 38 designed to engage the inner side of a bolt near the lower end of the latter, the bolt designated 39 being adapted to lie up against the side of the offset extension 35 and to be detachably clamped at its lower end by a radially disposed eccentric clamping device 40, pivoted at 41, and provided with a handle 42. When the bolt 39 is placed in position, its upper end will abut against the lower side of the upper bar 33 which is formed with an opening 43 extending therethrough for the passage of the

drill to the bolt and the upper end of the bolt is designed to bear against a dog 44 like the dog 37, both of said dogs being adjustable in a radial direction, as required. Each lower arm 34 is formed with a downwardly projecting forked extension 45 in which a roller 46 is journaled and the rollers of the several bolt-holding frames 32 are adapted to ride upon the cam 8 hereinbefore referred to.

From as much of the description as has preceded in connection with the correlated views of the accompanying drawings, it will be understood that as a rotary motion is imparted to the band or driving wheel 20. This motion will be transmitted thereby to the gear wheel 18 and from thence to the drill spindles 13 to impart a continuous rotary movement to the spindles about their own axes, while at the same time, the driving chain 26 will rotate the drill holder or carrier by direct engagement with the lower disk 10, and the drills will be carried around in a circle, the column 9 being also rotated about the post 4 as an axis. This movement of the column 9 will obviously carry the bolt holders around with the drills, and as the bolt holders are arranged for a free vertical movement within the slots or recesses 9 and for a rolling movement upon the upper surface of the cam 8, it will be understood that said bolt holders will be moved upwardly into engagement with the drill bits and be permitted to lower after the holes have been drilled to the required depth.

In the present embodiment of the invention, the operative surface of the cam is shown plotted in Fig. 2, in which the point D in the circular movement of the cam, is the highest point shown at the immediate front center of Fig. 1. As the drill holders rotate in the direction of the arrow shown in Fig. 2, they will, one after the other, meet the abrupt drop illustrated in Fig. 1, and the bolt which has been drilled to the fullest extent desired, will be at once dropped down with its carrier or holder and a boy or other attendant standing at this point may immediately grasp the handle 42 and release the bolt and remove it, and instantly replace it by an undrilled bolt. Thus, it will be understood that the bolts, one after another will be drilled, first from point A to B, then to C and to D, as the holders travel around on the gradually increasing upper surface of the cam and will be dropped one after the other after they have been completely drilled.

It will be seen, particularly by reference to Fig. 3, that the bolt holders and their bolt-engaging devices are so disposed that the bolts will be held in a vertical position in a circularly arranged series outside of the margin of the cam 8 upon which the rollers 46 ride, whereby the cam will not interfere at all with the bolts, but the latter will be permitted to drop freely in a downward direction when the boy or other attendant stationed at the required point, releases the bolt-clamping devices 40, one after the other, the bolt released dropping into any desired receptacle or being quickly grasped by the attendant and deposited in any suitable place and being immediately thereafter replaced by an undrilled bolt.

In order to keep the drills cool, I mount upon the upper disk 15, a reservoir 47 secured to the said disk by screws or the like, as illustrated in Fig. 9, and formed with openings 48 which extend downwardly through the disk and lead to branched pipes 49, whereby the soapy or similar drill-cooling fluid may drip down upon the drills. In order to save this fluid and use it over again repeatedly, a suction pipe 50 extends at one end down into the drip trough 3 and is connected at its upper end to a rotary pump 51 of any desired construction which is driven in any desired way. Also connected to this pump, is a pipe 52 which extends upwardly and discharges at its upper end into the reservoir 47 whereby the drippings which fall down into the trough 3, may be carried upward and again discharged into the reservoir.

While the accompanying drawings illustrate what I believe to be the preferred embodiment of my invention, it is to be understood that the invention is not limited thereto, but that various changes may be made in the construction, arrangement and proportions of the parts without departing from the scope of the invention as defined in the appended claims.

What I claim is:—

1. In a drilling machine of the character described, the combination of a drill carrier revoluble about a vertical axis, a plurality of drills carried thereby, means for rotating the drill carrier, means for rotating the drills during the revolution of the drill carrier, a plurality of work holders, a support therefor revoluble with the drill carrier and connected with the work holders, and a cam engageable by the work holders and adapted to cause the same to move toward the drills, the work holders being provided with work-engaging means for holding the work outside of the margin of the cam.

2. In a drilling machine of the character described, a drill carrier embodying upper and lower disks spaced from each other, drill spindles carried by said disks, pinions secured to the respective drill spindles between said disks, a gear wheel mounted within the series of pinions and meshing therewith and disposed between said upper and lower disks, a hub with which said gear wheel is provided, said hub projecting up-

wardly through the upper disk, a drive wheel connected to said hub above the drill carrier, means engaging the lower disk for rotating the drill carrier, and a revoluble holder movable with the drill carrier.

3. In a drilling machine of the character described, a drill carrier embodying upper and lower disks spaced from each other, drill spindles carried by said disks, pinions secured to the respective drill spindles between said disks, a gear wheel mounted within the series of pinions and meshing therewith and disposed between said upper and lower disks, a hub with which said gear wheel is provided, said hub projecting upwardly through the upper disk, a drive wheel connected to said hub above the drill carrier, means engaging the lower disk for rotating the drill carrier, said means consisting of a drive chain and the lower disk being formed on its periphery with sprocket teeth engaging said chain, and a revoluble work holder movable with the drill carrier.

4. In a drilling machine of the character described, a revoluble drill carrier embodying lower and upper disks secured together in spaced relation, a plurality of circularly arranged drill spindles journaled in said disks and provided between said disks with pinions, a gear wheel interposed between said disks and within the circle of said pinions and meshing with the latter, said gear wheel being provided with a hub projecting upwardly through the upper disk to a point above the drill carrier, a band wheel secured to the hub at the upper end thereof, a driving belt extending around said wheel to turn the same and the gear wheel to rotate the drill spindles, means for rotating the drill carrier, and a revoluble work holder movable with the drill carrier.

5. A machine of the character described, including a revoluble drill carrier, rotatable drills carried thereby, means for rotating the carrier, means for rotating the drills, a rotatable column movable with the drill carrier, a plurality of frames mounted for a longitudinal movement on and carried by said column, said frames including upper and lower bars, the lower bars each being provided with an outwardly projecting offset and radially disposed extension, bolt-engaging dogs carried by said upper and lower bars, and releasable bolt-clamping devices carried by the extensions of the lower bars, for the purpose specified, and a cam engageable by said lower bars and adapted to move the frames in a direction to carry them into operative relation to the drills.

6. A machine of the character described, including a revoluble drill carrier, rotatable drills carried thereby, means for rotating the carrier, means for rotating the drills, a rotatable column movable with the drill carrier, a plurality of frames mounted for a longitudinal movement on and carried by said column, said frames including upper and lower bars, the lower bars each being provided with an outwardly projecting offset and radially disposed extension, bolt-engaging dogs carried by said upper and lower bars, and releasable bolt-clamping devices carried by the extensions of the lower bars, for the purpose specified, and a cam engageable by said lower bars and adapted to move the frames in a direction to carry them into operative relation to the drills, the bolt-engaging dogs being formed with V notches and having radially adjustable connections with the arms to which they are connected.

7. In a drilling machine of the character described, a revoluble drill carrier, rotatable drills carried thereby, means for rotating the drill carrier, means for rotating the drills as they are carried around by the drill carrier, a column rotatable with the drill carrier and provided with longitudinal ways, retaining plates secured to the column and overlapping the sides of the ways, bolt-holding frames movable in said ways and engaged by said retaining plates, means carried by the frames for holding bolts therein in longitudinal alinement with the drills, and a cam at the lower end of the support, the frames being mounted to ride upon said cam, whereby the bolts carried by the frames will be moved, one after another, into operative relation to the drills.

8. In a drilling machine of the character described, a drill carrier embodying upper and lower disks spaced from each other, drill spindles carried by said disks, pinions secured to the respective drill spindles between said disks, a gear wheel mounted within the series of pinions and meshing therewith and disposed between said upper and lower disks, a hub with which said gear wheel is provided, said hub projecting upwardly through the upper disk, a drive wheel connected to said hub above the drill carrier, and means engaging the lower disk for rotating the drill carrier, said means consisting of a drive chain, a sprocket wheel around which said chain passes, a worm gear wheel movable with the sprocket wheel, means for rotating the worm gear wheel, the lower disk being formed on its periphery with sprocket teeth engaging said chain, and a revoluble work holder movable with the drill carrier.

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

KENT H. CARPER.

Witnesses:
ANNIE I. HIND,
FREDERICK S. STITT.