

Feb. 18, 1941.

F. S. ABEL

2,231,864

ATTACHMENT FOR DRILLING MACHINES

Filed Aug. 23, 1938

2 Sheets-Sheet 1

Fig. 1.

Fig. 10.

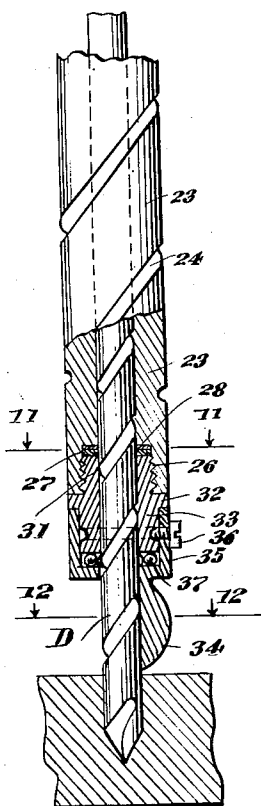


Fig. 11.

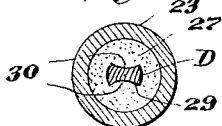


Fig. 12.

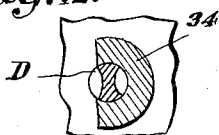


Fig. 9.

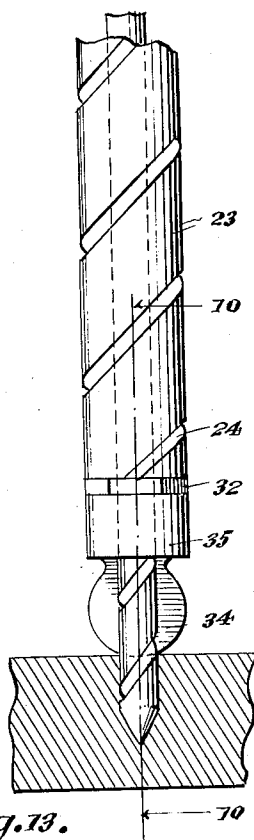
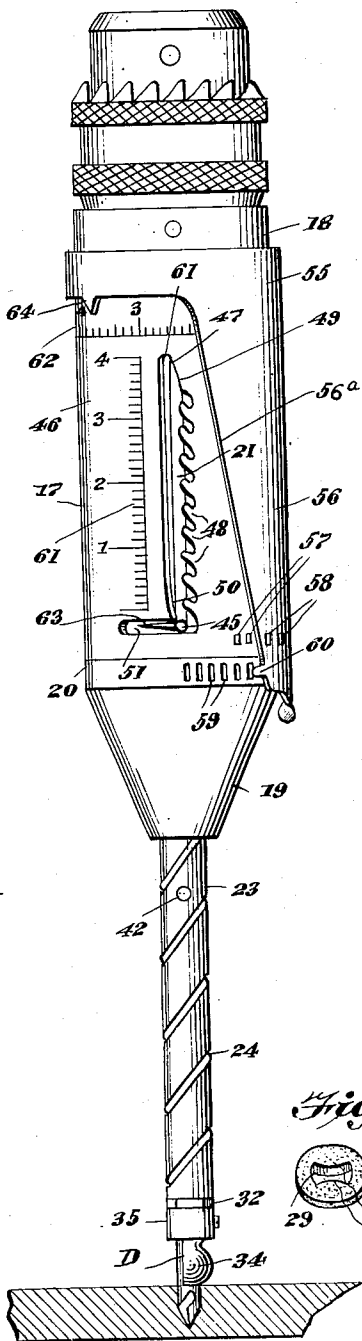
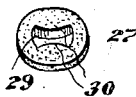


Fig. 13.



Inventor
FRANK S. ABEL

Irving R. M. Cathran
Attorney

Feb. 18, 1941.

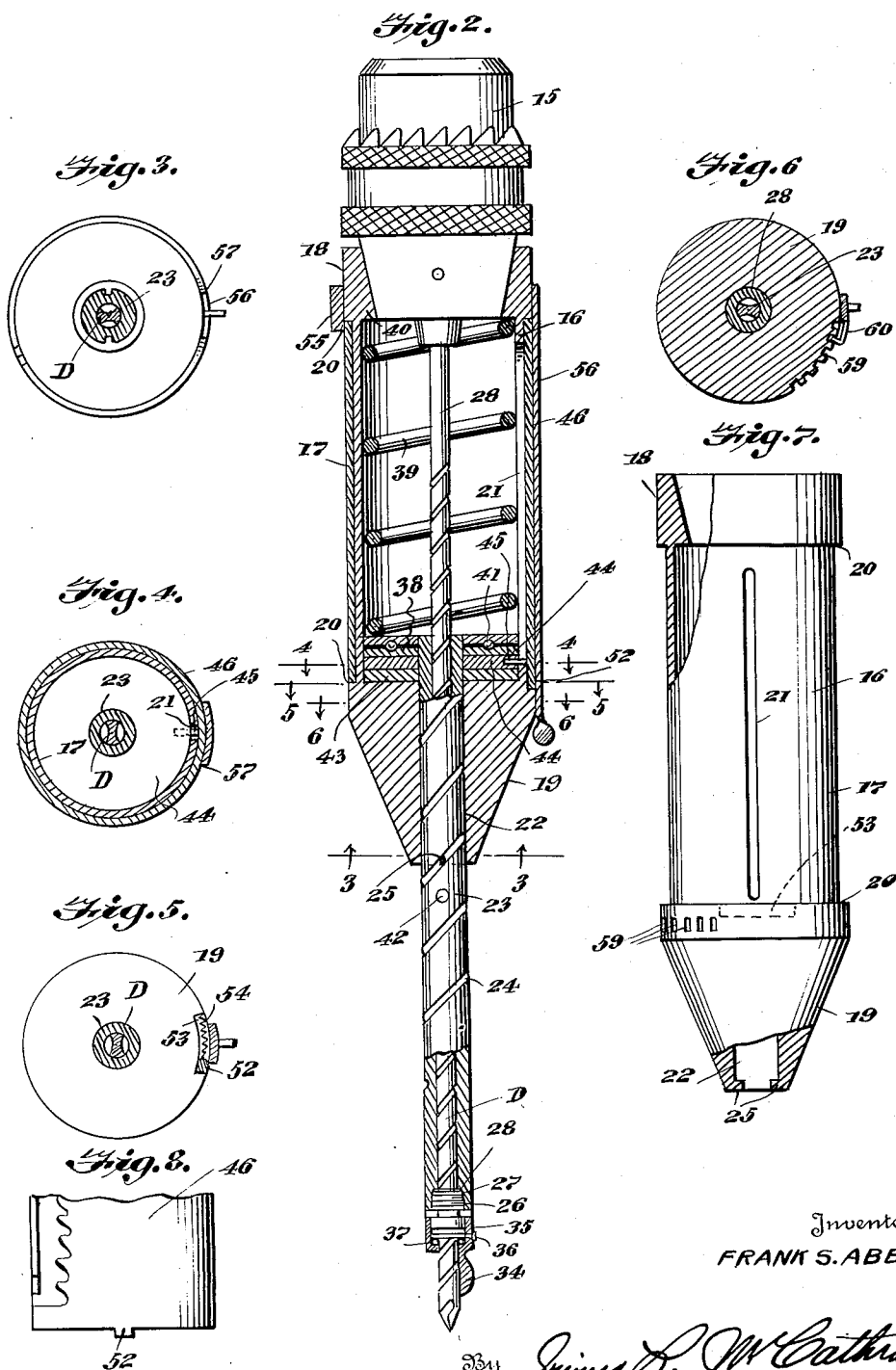
F. S. ABEL

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2 Sheets-Sheet 2



Inventor
FRANK S. ABEL

By *Irving R. McCutchan*
Attorney

UNITED STATES PATENT OFFICE

2,231,864

ATTACHMENT FOR DRILLING MACHINES

Frank S. Abel, La Grange, Ill., assignor of thirty-three and one-third per cent to Cora B. Korrer, Fond du Lac, Wis.

Application August 23, 1938, Serial No. 226,379

6 Claims. (Cl. 77—55)

The present invention relates to attachments for drilling machines, and especially to an attachment for preventing to a large extent the breaking of drills during the progress of the drilling operation.

There are two general causes of drill breakage during drilling. One of these is the application of excess pressure to the drill in a direction axial thereof. The other is the catching of the drill when it enters the work or when it cuts through the side opposite to the side that it enters. The first named cause is related to the resistance of the drill to longitudinal bending. Excess pressure will cause a drill, especially a long and relatively thin drill, to bend between the chuck and the work. This bending may cause the drill to work off from the line of intended drilling resulting in improper drilling, and the rotation of a drill in a hole that is not true almost invariably results in breaking the drill. The bending may also strain the drill beyond its elastic limit and the drill will be permanently bent and useless.

The second cause is related to the torsional strength of the drill. When the drill point first begins to cut into the work, or when it cuts through the work, it tends to stick and catch and the body of the drill is subjected to a twisting strain between the chuck and the point of catching. This strain, especially in long drills, is very apt to exceed the strength of the drill, and many drills are broken by the twisting strain that is imposed when the point sticks. In this connection it may be pointed out that a short body has much greater torsional strength than a longer body of the same diameter.

One object of the present invention is the provision of a novel attachment for drilling machines that will transmit both the thrust and the rotative force of the chuck to the drill at a point closely adjacent the surface of the work.

Another object is the provision of such an attachment that has novel means for supporting a drill against bending throughout a major portion of its length adjacent and above the point at which the drill enters the work.

Still another object is the provision of an auxiliary connection between a chuck and a drill mounted therein that will permit feed of the drill while the connection only rotates.

A further object is to provide in such an attachment a novel depth gauge that is operated by the movement of the parts incidental to the feed of the drill, and that will, when the required depth is reached, stop the feed of the drill.

A still further object is to provide a novel re-

turn mechanism that will, when the feed pressure of the machine is released, withdraw the drill from the work, and return the assembly to its starting position ready for the next operation.

In the accompanying drawings:

Figure 1 is an elevation of the attachment mounted on the chuck of a machine.

Figure 2 is a sectional elevation.

Figure 3 is a sectional view on line 3—3 of Figure 2.

Figure 4 is a sectional view on line 4—4 of Figure 2.

Figure 5 is a sectional view on line 5—5 of Figure 2.

Figure 6 is a sectional view on line 6—6 of Figure 2.

Figure 7 is a broken elevation of the cylindrical body member of the device.

Figure 8 is a fragmentary elevation of the member that controls the depth gauge.

Figure 9 is an enlarged fragmentary elevation of the hollow drill-supporting and driving shaft.

Figure 10 is a sectional view on line 10—10 of Figure 9.

Figure 11 is a sectional view on line 11—11 of Figure 9.

Figure 12 is a sectional view on line 12—12 of Figure 10.

Figure 13 is a perspective view of the member that is used to connect the drill to the hollow driving and supporting shaft.

Describing the drawings more particularly, in Figures 1 and 2 a machine chuck is illustrated at 15, such chuck being illustrated as a well known standard type, but which may be of any other construction. Suitably secured to the chuck 15 for rotation therewith is a cylindrical casing or body member 16 that comprises an annular side wall 17 that extends between a rim 18 engaged with the chuck and a head 19 that closes the outer or forward end of the casing. The rim 18 and the head 19 are slightly larger in diameter than the wall 17, and they form shoulders 20 at each end of the wall. Between the shoulders 20, the wall is provided with an axially extending slot 21.

The head 19 has a central bore 22 that is in line with the center of the chuck 15, for slidably receiving a hollow drill-supporting and driving shaft 23 that extends from a point within the casing 16, through the bore 22, and outward to a point beyond the end of the head 19. The outer surface of the shaft 23 is fluted, the flutes 24 corresponding in pitch to the flutes of the drills 55

used with the attachment, and the head 19 bears lugs 25 that extend into the bore 22 and engage in the flutes of the shaft 23.

At its outer end, the shaft 23 has a threaded counterbore 26 in which is mounted a disk-like member 27 that connects the shaft 23 with a drill D mounted in the chuck 15 and extending through the casing 16 and shaft 23. The member 27 is preferably made of a hard, fibrous material that will not damage a drill but that is sufficiently rigid to key together the shaft 23 and a drill extending through it. Rawhide is a material excellently suited for this purpose. A felt washer 28 is placed in the assembly with the member 27. The member 27 has a central opening 29, as has the washer 28, for the reception of the body of a drill, and tongues 30, that correspond in size and shape to the configuration of the drill flutes, extend into the opening for engagement in the flutes.

The connecting member 27 is rigidly secured with relation to the shaft 23 by a jam plug 31 that is threaded into the counterbore 26 and presses the member 27 and washer 28 tightly against the inner end of the bore. Advantageously, the plug has an angular flange 32 for engagement by a wrench, and the plug is provided with a stud 33 that extends beyond the end of the shaft 23 for supporting a thrust member. The plug member 31 is bored from end to end to provide passage for a drill extending from the end of the shaft 23.

The thrust member supported upon the stud 33 consists of a ball rest 34, bored to receive a drill, and faced off at one side to provide chip clearance. The ball rest is surmounted by a cup 35, the wall of which surrounds the stud 33 to which it is rotatably secured, as by the screw and channel connection 36. Ball bearings 37 may be inserted between the end of the stud 33 and the cup 35.

From the above, it will be seen that the shaft 23, by reason of the engagement of the lugs 25 in its flutes 24, will be rotated with the casing 16 and chuck 15, and that a drill D extending from the chuck through the assembly to the ball rest 34 will be locked for rotation with the shaft 23 by reason of the engagement of the tongues 30 of the member 27 and washer 28 in its flutes. Because the flutes 24 of the shaft 23 correspond in pitch to the flutes of the drill, the shaft 23 may move axially of the assembly by performing a spiral motion with relation to both the head 19 of the casing and the drill, and as the drilling progresses and the chuck, casing and drill advance, the shaft 23, being held against advance by the stationary ball rest 34 that rests upon the surface of the work, will be turned by the lug and flute connections, resulting in relative spiral motion between it and the other parts, and the shaft 23 will be progressively received into the casing 16.

The effect of this construction and arrangement is to rigidly key together the drill at the point where it enters the work, and the chuck, so that the drill is not driven only through its direct connection with it at a point remote from the work, but is also driven at a point close to the work through the casing 16, shaft 23 and member 27. This auxiliary drive relieves the body of the drill of the twisting strain throughout the greater portion of its length, and subjects only that portion of the drill that is between the member 27 and the point to such strain. As mentioned above, a short body is much more resistant to twisting strains than a long body, and

the auxiliary driving of the forward portion of the drill results in avoiding a great deal of breakage due to the sticking of the drill in the work.

The pressure exerted by the chuck along the axis of the drill is similarly transmitted from the chuck through the casing and shaft 23, and is delivered to the drill by the member 27, and therefore the drill is relieved of such pressure between the chuck and the member 27 between which it is rigidly held. Inasmuch as the drill is adequately supported below the member 27 by the ball rest 34 and the bore in the work, there is little danger of the drill being flexed even by a heavy pressure. In addition to bridging the thrust from the chuck to the drill at a point near the work, the drill is supported against bending through a great portion of its length by the shaft 23 and the ball rest 34.

To lubricate the cutting edges of the drill and the moving parts, an oil hole 42 leading into the interior of the shaft 23 is provided. Oil may be introduced through this hole into the flutes of the drill within the shaft 23, and as the drilling progresses the oil seeps past the member 27 and to the drill point, its passage being controlled by the felt washer 28 which is constructed to closely conform to the cross section of the drill to act as a wiper as the drill moves spirally through it. By this means, adequate lubrication is provided, not only for the cutting action of the drill, but also for the meeting surfaces of the drill and shaft 23 and ball rest 34 respectively.

The following mechanism provides an automatic and easily adjustable depth gauge, and also a means for automatically raising the drill out of the work when the feed pressure of the machine is released.

Adjacent its inner end, and within the cylindrical casing 16, the shaft 23 carries a collar 38 that rotates with the shaft, and a coil spring 39 is interposed between the collar 38 and an annular shoulder 40 formed by the inner periphery of the rim 18 at the upper end of the wall 17. The spring 39 is of sufficient strength to exert a force great enough to raise the drill, assembly, and chuck by thrusting against the rim 40 and collar 38, the thrust being exerted through the shaft 23 and ball rest 34 upon the surface of the work. An antifriction device such as the ball race 41 may be interposed between the collar 38 and the end of the spring 39.

Below the collar 38 and spaced therefrom is a collar 43 that is mounted upon and rotates with the shaft 23. A nonrotary collar 44 rests upon the collar 43 and carries a pin 45 that extends radially from the periphery of the collar through the slot 21 in the wall 17 of the cylindrical casing to a point beyond the outer surface of such wall.

An annular member 46 is rotatably mounted between the shoulders 20 of the casing 16 and surrounding the wall 17, and said annular member has an axially extending slot 47 that is somewhat wider than the slot 21 with which it is adapted to register. Rack teeth 48 are arranged along one side of the slot 47 for the pin 45 to engage, whereby the position of the shaft 23 with axial relation to the casing 16 may be fixed.

The edge of the slot 47, upon the same side as are the teeth 48, and adjacent its upper end is extended upwardly and at an angle across the slot to form an inclined cam surface 49. Adjacent the foot of the slot 47, the opposite edge is extended downwardly at an angle to form a second oppositely extending inclined cam surface 50. The upper cam surface 49 forms a means of trip-

ping the assembly at the limit of the travel of the shaft 23, and the lower cam surface sets the assembly in condition for a succeeding operation, all of which will be described in detail. At the

5 lower end of the slot 47, below the cam surface 50, the slot is extended laterally as at 51. To limit the rotation of the annular member 46 upon the wall 17, and to urge it toward the position in which the teeth 48 engage the pin, a tongue 52 depends from its lower edge and extends into a pocket 53 in the underlying upper surface of the head 19. A spring 54 within the pocket 53 bears upon the side of the tongue 52 to urge it toward the end of the pocket.

15 A stop sleeve 55 is rotatably mounted about the upper portion of the annular member 46 and this sleeve is provided with a depending arcuate fin 56 extending over and along the surface of the member 46 to a point overlying the surface of the head 19. The fin 56 has an edge 56a that is inclined to the axis of the assembly and to the slots 21 and 47 across which it is adapted to be moved as the sleeve 55 is turned, thereby providing an adjustable stop for limiting the travel of the pin 25 45 along the slots 21 and 47.

A series of holes 57 is provided in the surface of the annular member 46 to receive a locking stud 58 extending inwardly from the inner surface of the fin 56 to positively lock the fin in its adjusted position upon the member 46. The fin 30 56 is sufficiently resilient to permit it to be sprung outwardly to disengage the stud 58 from the respective holes 57, so that the fin may be adjusted.

35 A series of pockets 59 is provided in the outer surface of the head 19 in the path of spring lug 60 extending from the edge of the fin 56, so that the fin may be releasably and temporarily secured in adjusted position with relation to the head 19. The pockets 59 and the lug 60 are so formed that the lug, when engaged in a pocket, will ride out of it quite easily when a turning force is applied between the head and the fin.

To adjust the device, the fin 56 is turned upon the member 46 until its edge 56a crosses the slot 47 at the proper point to stop travel of the pin 45 when the desired depth of drilling has been reached. The fin is rigidly secured to the annular member 46, in this adjusted position, by the stud 50 57 and hole adjustment 51, 58, and the fin is releasably secured to the head 19 by the lug and socket engagement 59, 60. To assist in bringing the parts to proper adjustment, scales at 61 and 62 respectively may be marked upon the surface of the annular member 46 for cooperation with pointers 63 and 64 mounted respectively upon the pin 45 and the sleeve 55.

The operation of the depth gauge and automatic return will now be described. When the 60 automatic return is to be used, without gauging the depth for less than the full travel of the drill that the assembly permits, the collar 55 is turned so that the edge 56a of the fin 56 is clear of the slot 47, this adjustment of parts being shown in 65 Figure 1. At the start of the drilling, the shaft 23 will be in its most extended position and the collars 41, 42, 43 within the casing will be at their outer limits of travel, the pin 45 also being at its outermost position. As the drilling progresses, the chuck and the casing assembly will approach the work as the drill advances, and the shaft 23 will be progressively received into the casing 16. This movement results in the relative upward travel of the pin 45 along the slots 21 and 70 47. When the pin 45 reaches the upper cam sur-

face 49, its further travel moves the member 46 (to the right as seen in Figure 1). This turning of the member 46 places the lower oppositely inclined cam surface 50 across the slot 21. The upward motion of the pin 45 continues until it 5 comes into contact with the end of the slot 47 at 61, when further relative motion between the pin 45 and member 46 is prevented, this stopping the feed of the drill into the work since the thrust of the chuck is then transmitted through the member 46, pin 45, and shaft 23 to the ball rest 34 that rests upon the surface of the work. When the feed pressure of the machine is released, the thrust of the spring 39, exerted between the shaft 23 and the upper end of the casing 16, will raise 15 the casing 16, withdrawing the drill from the work. As the casing is moved upwardly, there will be relative downward motion by the pin 45 since it is supported upon the shaft 23 which is being thrust out of the casing. When the pin 20 comes into contact with the lower cam surface 50, the member 46 is turned back to the position it occupied at the start of the operation, and the assembly is then in condition for another drilling operation.

When the depth of the drilling is to be limited to a distance less than the full travel that the assembly will permit, the collar 55 is rotated upon the member 46 until the pointer 64 indicates the required depth upon the scale 62. This adjust- 30 ment will place the inclined edge 56a of the fin 56 across the slots 47 and 21 at the point that is proper to stop the relative movement of the pin 45 in the slots when the drill has been projected the required distance. The fin being securely 35 locked in adjusted position with relation to the member 46 by the engagement of the stud 58 in a hole 57, and releasably held with relation to the head 19 by the spring lug 60 engaging in a pocket 59, and the edge 57 being inclined in the manner 40 of the upper cam surface 49, when the pin 45 strikes the edge 56a, the fin 56, and with it the member 46, will be turned in exactly the same manner as above described in full length drilling by the cam surface 49. This turning places the 45 lower cam surface 50 across the slots, as in full length drilling, so that upon return of the pin, the assembly will be placed in starting position. After the pin has turned the member 46, its travel 50 is stopped by the edge 56a, and thereafter the release of the feed pressure of the machine will enable the spring 39 to operate to withdraw the drill from the work, the withdrawal also operating to return the pin to the lower end of the 55 slot where it will engage cam surface 50 and turn the assembly back to starting position.

In either full length or gauged depth drilling, if a drill too short to extend beyond the ball rest 34 is used, or if it is desirable for any reason to 60 extend the drill beyond the ball rest before drilling is begun, the pin 45 is seated upon one of the teeth 48, the tooth being selected to adjust the extension of the shaft 23 from the casing to the required relation to the length of the drill. Upon 65 starting the drill, the pin, during its relative upward motion, will engage the bottom of the next higher tooth which it will move aside, and the member 46 and fin 56 will be thereby turned, placing the upper cam surface 59 across the slot 70 21. The upward relative motion of the pin 45 in the slots 21 and 47 will then continue until the pin strikes the cam surface (in full length drilling) or the edge 56a of the fin (in gauged depth drilling), which will turn the fin and annular 75

member and then stop further progress of the drill as above described. Upon release of the feed pressure, the drill will be raised, the pin moving downward with relation to the member 46 until it reaches the bottom of the slots, when the raising of the drill will be stopped, and from where the pin may be raised to again be seated upon the proper tooth 48 for another operation.

In each of these operations, the turning motion of the fin upon the head 19 is permitted by the spring lug 60 snapping into and out of the pockets 59 as it moves over the surface of the head. The member 46 and the fin 56, however, are securely held together by the stud 58 and holes 57 until the adjustment is manually changed.

It will be understood that although the attachment is illustrated and described as being mounted upon a geared chuck, it may be used with any other type of chuck, for example, the Morse taper chuck, or any other sort of rotary power head that is suitable for drilling, by providing it with a suitable means for engaging the chuck or head.

The attachment that has been described will effectively protect drills from breakage due either to excess feed pressure or to twisting strains that are developed when the drill catches in the work. It is especially useful with the modern high speed drills that are extremely hard and heat resistant, but which are relatively brittle. The use of such drills is of great advantage, since they are capable of being driven at high speeds and rapid cutting, resulting in great savings of time, but such drills are expensive, and unless they are protected against strains developed in drilling, they are subject to a high breakage rate, which, when combined with their cost, detracts from their desirability. The use of this attachment reduces the breakage rate materially and therefore cuts down the expense of high speed drilling to a great extent.

The automatic character of the attachment in respect to the depth gauging of the drilling, and the return of the drill out of the work, accompanied by the resetting of the assembly for the next operation provides for uniformity of work without a high degree of skill on the part of the operator, and this result is contributed to by the ease and accuracy with which the device may be set for any particular depth of drilling.

From the foregoing it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description, and it will be understood that changes in the size, shape, proportions and minor details may be resorted to without sacrificing any of the advantages and without departing from the spirit of the invention as set forth in the accompanying claims.

What I claim is:

1. A safety attachment for drills comprising a casing for mounting on the chuck of a machine for rotation therewith, a hollow shaft slidably mounted in the casing and adapted to surround a drill mounted in a chuck upon which the casing is mounted, a key device carried by the casing and engaging the hollow shaft for driving said shaft with the casing, and means mounted adjacent the end of the hollow shaft for engaging a drill extending through the shaft and driving it with the shaft, said means permitting axial

motion between the shaft and a drill so engaged and driven by it.

2. A safety attachment for drills according to claim 1 wherein the casing has a forward head provided with a bore through which the hollow shaft extends, the outer surface of the shaft is provided with flutes corresponding in pitch to the flutes of drills to be used with the attachment, and the head of the casing is provided with lugs that engage in the flutes of the shaft, and the means mounted adjacent the end of the shaft for engaging the drill comprise tongues that engage in the flutes of such drill.

3. A safety attachment for drills according to claim 1 wherein the wall of the casing has an axially arranged slot, a pin is mounted upon the shaft within the casing and extends outward through the slot, and a movable stop is mounted upon the casing for adjustably limiting the movement of the pin along the slot and thereby limiting relative movement between the shaft and the casing.

4. A safety device for drills comprising a hollow cylindrical casing for mounting on the chuck of a machine, said casing having a side wall provided with an axially arranged slot and a forward head having a central bore, a fluted hollow shaft extending from a point beyond the head of the casing through the bore and into the interior of the casing, lugs carried by the head within the bore and engaged in the flutes of the hollow shaft, a spring mounted within the casing and engaged with the casing and the shaft for urging the latter outwardly, means rigidly carried by the shaft adjacent its outer end for engaging the flutes of a drill extending through the shaft, a bearing member rotatably mounted on the end of the shaft for engaging the work, a radially disposed pin rotatably mounted on the shaft within the casing and extending through the slot in the wall thereof to a point beyond the outer surface of the wall, an annular member surrounding the cylindrical casing and rotatable thereon, said wall having a slot for registration with the slot in the wall of the casing and one side of the slot being provided with a plurality of teeth for engaging the pin mounted on the shaft, a stop sleeve mounted about the surface of the annular member and having an inclined surface movable across the slots as the sleeve is rotated for limiting the movement of the pin along the slots, and means for securing the sleeve in adjusted position.

5. A safety attachment for drills according to claim 1 wherein the wall of the casing has an axially arranged slot, a pin is mounted upon the shaft within the casing and extends outwardly through the slot, an annular member is rotatably mounted about the casing and is provided with a slot for registering with the slot in the casing, and the ends of the slot are provided with oppositely inclined cam surfaces for engagement by the pin to turn the member as the pin approaches the respective ends of the slot.

6. A safety attachment for drills according to claim 4 wherein the annular member, at the respective ends of the slot is provided with oppositely inclined cam surfaces extending across the slot for engagement by the pin as it approaches the respective ends of the slot, and the annular member is adjustably keyed to the adjustable stop sleeve.

FRANK S. ABEL.