Nov. 1, 1927.

1,647,670

G. B. SIPE

COMBINED DRILL AND UNDERREAMER

Filed April 15, 1925

3 Sheets-Sheet 1

Fig. 1.

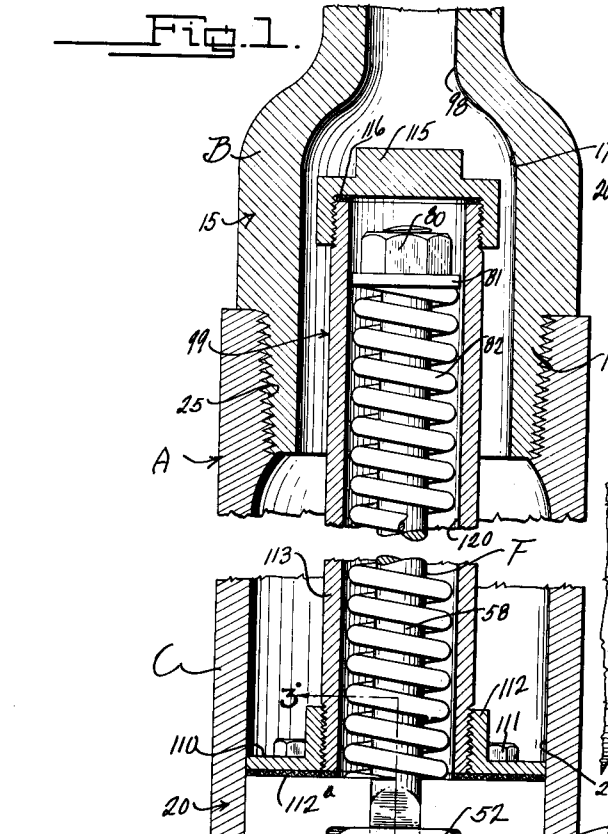



Fig. 5.

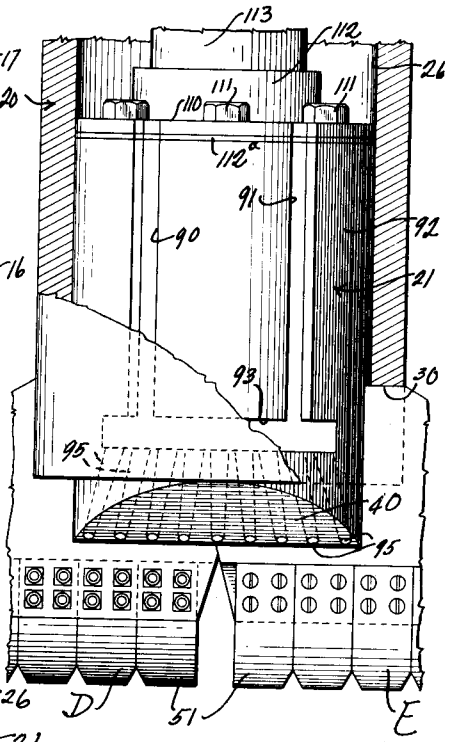
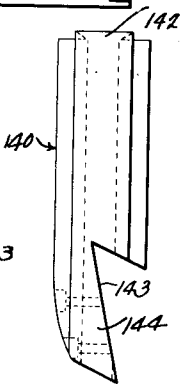



Fig. 6.




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Fig. 2.

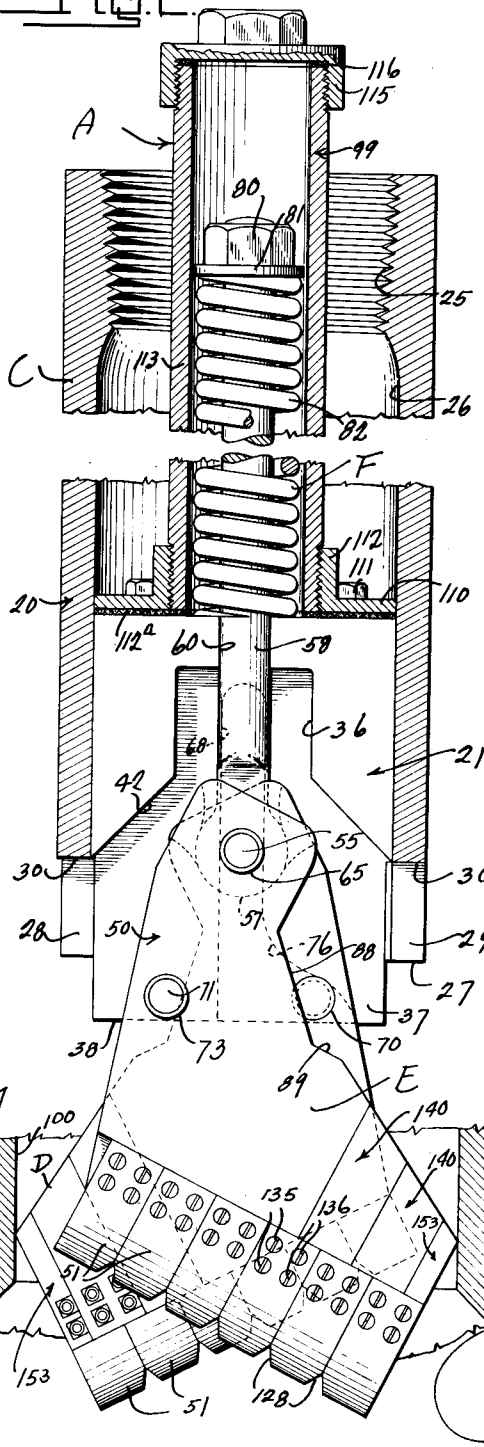



Fig. 3.

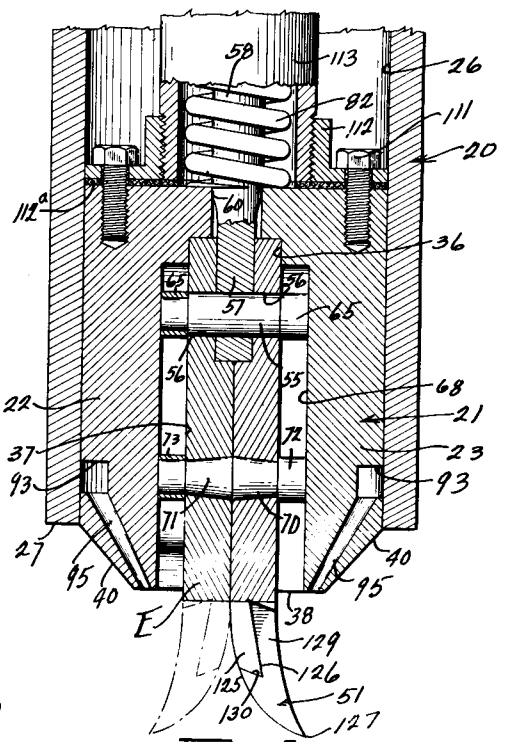
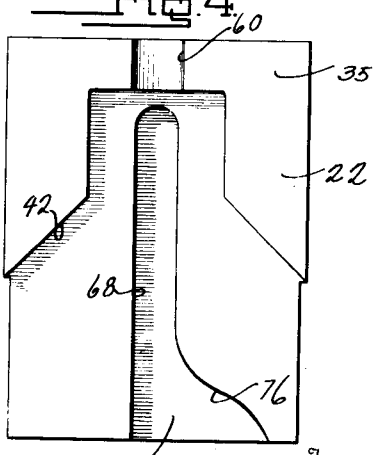



Fig. 4.




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Fig. 7.

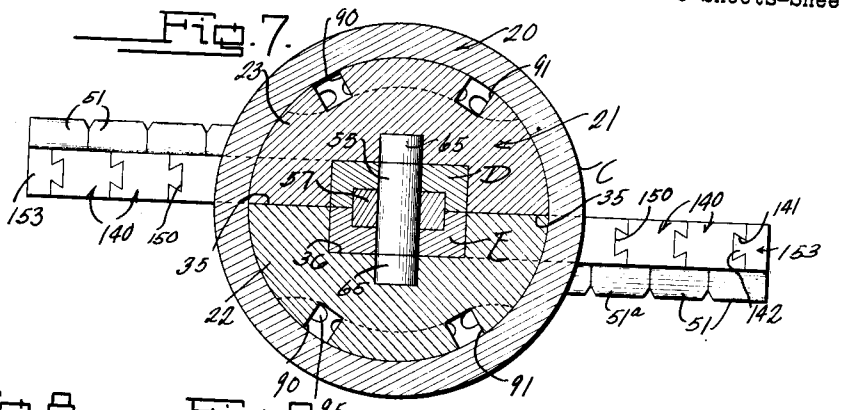



Fig. 8.

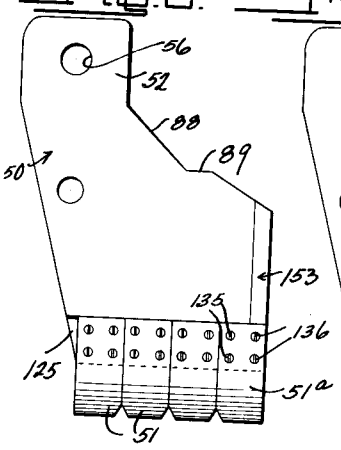



Fig. 9.

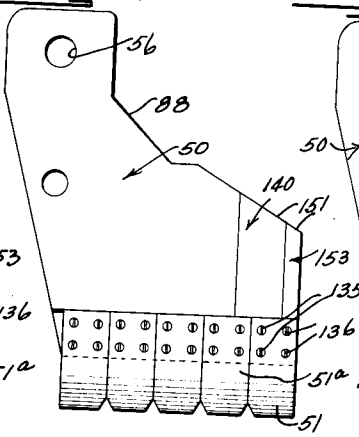



Fig. 10.

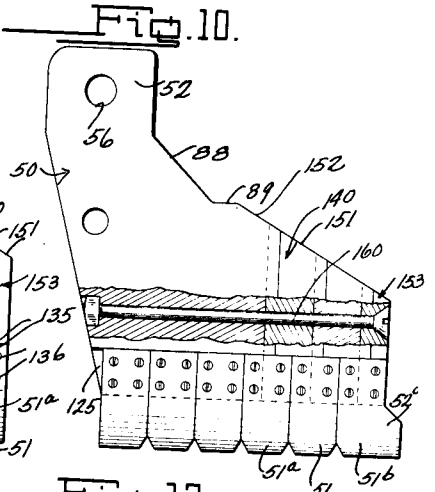



Fig. 11.

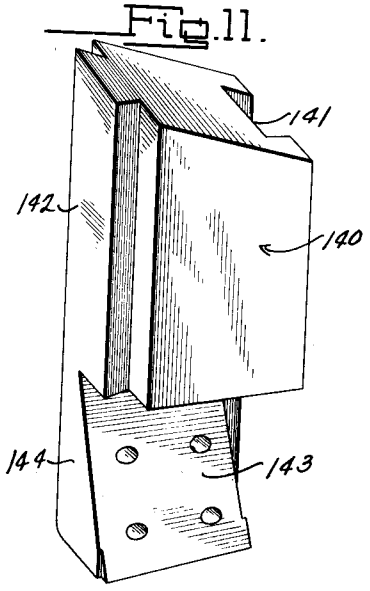
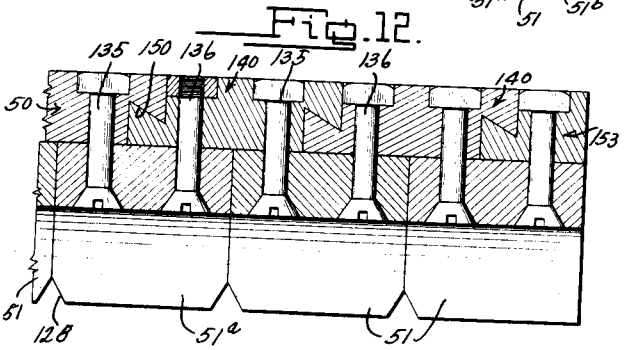



Fig. 12.




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Patented Nov. 1, 1927. 1,647,670

# UNITED STATES PATENT OFFICE.

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## COMBINED DRILL AND UNDERREAMER.

Application filed April 15, 1925. Serial No. 23,350.

This invention relates to improvements in drill bit constructions.

The primary object of this invention is the provision of an improved type of collapsible drill bit and underreamer which may be used in the sinking of shafts or drilling of holes of exceptionally large diameter.

A further object of this invention is the provision of an improved type of rotary drill bit and underreamer, which is very durably constructed, and compactly arranged of a plurality of parts which renders the drill bit particularly well adapted for the drilling and boring of holes of exceptionally large diameter, in connection with a method of producing and placing shafts, piles, and the like, such as has been set forth in my co-pending application, Serial No. 23,349 filed April 15, 1925.

A further object of this invention is the provision of a drill bit construction which is particularly well adapted for the drilling of holes of large diameter, and which includes a novel extensible blade construction by means of which the diameter of the hole being drilled may be increased or reduced, without other modification of the drill or drilling equipment.

A further object of this invention is the provision of an improved drill bit construction embodying a novel sectional blade construction which will enable the diameter of a hole or shaft being drilled to be varied, with ease.

A further object of this invention is the provision of an improved drill bit and underreamer, embodying a novel collapsible blade construction.

A further object of this invention is the provision of an improved drill and underreamer which embodies details which renders the same practical in construction, and embodying a novel assemblage of parts, with improved water feeding means.

A further object of this invention is the provision of an improved drill bit construction embodying novel improvements over the drill bit construction shown in my co-pending application, Serial No. 673,584, filed November 8, 1923.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a longitudinal sectional view taken through the improved drill bit and underreamer, showing the novel blade construction thereof extended and in position for drilling a hole or sinking a shaft of relatively great diameter.

Figure 2 is a sectional view of the details illustrated in Figure 1, showing the drill blades in collapsed condition within a casing.

Figure 3 is a cross sectional view taken through the improved drill bit construction, at its lower end, substantially on the line 3—3 of Figure 1.

Figure 4 is an elevation of the inside face of one of the sections of a pair of complementary body parts, showing the grooved and recessed construction of the same for receiving details of the bit blades and carriers.

Figure 5 is a fragmenatry sectional view taken through details of the bit, with the blades extended, showing more particularly the water course and the means for providing the same in the body of the drill bit.

Figure 6 is an edge elevation of a novel type of extension member adapted to be used as a part of the bit blade construction.

Figure 7 is a transverse sectional view taken through the bit and under-reamer, substantially on the line 7—7 of Figure 1.

Figures 8, 9 and 10 are side elevations showing the blade construction, and the means for varying the width thereof.

Figure 11 is a perspective view of a novel type of extension member adapted to be attached to the blade carrier to serve as a support for the blade sections.

Figure 12 is an enlarged fragmentary sectional view taken through the blade construction substantially on the line 12—12 of Figure 1.

In the drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the invention, the letter A may generally designate the improved drill bit or under-reamer, which may include a drill stem B to which the holder C is attached at its lower end for collapsibly supporting blades D and E as by means F.

The drill stem B may, of course, be of any approved construction, including the en-

larged lower end portion 15, providing the reduced screw threaded depending shank 16, and having the enlarged compartment 17 extending upwardly from the lower edge thereof.

The holder C preferably comprises a hollow cylindrical shaped barrel portion 20, and the body plug 21 in the lower end thereof which comprises the complementary semi-cylindrical shaped sections 22 and 23, of a novel construction to be subsequently described.

The barrel portion 20 of the holder C is internally screw threaded at its upper end, at 25 for detachably receiving the reduced screw threaded shank 16 of the drill stem B, by means of which to axially connect the barrel 20 to the drill stem. The barrel 20 is provided with a compartment 26 therein in the lower end of which the body plug 21 is positioned. Upwardly of the lower marginal edge 27, the barrel 20 is slotted, at opposed points, at 28 and 29, providing shoulders 30 at the inner ends of said slots, at right angles to the axis of the drill stem and barrel, against which certain shoulders of the collapsible blades abut, as will be subsequently described. It is of course understood that the slots 28 and 29 are not exactly diametrically opposed to each other, since the blades D and E overlap. Portions of these blades respectively extend through the slots 28 and 29, as is illustrated in Figure 1 of the drawings.

The main body or plug 21 at the lower end of the barrel 20 is fixedly secured in position against liability of detachment, within the barrel 20, by shrinking the latter thereon. The complementary sections 22 and 23 when held together form a cylinder. These sections are in abutment on a diametrically disposed plane, at the facing surfaces 35 thereof. Inwardly of the surfaces 35 the said sections 22 and 23 are grooved and recessed to provide a socket 36 of polygonal formation, which faces downwardly into the transverse way 37, within which the blade sections D and E may slide and oscillate. The pocket which is formed by the transverse way 37 opens at the lower end surface 38 of the body 21, and the lower ends of the sections 22 and 23 extend below the lower edge 27 of the barrel 20, and are there beveled in sloping relation towards the axis of the drill, as at 40, illustrated in Figures 3 and 5 of the drawings. The sections 22 and 23 are each provided with beveled shoulders 42, sloping upwardly from the barrel shoulders 30 of the slots 28 and 29, towards the socket 36 provided by the body 21, and against which beveled shoulders 42 the blades cooperate, as is illustrated in Figure 1 of the drawings, to stabilize said blade constructions.

Referring at this time to certain details of the blades D and E, each comprise a carrier or body portion 50, having a plurality of detachable blade sections 51 connected therewith in a manner to be subsequently described. Each of the blade constructions D and E includes the upper substantially polygonal shaped head portion 52, which are adapted to fit into the socket 36 when the blades are extended, and which are adapted to slide from the socket when the blades are collapsed, and which positions are illustrated in Figures 1 and 2 of the drawings. The carrier portions 50 of the blades D and E are pivotally connected by means of a pin 55, transversely bearing through openings provided in the head portions 52 of the blade carriers 50. The blade carriers 50 are in sliding abutment at their facing side surfaces, and the head portions on the facing surfaces are countersunk to accommodate the substantially ring-shaped attaching end 57 of a supporting rod 58; the ring-shaped end 57 being apertured for bearing in the pin 55 between its ends, as is illustrated in Figure 3 of the drawings. The blade constructions D and E when in position in the way or pocket 37 of the body 21, are of just sufficient width to permit their sliding therein, and to oscillate or pivot on the pin 55, but prevented from movement axially of the pin 55. The supporting rod 58 extends upwardly through a passageway 60 provided in the top of the body 21, above the socket 36, and the upper end of this rod is supported in a manner to be subsequently described.

The outer ends of the pin 55, at opposite sides of the blade constructions D and E project beyond the outer surfaces of the carrier portions 50 thereof, and rotatably receive rollers 65, which extend into longitudinal guide grooves 68 formed inwardly of the facing surfaces of the body sections 22 and 23.

The carrier portions 50 of each of the blade constructions D and E furthermore respectively support pins 70 and 71, which project beyond the outer sides of said blade carriers, and support rollers 72 and 73 respectively, which are likewise adapted to seat in the grooves 68. These rollers 72 and 73 are formed in a definite spaced relation to the common pivot pin 55, and when the blades D and E are extended for drilling, the pins 70 and 71 are in axial alignment with each other, and in alignment with the pivot pin 55 axially of the drill stem. However, when the blades D and E are collapsed, the lowermost guide pins are out of axial alignment, and to this end the lower portions of the grooves 68, are enlarged at 75, and provide a cam edge 76 against which the respective rollers 72 or 73 ride, to permit the collapsing of the blade constructions, and when the blades are drawn upwardly into the holder C, responsive to the force to

be subsequently described, the rollers 72 and 73 thereof will pass along the cam edges 76, and be guided into the straight portions of the grooves 68, for bringing the said blade structures D and E into the extended relation illustrated in Figure 1.

Referring to the means F, the same includes the supporting and connecting rod 58, which is reciprocally mounted in the passageway 60 above mentioned, and extends upwardly axially through the holder barrel 20, and at its upper end is preferably provided with a detachable nut 80. Below this nut, and about the rod 58 is a washer 81, against which the upper end of a spiral compression spring 82 abuts; the lower end of the spring 82 preferably engaging the upper surface of the body 21. The spring 82 is under compression to normally draw the blade constructions D and E upwardly into the holder C, in the relation illustrated in Figure 1, to position the head portions 52 snugly in the socket 36, and to engage the beveled shoulders 88 of the blade carrier portions 50 against the beveled shoulders 42 of the respective sections of the body or plug 21. Each of the carrier portions 50 is furthermore provided with an edge 89, oblique to the beveled edge 88, which is horizontally positioned in abutment with a shoulder 30 of a slot 28 or 29, when the blade structures are extended, as is illustrated in Figure 1. The abutment of these edges 88 and 89 with the beveled edges and shoulders 42 and 30, as well as the snug positioning of the head portions 52 in the socket 36, provides a very stable bracing for the carrier portions 50 of the blade structures D and E, as can readily be understood.

Referring again to the sections 22 and 23 of the body or plug 21, each of said sections is preferably provided with a pair of parallel grooves 90 and 91 extending inwardly of the outer arcuate surface 92 thereof, grooved to the extreme upper surface of the body 21, and at their lower ends terminating short of the lower ends of the body sections 22 and 23, in a segmental groove 93. Each of the sections 22 and 23, from the segmental groove 93, is provided with a plurality of tapered ducts 95, disposed at an inclined relation towards the axis of the drill bit, and outleting at the lower edge of the sections in sloping relation towards the blade sections 51 of the blade constructions D and E. The object of providing these passageways and ducts will be apparent to anyone skilled in the art. The water passage downwardly thru the passageway 98 of the drill stem 15, and into the compartment 17, and about the housing 99 for the spring 82, and passes into the compartment 26 above the body 21. As the ways 90 and 91 communicate with this compartment 26, the water passes downwardly through the ways 90 and 91 into the transverse grooves 93, and from thence the water passes thru the ducts 95 and outlets directly on the blade sections 51, cleansing the same. The water, mud, and other foreign materials drilled from the hole or shaft which is being sunk then passes upwardly through the annular space 100 between the casing and the drill stem.

In order to permit efficient operation of the spring 82, it is desirable to seal the same from water contact. This is accomplished by enclosing it in a housing 99. A base collar 110 is bolted upon the top surface of the body sections 22 and 23, as by bolts 111, with a gasket $112^a$ between the same and the body 21. The base collar 110 includes the internally screw threaded collar 112 within which the lower screw threaded end of the body 113 of the housing 99 extends, with its lower end in abutment with the gasket $112^a$, to provide a leak-proof connection. The upper end of the body 113 is externally screw threaded and detachably receives a nut cap 115; a gasket 116 being provided to seal the connection of this cap with the body 113. Thus, the spring 82 and the rod which extends therethrough is sealed in the compartment 120 of the housing 99, from the water which passes downwardly through the drill stem. It is of course understood that the base 110 and the gasket 112 do not interfere with the entrance of the water into the upper ends of the grooves 90 and 91, since they are slotted, as is illustrated in Figure 5 of the drawings.

Referring to novel features of the blade constructions D and E, each of said constructions are identical, and the following description applies to each of the same. The carrier 50 at its lower portion has a reduced attaching tongue 125, set inwardly from the outer face of the carrier portion 50, to provide the pocket or recess 126 disposed at an acute angle with respect to the plane of the carrier portion 50.

The blade sections 51 are of approximately the same width, and are preferably cambered, and at their lower ends provide a sharpened edge 127. At the corners of this edge the blade 51 is cut away at 128, to provide V-shaped recesses when the blade sections are assembled in alignment to provide the cutter for the blade construction D or E. Each of the blade sections 51 includes an attaching portion 129 adapted to fit into the recess 126, and at the juncture of this attaching portion 129 the said blade section provides a beveled shoulder 130 for abutment against the lower edge of the tongue 125, to stabilize the positioning of the same. Each blade section has its attaching portion 129 provided with a plurality of recesses for receiving a pair of bolts 135 adjacent one side edge thereof, and another pair of bolts 136 adjacent the opposite side

edge thereof, and this arrangement is important, as will be subsequently shown in connection with the attachment of the blade sections and extensions of the carrier 50.

In certain instances it is desirable to enlarge the base of a shaft or hole which has been sunk, in connection with the placing of piles, piers and the like, and to underream, as has been set forth in my co-pending application first above referred to. It is thus desirable to vary the width of the drill, and this may be readily accomplished by adding blade sections to the carrier bodies of the blade constructions D and E. As it is an object of this invention to provide a drill bit which can drill a hole of a diameter several times greater than the diameter of the casing in which the drill bit is received, and to provide a blade construction of a maximum width, I have provided extensions 140 for dove-tailed connection at the outer sides of the blade carriers 50, which are thus connected as a part of the carrier, and provide means for the attachment of additional blade sections. These extensions 140 each includes a body portion, provided with a dove-tailed groove 141 along one side edge thereof and a dove-tail extension 142 at the opposite side edge thereof. At the lower portion the same is recessed, at 143 inwardly from the front face thereof, and extending to the bottom edge thereof, providing the attaching tongues 144 similar to the attaching tongues 125 above described, for receiving the upper reduced attaching shanks or ends 129 of the blade sections 51, by means of a series of bolts 135 and 136, as shown. It is of course understood that the carrier portions 50 of the blades D and E at the outside edges thereof are each provided with the dove-tail slots 150 for the reception of the dove-tail extensions 142 of the next adjacent extension 140. The extensions 140 at their upper edges 151 are beveled, in flush relation with the adjacent beveled edge 152 of the carrier 50. A special extension 153 is provided at the extreme outside, for the last blade section. This extension 153 is of necessity narrower than the others, since the blade sections 51 are each in overlapped relation at their attaching portions 129 with a pair of depending shanks 144 of adjacent extension units 140. This is obvious, since thereby the extensions 140 are tied together and the blade section $51^a$, which is illustrated in the drawings, is connected by means of its bolt 135 to the carrier 50, and by means of its other bolt 136 to the extension unit 140 immediately adjacent the carrier 50. In this manner the carrier and extensions 140 and 153 and blade sections 51 and $51^a$ are connected together, so that the blade sections are in transverse alignment. If desired, a special blade $51^b$ may be provided at the outer end of the cutter, wider than the other blade sections, providing the blade extension $52^a$, at the outer edge of the narrow extension 153, and as is illustrated in Figure 10 of the drawings.

From the foregoing description of this invention it is apparent that a novel type of collapsible bit has been provided, which embodies a novel blade construction which will permit the blade to be varied in cutting width. The collapsing of the blade can be readily understood by anyone skilled in the art to which this invention relates, since it is accomplished by pulling upwardly upon the drill stem, and when the flush beveled edges 151 and 152 which project beyond the barrel 20 engage the lower edge of the casing M, the blade constructions D and E will collapse, as is illustrated in Figure 2 of the drawings. I have found that it is possible to drill a hole or sink a shaft several times the internal diameter of the casing M in which the blade structures have to be collapsed to withdraw the drill bit. This enables a very large cavity to be drilled, and the drill blade structures to be collapsed in a relative small diametered casing. The parts of the holder C have been constructed in the novel manner shown, principally because of the huge size of the drill bit, and the character of the work which the same is to perform. With such a drill bit a hole of six feet in diameter can easily be sunk, and it can well be appreciated that certain conventional types of small drill bits could not be used practically. In order to better connect the blade carrier extension pieces 140 to the carrier 50, it is preferred to provide a bolt 160, transversely connected thru the extensions 140 and through the carrier 50, substantially as is illustrated in Figure 10 of the drawings.

Various changes in the shape, size, and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a drill bit the combination of a holder having a guide groove therein, and a collapsible bit blade movably connected with said holder and including a pair of spaced projections operating in said groove of the holder to guide the blade into extended and collapsed positions.

2. In a drill bit the combination of a holder having a guide groove therein, a blade construction, means normally urging the blade construction into laterally extending relation from the holder, and a pair of spaced projections carried by said blade construction operating in said groove for guiding the blade construction into extended and collapsed relation with respect to the holder.

3. In a drill construction the combination of a supporting holder having a narrow

groove in the lower end thereof which widens at the lowermost end of the same, a blade construction, means normally urging the blade construction upwardly into the holder, and upper and lower spaced guide projections carried by the holder normally positioned in the narrow part of said groove when the blade construction is extended, the lower projection being so situated with respect to the groove that it will ride into the widened part of said groove upon collapsing of the blade with respect to the holder.

4. In a drill bit the combination of a supporting holder providing guide grooves therein, a pair of collapsible bit blades, a common pivot pin for said bit blades extending into said guide grooves, and guide pins carried by said blades independent with respect to each other extending into said guide grooves.

5. In a drill bit construction the combination of a holder providing a pair of longitudinally extending guide grooves therein which are narrow at their upper part and wider at their lower part, a pair of collapsible bit blades, means normally acting on the bit blades to force the same upwardly into the holder and in laterally extending drilling relation therefrom, a common pivot pin for the drill blades extending laterally therefrom into said guide grooves at their upper narrow portions, and a guide projection carried by each of said blades independent with respect to each other in spaced relation from the common pivot pin, said last mentioned guide projections extending into said grooves for riding into the narrow portion thereof when the blades are extended and into the widened portion when the blades are collapsed.

6. In a drill bit the combination of a supporting holder having a pocket extending upwardly thereinto with grooves facing the pocket and extending longitudinally of the holder, said grooves at their upper ends being narrow and at their lower ends being widened, a pair of collapsible bit blades including carrier portions adapted to extend upwardly into said pocket in movable relation therein and blade portions adapted to extend below the pocket laterally of the holder, a pivot pin connecting said blades together extending laterally therefrom into the narrow upper portions of said grooves, spring means connected with said pivot pin and with the holder for normally urging the blades upwardly into the holder and into extended relation, and a guide projection carried by each of said blades independent with respect to each other operating one in each of the grooves and in such relation that when the blades are extended the projections will lie in the narrow portions of said grooves and when the blades are collapsed said projections will extend into the wider portions of said grooves to permit the blades to be collapsed.

7. In a drill bit construction the combination of a holder providing a reduced socket extending upwardly therein and from said socket the holder being recessed and providing oppositely disposed beveled shoulders diverging from the socket towards the holder sides, said holder at the sides thereof being upwardly slotted and providing shoulders at right angles to the axis of the holder and into which shoulders the beveled shoulders above mentioned merge, and collapsible blades for said holder including carrier portions having head portions for seating in said socket and beveled and adjacent horizontal shoulders for seating on the beveled shoulders and right angled shoulders respectively of the holder.

8. In a drill bit construction the combination of a holder recessed at its lower end and provided with longitudinal grooves facing said recess and which grooves are narrow at their upper ends and wider at their lower ends, a pair of blades, a pin pivotally connecting said blades at their upper ends so that opposite ends of said pin project beyond said blades and into the upper ends of said grooves, rollers on said projecting ends of the pin in said grooves, other projections for each of said blades extending into said grooves and adapted to seat in the narrow portion thereof when the blades are extended and moving into the wider portion when the blades are collapsed, and means connected with the pin which pivotally connects said blades together and acting on said blades normally tending to urge them upwardly into said recess and into extended relation for drilling purposes.

9. In a drill bit construction the combination of a holder comprising a body formed of a pair of semi-cylindrical parts recessed at their facing surfaces, a sleeve shrunk upon said parts to hold them in cylindrical formation with the recesses providing a pocket facing downwardly from the holder, and blade means for said pocket.

10. In a drill bit construction the combination of a holder comprising a body formed of a pair of semi-cylindrical parts recessed at their facing surfaces, a sleeve shrunk upon said parts to hold them in cylindrical formation with the recesses providing a pocket facing downwardly from the holder, and a collapsible blade construction movably connected to the holder in the pocket provided thereby.

11. In a drill bit the combination of a supporting holder comprising a substantially cylindrical shaped body portion formed of a pair of sections and a sleeve connecting said sections and holding them in substan-

tially cylindrical relation, said sections of the body providing recesses which form a pocket extending upwardly into the holder, and collapsible blade means connected to the holder in said pocket.

12. In a drill bit the combination of a holder formed of a substantially cylindrical shaped body having water grooves formed in the outer surface thereof and which grooves extend to the upper and lower surfaces of said body, a sleeve affixed to the body and extending across said grooves to provide water passageways which have openings in the holder above the body and below the body, and blade means carried by the holder in such relation to the lower open ends of the water passageways that water passing therefrom will be directed towards said blade means.

13. In a drill bit construction the combination of a holder comprising a substantially cylindrical shaped body having water grooves formed in the outer surface thereof, a sleeve in snug engagement with said outer surfaces of the body and extending across said grooves to enclose the sides thereof, the same being open at the upper and lower ends of said body, and blade means supported by said holder.

14. In a drill bit construction the combination of a holder, blade means supported by said holder, said holder having a plurality of longitudinal water ways extending therealong, a transverse way connecting said longitudinal ways at their lower ends, and ducts extending from said transverse way and outleting in adjacent relation towards the blades.

15. In a drill bit construction the combination of a holder formed of a substantially cylindrical shaped body and a sleeve snugly engaging about the outer circumference of said body, said body in the outer surface thereof having grooves opening at the upper and lower ends of the body and laterally enclosed by said sleeve to provide waterways having inlet and outlet openings.

16. In a drill bit construction the combination of a holder comprising a substantially cylindrical shaped body and an outer sleeve shrunk upon said body, said substantially cylindrical shaped body having vertical grooves in the outer circumference thereof and a circumferential groove open to the lower ends of said vertical grooves, said body furthermore having a plurality of ducts extending from said circumferential groove to the lower end surface of said body, and blade means supported by the holder in such relation that water coming thru said ducts will be directed upon said blades.

17. In a drill blade construction the combination of a supporting carrier, a plurality of blade sections for the carrier, and means for supporting certain of said blade sections entirely beyond the side edge of said carrier.

18. In a drill bit construction the combination of a holder, collapsible blade structures for the holder, means resiliently urging the collapsible blade holders to extended relation, and sectional blade means whereby to add to the cutting width of said blade structures.

19. In a drill blade construction, the combination of a carrier, extension units for the carrier, and blade section means for attachment to said carrier and extension units.

20. In a drill blade construction the combination of a supporting carrier, blade means, and means for varying the effective blade supporting width of the carrier.

21. In a drill blade construction the combination of a supporting carrier, means whereby to increase or decrease the width of said carrier, a blade section, and means whereby to detachably connect said blade section to said carrier and to said first mentioned means.

22. In a drill bit blade construction the combination of a supporting carrier, carrier extensions for said carrier, blade sections, and means whereby to connect said blade sections to said carrier and extensions in relatively overlapping relation with the latter.

23. In a drill bit blade construction the combination of a carrier body, extension pieces for detachable connection with the carrier body and with each other to vary the width of the carrier body, and detachable blade sections for detachable connection with said carrier body and extension pieces of the carrier body.

24. In a drill bit blade construction the combination of a carrier body, an extension piece for detachable connection with the carrier body to increase the width of the carrier body, a blade, and means whereby to detachably connect the blade to the carrier body and extension piece in overlapped relation with both the carrier body and extension piece.

25. A drill blade construction comprising a carrier body, extension units for detachable connection at the outer edge of the carrier body, said carrier body and extension units providing reduced attaching tongues, blade sections including attaching tongues, and means whereby to detachably connect the attaching tongues of the carrier body and extension units and blade sections.

26. A drill blade construction comprising a carrier body, extension units for detachable connection at the outer edge of the carrier body, said carrier body and extension units providing reduced attaching tongues, blade sections including attaching tongues, and means whereby to detachably connect the attaching tongues of the carrier body and extension units and blade sections, with

the blade sections in overlapping relation at the joint between the carrier body and extension units.

27. In a drill bit blade construction the combination of a supporting carrier body having a dove-tail groove at the outer edge thereof, an extension piece for detachable connection with the carrier body having a dove-tail tongue for fitting in said groove, blade means, and means whereby to detachably connect the blade means with the carrier body and extension piece.

28. In a drill bit blade construction the combination of a supporting carrier body having a dove-tail groove at the outer edge thereof, an extension piece for detachable connection with the carrier body having a dove-tail tongue for fitting in said groove, blade means, and means whereby to detachably connect the blade means with the carrier body and extension unit and in overlapped relation at the joint between said carrier body and extension unit.

29. In a drill bit blade construction the combination of a substantially flat carrier body, extension pieces, dove-tail joints for detachably connecting the extension pieces to each other and to the outer edge of said carrier body, blade sections, and bolt means whereby to detachably connect said blade sections with the carrier body and extension units.

30. In a drill bit blade construction the combination of a substantially flat carrier body, extension pieces, dove-tail joints for detachably connecting the extension pieces to each other and to the outer edge of said carrier body, blade sections, and bolt means whereby to detachably connect said blade sections with the carrier body and extension units, and in overlapped relation at the dove-tail joints.

31. In a drill blade construction the combination of a carrier body, extension pieces, means for attachment of the extension pieces at the outer edge of the carrier body including a transverse bolt connected to said extension pieces and carrier body, and blade means detachably connected to said carrier body and extension pieces.

32. In a drill blade construction the combination of a supporting body made up of a plurality of detachable sections, a plurality of blade sections, and means connecting said blade sections to the sections of the supporting body in overlapped relation with respect to the joints of connection of said supporting body sections.

33. In a drill bit construction the combination of a holder including a sleeve having a plug in the lower end thereof, said holder having water passageways through said plug, blades collapsibly carried by the plug below the holder, a spring, means compressing the spring in a connected relation with the blades to normally urge the latter into extended relation, a housing for said spring to enclose the same and seal it from water in the holder sleeve, a gasket, and means connected with said housing for attaching the same to the plug of said holder with the gasket compressed against the plug to seal the connection of the housing therewith to prevent access of water to said spring housing.

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