

Nov. 10, 1931.

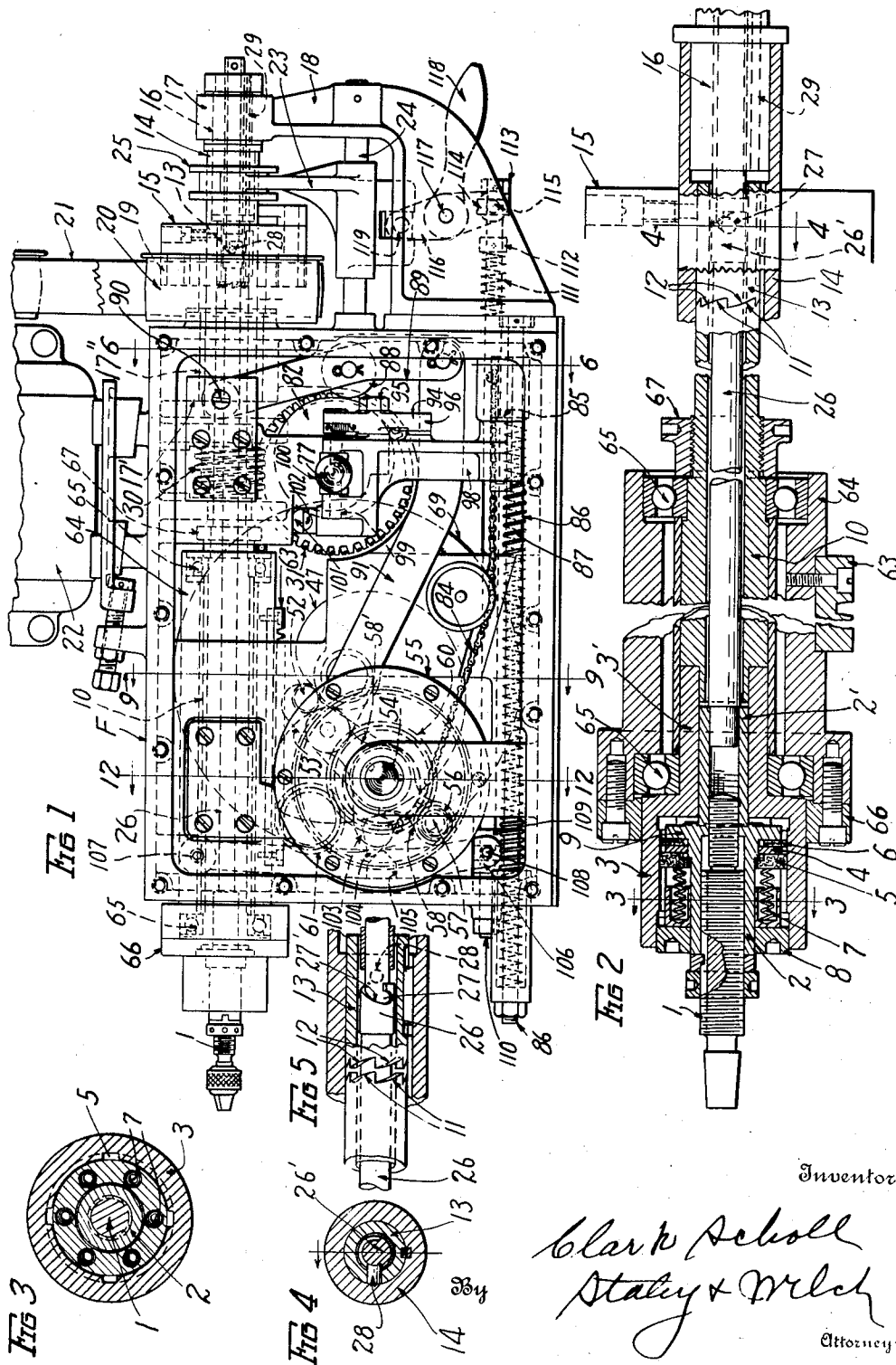
C. SCHOLL

1,831,547

DRILLING MACHINE

Filed March 1, 1928

5 Sheets-Sheet 1



Nov. 10, 1931.

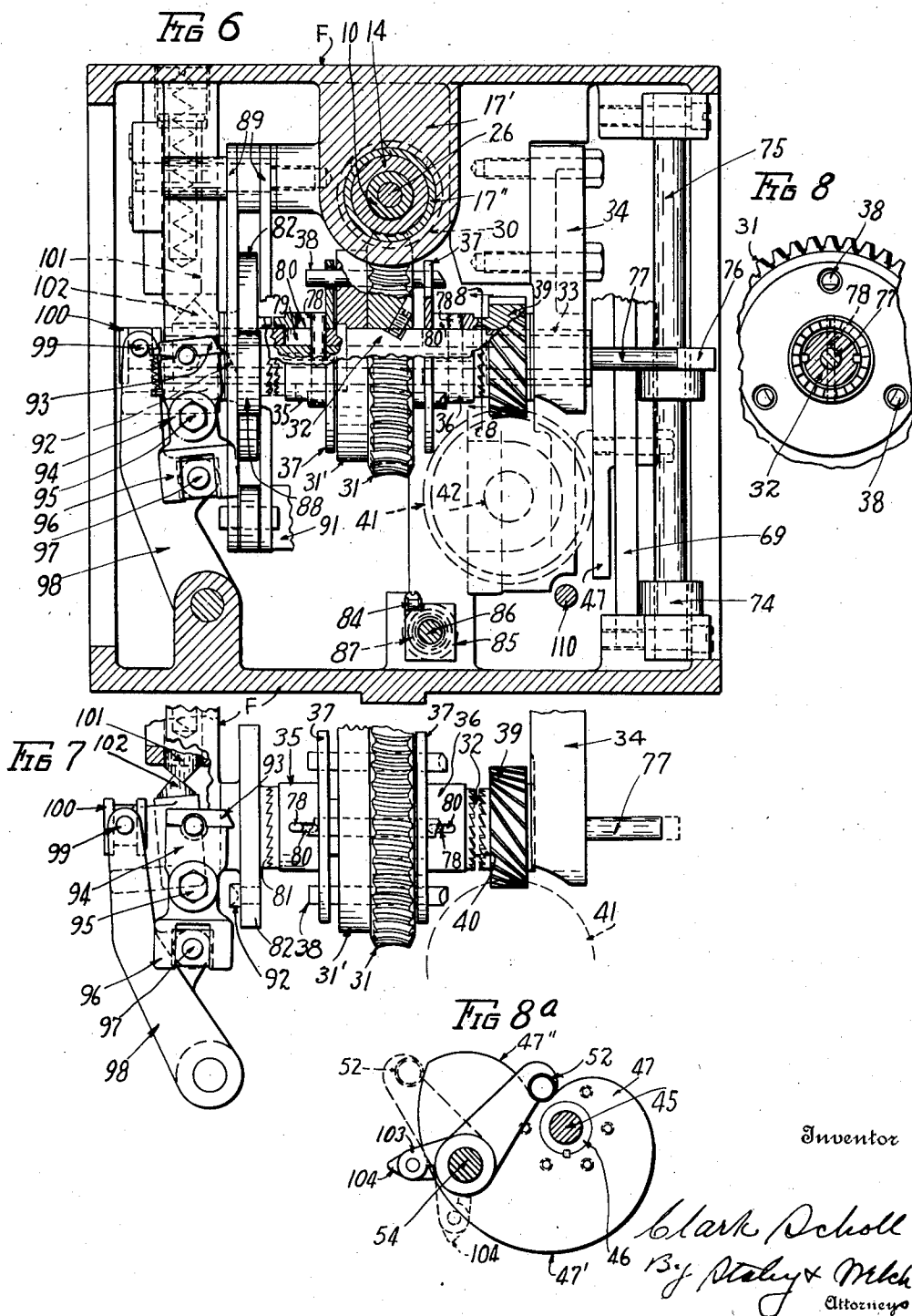
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FIG 9

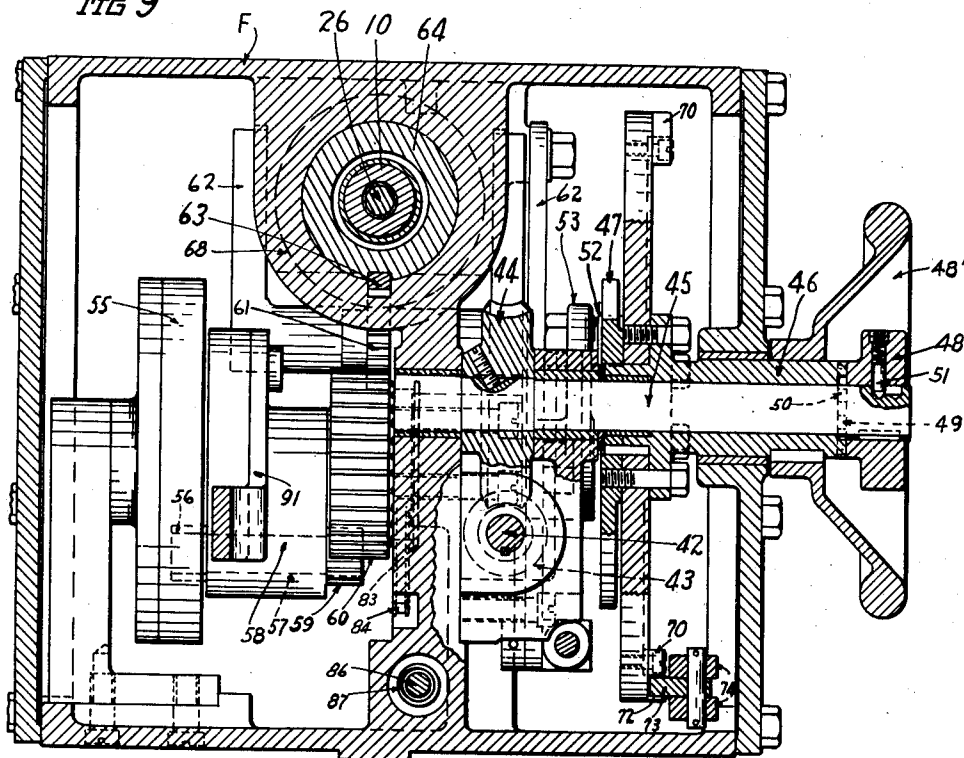


FIG 10

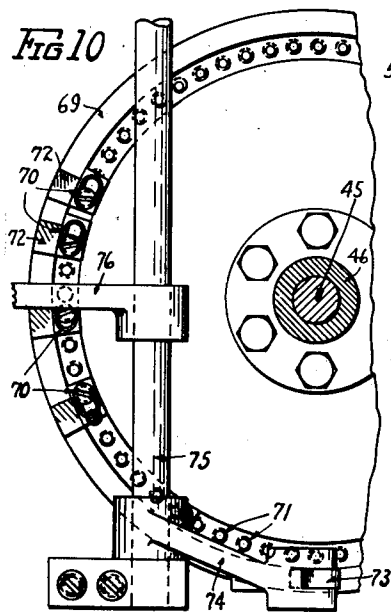
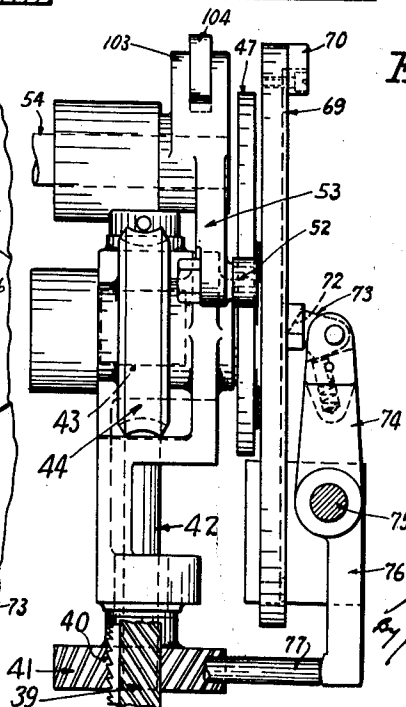


FIG 11



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FIG 12

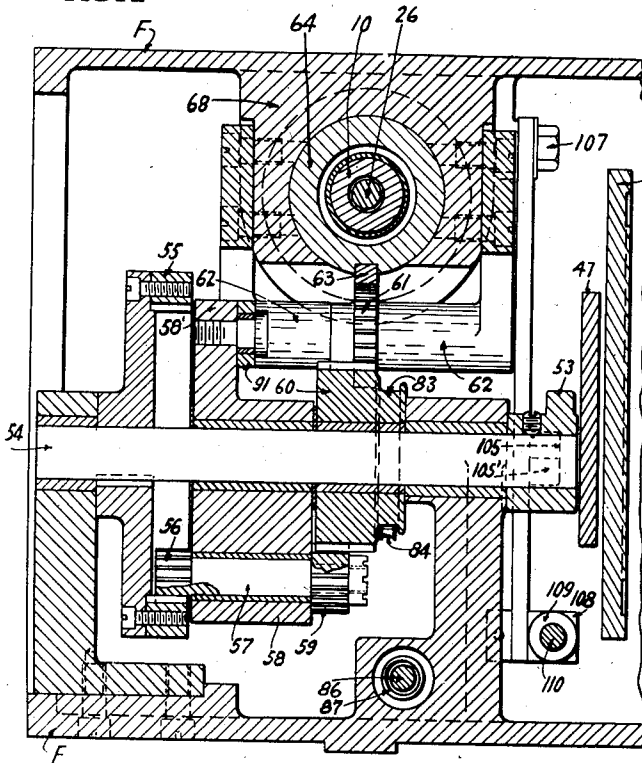


FIG 13

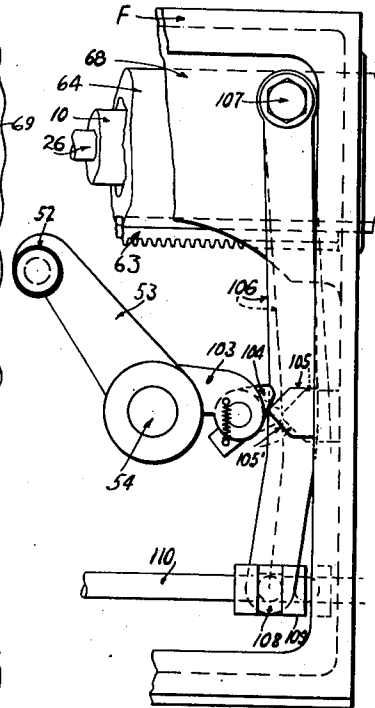


FIG 14

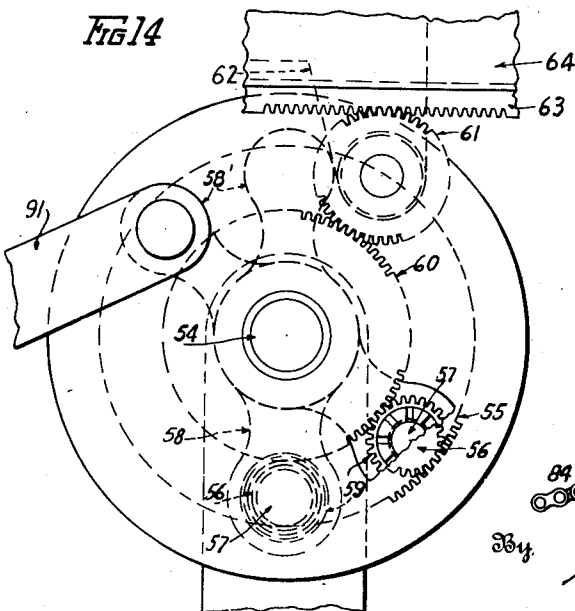
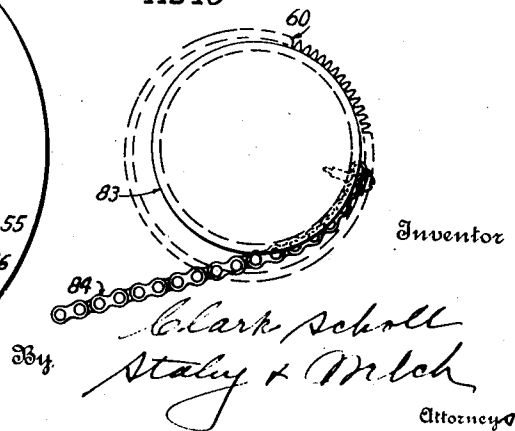


FIG 15



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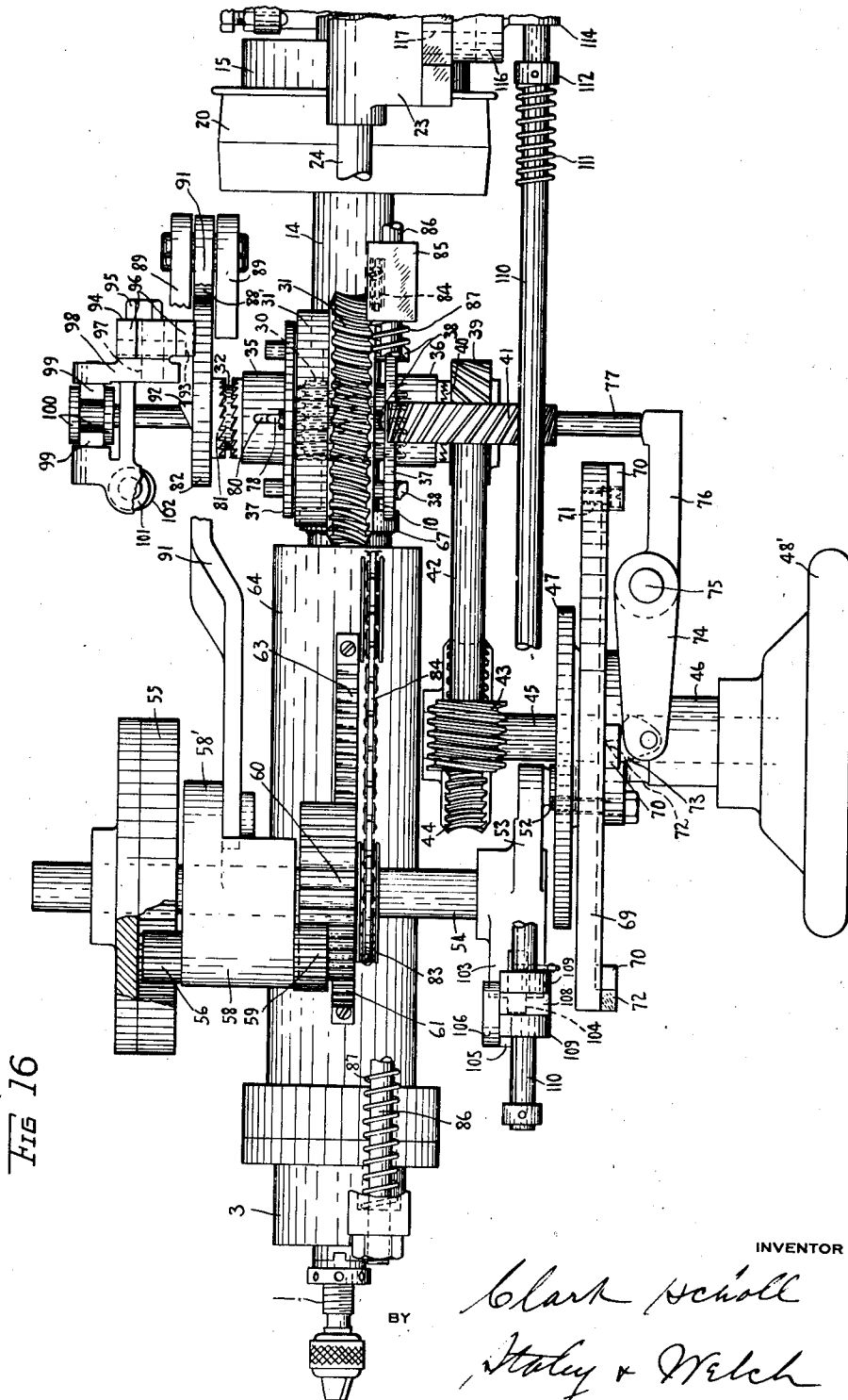
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DRILLING MACHINE

Filed March 1, 1928

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DRILLING MACHINE

Application filed March 1, 1928. Serial No. 258,225.

This invention relates to drilling machines of the automatic type.

machine at the end of the complete drilling operation.

One of the objects of my invention is to provide improved mechanism for arresting the tool and withdrawing it from the work at predetermined intervals, and for restoring the tool to working position; a more specific object in this connection being to accomplish this result automatically.

Fig. 14 is an enlarged side elevation of the gearing and associated parts for feeding the drill.

Another object of the invention is to provide means for automatically varying the depth of cut of each successive drilling operation.

Fig. 15 is an enlarged side elevation of a portion of the withdrawing devices for the drill.

Fig. 16 is a bottom plan view of the spindle assembly, and the feeding devices and withdrawing and restoring devices for same.

Another object of the invention is to provide for automatically stopping the feeding action of the tool spindle whenever the spindle ceased to rotate due to unusual pressure thereon.

Other objects of the invention will appear from the accompanying description and claims.

Drill spindle assembly

In the accompanying drawings:

Fig. 1 is an elevation of one side of a machine embodying the improvements.

Fig. 2 is a longitudinal section of the drill spindle assembly.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a section on the line 4—4 of Fig. 2.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is a vertical section on the line 6—6 of Fig. 1.

Fig. 7 is a detail of a fragmentary part of the worm wheel which form a part of the mechanism which feeds the drill and the devices which throw the same into and out of operation.

Fig. 8 is a section on the line 8—8 of Fig. 6.

Fig. 8a is a side elevation of the feed cam and its associated cam arm.

Fig. 9 is a vertical section on the line 9—9 of Fig. 1.

Fig. 10 is a side elevation of a portion of the tripping disk and its pawls.

Fig. 11 is a plan view of the tripping disk, feed cam and associated parts.

Fig. 12 is a vertical section on the line 12—12 of Fig. 1.

Fig. 13 is a side elevation of a portion of the devices for automatically arresting the

Referring first to Figs. 1—5 inclusive, there is shown the construction of the drill spindle assembly. The spindle 1 is secured into the threaded bore of one member 2 of a clutch, the other member 3 of which surrounds the member 2 and has a reduced sleeve portion 3' which is journaled upon the reduced extension 2' of the clutch member 2. The clutch member 2 has connected to rotate therewith a metallic disk 4 located between a pair of fibre disks 5 and 6 which are connected to rotate with the clutch member 3. Coil springs 7 are interposed between the fibre disks 5 and a plug 8 in the end of the clutch member 3 to hold all of the disk in frictional engagement; a collar 9 formed integrally with the clutch member 2 acting as an abutment. The sleeve portion 3' of the clutch member 3 is fitted on a reduced shouldered portion formed on the forward end of a long sleeve 10 so as to rotate therewith and the rear end of this sleeve has clutch faces 11 adapted to engage with clutch faces 12 formed on a short clutch sleeve 13. The clutch sleeve 13 is keyed to the elongated hub 14 of a clutch member 15, this hub having pressed therein with a tight fit a journal 16 which rotates in the bearing 17 at the upper end of a bracket 18 suitably supported from the main frame F. The forward end of the hub 14 rotates in a bushing 17' carried by a bearing bracket 17' formed integrally with the frame F (Fig. 6). The clutch member 15 is of a well known type having an expanding ring indicated in dotted lines at 19, which engage with the inner surface of a pulley 20 which is driven by the belt 21 from an elec-

tric motor 22. The ring is expanded by a clutch shifter 23 slidably mounted upon a rod 24 and cooperating with a grooved collar 25 which is slidably mounted upon the clutch hub 14 and has connected therewith a beveled end key (not shown). A shaft 26 has its forward end secured to the extension 2' of the clutch member 2 and extends rearwardly through the clutch sleeve 13 where it is provided with an enlarged portion 26' having a recess 27 approached by an inclined wall 27', (Fig. 5). The clutch sleeve 13 has a pin 28 which normally lies in the recess 27. In the event however of the stoppage of the drill, which results in slippage of the clutch disks 4, 5 and 6, continued rotation of the clutch sleeve 13 also results in the pin riding upon the inclined wall 27' and sliding the sleeve 13 to the position shown in Fig. 5 to disengage the clutch teeth 11 and 12 to thereby stop rotation of the parts.

When the clutch teeth 11 and 12 are disengaged in this manner, they are again caused to be engaged with each other by the operator inserting in an opening indicated in dotted lines at 29 in the journal 16 a small rod or pin to engage the end of the clutch sleeve 13 and pushing it toward the clutch teeth 11; the drill spindle being turned by hand to the proper point to cause the pin 28 to enter the opening leading to the recess 27.

Drill feeding mechanism

Secured to the rotatable sleeve 10 is a worm 30 which drives a worm wheel 31 having a reinforcing ring 31' (Figs. 1, 6 and 16). This worm wheel 31 is fast to a transverse shaft 32 which is journaled in a portion of the frame F and in a bushing 33 carried by a bracket 34 secured to the frame. There is located on the shaft 32 on each side of the worm 31 and its reinforcing ring a shiftable clutch member 35 and 36 which clutch members are provided with flanges 37 apertured to receive pins 38 which extend through the web of the worm so as to rotatably connect the clutch members with the worm (see also Figs. 7 and 8). Loosely mounted upon an extended portion of the bushing 33 is a spiral pinion 39 which has clutch teeth 40 to engage with the clutch teeth of the clutch member 36 to rotate the pinion from the worm wheel. This pinion meshes with the spiral gear 41, fast to a longitudinal shaft 42 (see also Figs. 9 and 16), which has a worm 43 driving a worm wheel 44 on a transverse shaft 45 suitably mounted in the frame.

Connected with the shaft 45 is a sleeve 46 having fast thereto a cam 47. The connection between the shaft and sleeve is preferably made through a hand-operated clutch member 48, having clutch teeth 49 movable into and out of engagement with clutch teeth 50 on the sleeve 46 and held in different positions by the spring pressed detent 51, the pur-

pose of this connection being to permit the drill to be withdrawn by hand if necessary independently of the mechanism which feeds it, this being accomplished by disconnecting the clutch teeth 49 and 50 and rotating the sleeve 46 and cam 47 by a hand wheel 48' keyed to the sleeve 46, together with the train of devices about to be described. Cooperating with the cam 47 is a cam roller 52 (see Figs. 1, 11 and 16) on the free end of a rocker arm 53. This rocker arm is connected with one end of a transverse shaft 54 (see also Figs. 12 and 16) located in suitable bearings in the frame, and connected to the other end of the shaft is an internal gear 55. Meshing with this gear is a pinion 56 connected with one end of a short shaft 57 rotatably mounted in a rocker arm 58 mounted loosely upon the shaft 54. The other end of this shaft 57 has connected therewith a pinion 59 meshing with a gear 60 which is loosely mounted upon the shaft 54. Meshing with this gear 60 is a pinion 61 loosely mounted upon brackets 62 depending from the frame member and this pinion 61 meshes with a rack 63 which is fast to the under side of a sleeve 64 carried by the drill spindle assembly. As shown best in Fig. 2 this sleeve 64 has the drill spindle assembly mounted therein through the instrumentality of ball bearings 65 which are retained by the ring 66 and nut 67. This sleeve 64 is slidably mounted in a block 68 depending from the frame as shown best in Fig. 12. In the arrangement just described a slow feeding movement is imparted to the spindle assembly to feed the drill into the work.

Drill arresting and withdrawing devices

Referring particularly to Figs. 9, 10, 11 and 16, there is secured to the cam sleeve 46 a disk 69 carrying dogs 70 which may be placed in any one of a series of openings 71 so as to position the dogs at various predetermined points with relation to the cam 47. Each of these dogs has an inclined face 72 adapted to make contact with a pivoted spring-pressed pawl 73 carried on the free end of an arm 74 connected with a rock shaft 75. This rock shaft has an arm 76 which when the shaft is rocked makes contact with the rod 77 which extends through the shaft 32 previously described, as shown in Figs. 6, 7 and 8. This rod has a pair of pins 78 which project through slotted openings 79 in the shaft and into slotted openings 80 in the clutch members 35 and 36 as a result of which when the rod is shifted by one of the dogs engaging the pawl arm the teeth of the clutch 36 are disengaged from the clutch teeth 40 and the teeth of the clutch 35 engaged with the teeth 81 of a cam 82 loosely mounted upon the shaft 32.

The gear 60 previously described has integrally formed therewith an eccentric disk

83 (Figs. 12-15 for detail). Attached to this eccentric disk is a chain 84 which extends rearwardly and is connected with a block 85 (Figs. 1 and 6) which is slidably mounted on a rod 86 about which is coiled a long spring 87 which has been placed under tension by the operation of feeding the drill so that when the clutches 36 and 40 are disengaged this spring acts to rotate the gear 60, which through the medium of the pinion 61 and rack 63 withdraws the drill assembly. This withdrawing movement however is controlled by the cam 82, which has two similar inclined faces leading to the high point of the cam. Co-operating with the cam is a cam roller 88 (Figs. 1 and 16) mounted between a pair of arms 89 which are pivoted at 90 to a suitable point on the frame. The lower ends of the arms have connected therewith a forwardly extending link 91 which is pivotally connected with an extension 58' of the arm 58. As the gear 60 rotates under the influence of the spring it of course rotates the pinions 56 and 59, but, as the large internal gear 55 has ceased to rotate due to the disengagement of the clutches 32 and 40, the pinion 56 rides around the gear 55, at a speed controlled by the movement of the cam 82, thus controlling the speed of withdrawal of the tool assembly. The initial engagement of the cam roll 88 is with the high part of the cam and the withdrawal movement of the tool takes place during one-half of the revolution of the cam. At the end of that movement, the cam roller 88 begins to ride up the opposite side of the cam with the result that the arms 58 and 58' are rocked in the opposite direction, thereby causing reverse rotation of the pinions 56 and 59, gear 60 and pinion 61, restoring the tool to drilling position.

At this point the clutches 35 and 81 are disengaged and the clutches 36 and 40 engaged by reason of a projection 92 (Figs. 7 and 16) on the cam 82 striking a beveled nose 93 on a lever 94 pivoted at 95 to a suitable point and having a yoke 96 straddling a pin 97 connected with the pivoted lever 98 which has two pins 99 extending in a grooved collar 100 on the end of the rod 77 which acts to move the rod axially and through the pins 78 shift the clutch members 35 and 36. A spring-pressed pawl 101 having a pair of beveled faces coacts with a pair of beveled faces on a part 102 secured to an offset portion of the lever 98 to yieldably lock the clutches in either of their shifted positions.

When the tool has completed its final drilling operation means are provided for disengaging the clutch 15, by operating the clutch shifter 23. Projecting from the arm 53 near its pivotal point is a nose 103 carrying a spring pressed pawl 104 (Fig. 13).

This pawl cooperates with inclined faces on

a dog 105 formed on a lever 106 pivoted at 107 to a suitable point on the frame. The lower end of this lever has a pin or pins 108 which project into a grooved collar 109 on the end of a rod 110 (see also Fig. 1). A spring 111 is coiled about the rod and is interposed between the frame and a collar 112 secured to the rod so as to normally project the rod rearwardly. The rear end of the rod has a collar 113 fixed thereto and in front of this collar there is a block 114 loosely threaded on the rod and having a pin 115 which projects loosely into the lower end of a rocker arm 116 pivoted at 117 to a suitable frame part. The upper end of the rocker arm 116 has a pin 119 which projects into a slot in the clutch shifter 23. The tendency of the spring 111 is to shift the rod 110 rearwardly so as to engage the clutch members, but when the pawl 104 rides upon the beveled nose 105' it shifts the rod forwardly to disengage the clutch members. A hand lever 118 connected with the rocker arm 116 provides a manual means for engaging the clutch members.

Means for varying the feed of the drill

It has been explained that the disk 69 has openings 71 in which dogs 70 may be secured. When it is desired to vary the feed of the tool into the work during the drilling operation, these dogs are positioned varying distances apart as shown in Fig. 10.

The inclined surface 47' of the feed cam 47 is such as to impart a uniform speed to the feeding mechanism. This inclined surface is of such length that at the end of the last drilling operation the cam roller 52 rides upon the inclined surface 47'' of the cam to thereby reverse the swinging movement of the arm 53 which allows the spring 86 to rotate the gear 60 in the opposite direction to withdraw the tool assembly. As soon as the roller 52 reaches an intermediate place between the low points of the surfaces 47' and 47'', the pawl 104 on the nose 103 acts to disengage the motor clutch in the manner before described.

General operation

In operation, the dogs 70 are positioned in the opening 71 of the disk 69 to give to each separate drilling operation the depth desired, it being the desirable practice to gradually decrease the depth of subsequent drilling operations. The machine may be started with the cam roll 52 at the zero point as shown in Fig. 8a, or by disengaging the clutch teeth 50 the cam may be rotated with the hand wheel 48' to bring the drill to working position, in which case the cam roll 52 will be initially located on an inclined portion of the cam 47. After these preliminary adjustments have been made the operator engages the motor clutch to start rotation of the

spindle and the feed cam, the clutches 36 and 40 being at this stage engaged and the cam roller 88 being positioned on the high part of the cam 82. The cam 47 rotates and feeds the spindle and its tool through the connections described until the first dog on the disk 69 rocks the arm 74, which through the means described disengages the clutch members 36 and 40 and engages the clutch members 35 and 81. This stops the rotation of the feeding cam and starts rotation of the cam 82 whereupon the direction of rotation of the loose gear 60 is reversed by the action of the spring 87 by reason of its connection through the chain 84 and eccentric 83 with this gear, thereby causing the drill spindle assembly to be withdrawn, this withdrawal being controlled by the action of the roller 88 upon the cam 82 and connection 91 with the arm which carries the pinion 57, as it will be understood that the gear 60 can only rotate as fast as permitted by the movement of the pinion 57 about the internal gear 55, which is now stationary. So soon as the cam roller 88 has reached the low point of the cam 82, the withdrawal movement of the spindle assembly has been completed and when the roller 88 starts up the opposite side of the cam 82, the direction of rotation of the loose gear 60 will be reversed because of the fact that the arm which carries the pinion 59 will be rocked in the opposite direction causing the pinion to rotate in the opposite direction and thereby rotate the gear 60 and pinion 61 to feed the drill assembly forwardly. As the cam surfaces of the cam 82 are alike the drill spindle will be returned a distance equal to that of its withdrawal. So soon as the cam roller 88 has reached the high point of the cam 82, the clutches are again shifted by contact of the projection 92 of the cam 82 with the beveled nose 93, whereupon rotation of the cam 82 ceases and rotation of the feed cam 47 starts to feed the drill into the work.

Having thus described the invention, it is claimed:

1. In a drill, a rotatable drill spindle, means for periodically projecting and withdrawing the spindle to and from working position including a clutch, means including a clutch and cam for feeding the spindle to perform the drilling operation after it has been projected into working position, said cam being of a length capable of imparting the maximum range of feeding movement to said spindle by a single rotation thereof, shifting devices for simultaneously shifting said clutches, and a plurality of adjustable devices movable with said cam to operate said clutch shifting devices at predetermined times in the rotation of said cam.

2. In a drill, a rotatable drill spindle, means for periodically projecting and withdrawing the spindle to and from working position including a clutch, means including a

clutch and cam for feeding the spindle to perform the drilling operation after it has been projected into working position, said cam being of a length capable of imparting the maximum range of feeding movement to said spindle by a single rotation thereof, shifting devices for simultaneously shifting said clutches, a disk movable with said cam, and a plurality of dogs, together with means for connecting the same at predetermined points on said disk, each of said dogs being adapted to operate said clutch shifting devices.

3. In a drill, a rotatable spindle, feeding devices for said spindle including an internal driving gear, a loose gear operatively connected with said spindle, a pair of connected pinions meshing respectively with said internal driving gear and said loose gear, a rocker arm upon which said pinions are carried, means for rotating said internal gear including a clutch, devices rotatable with said rotating means to disengage said clutch, a spring connected with said loose gear to reverse its rotation when said clutch is disengaged, and means connected with said rocker arm to control the action of said spring.

4. In a drill, a driving member, a tool spindle, feeding mechanism for said spindle including a drive gear, a loose gear operatively connected with said spindle, a driving connection between said gears, a rocker arm on which said driving connection is mounted; withdrawing and restoring devices for said spindle including a spring for rotating said loose gear in the reverse direction to withdraw said spindle, a double-face cam, a cam lever cooperating with said cam having a connection with said rocker arm to control the withdrawal of said spindle and to thereafter rock said arm to restore the spindle to working position; said feeding mechanism and withdrawing and restoring devices including clutch devices, and means movable with said feeding mechanism to operate said clutch devices to disconnect said drive gear from and connect said cam with said driving member, and means movable with the withdrawal and restoring devices to operate said clutch devices to disconnect the withdrawal and restoring devices from and connect the feeding mechanism with said driving member.

5. In a machine of the character described, a driving member, a drill assembly having a rotatable member connected with said driving member, a drive shaft arranged at right angles to said drill assembly, gears between said rotatable member and said drive shaft, a second shaft extending parallel with the rotatable member of said drill assembly, means for driving said second shaft from said drive shaft including a clutch, a third shaft arranged at right angles to said second shaft and geared thereto, means connecting said third shaft with said drill assembly to feed

the drill into the work, a plurality of dogs on
said third shaft rotating therewith, devices
for withdrawing said drill assembly and re-
storing the same to working position, means
5 for connecting said devices with said drive
shaft including a clutch, a clutch shifter com-
mon to said clutches, connections for operat-
ing said clutch shifter from said dogs, and
means for operating said clutch shifter from
10 said withdrawing and restoring devices.

In testimony whereof, I have hereunto set
my hand this 9th day of February, 1928.

CLARK SCHOLL.

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