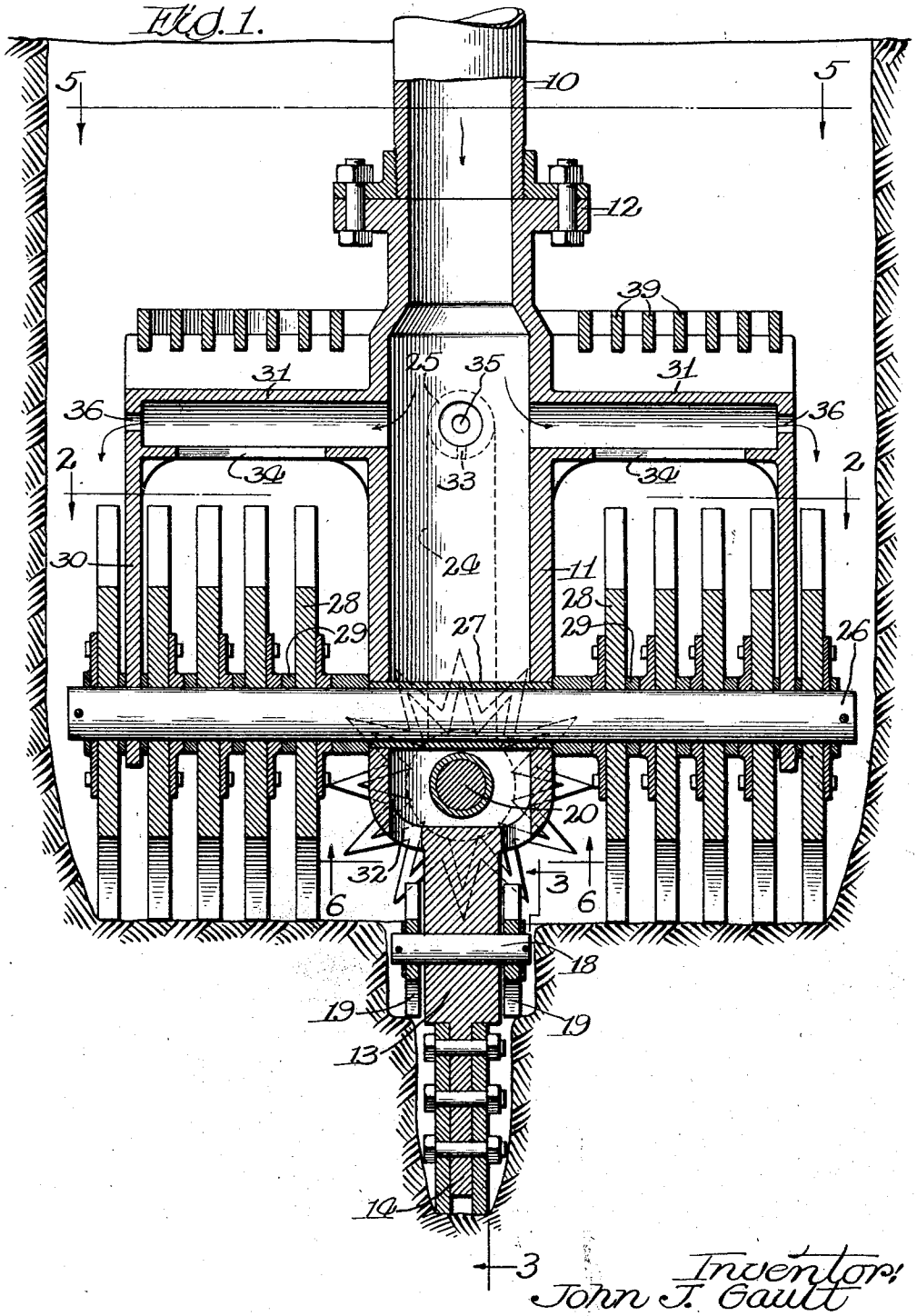
Sept. 27, 1932. J. J. GAULT 1,879,177

DRILLING APPARATUS FOR LARGE WELLS

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FIG. 1.



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DRILLING APPARATUS FOR LARGE WELLS

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Fig. 2.

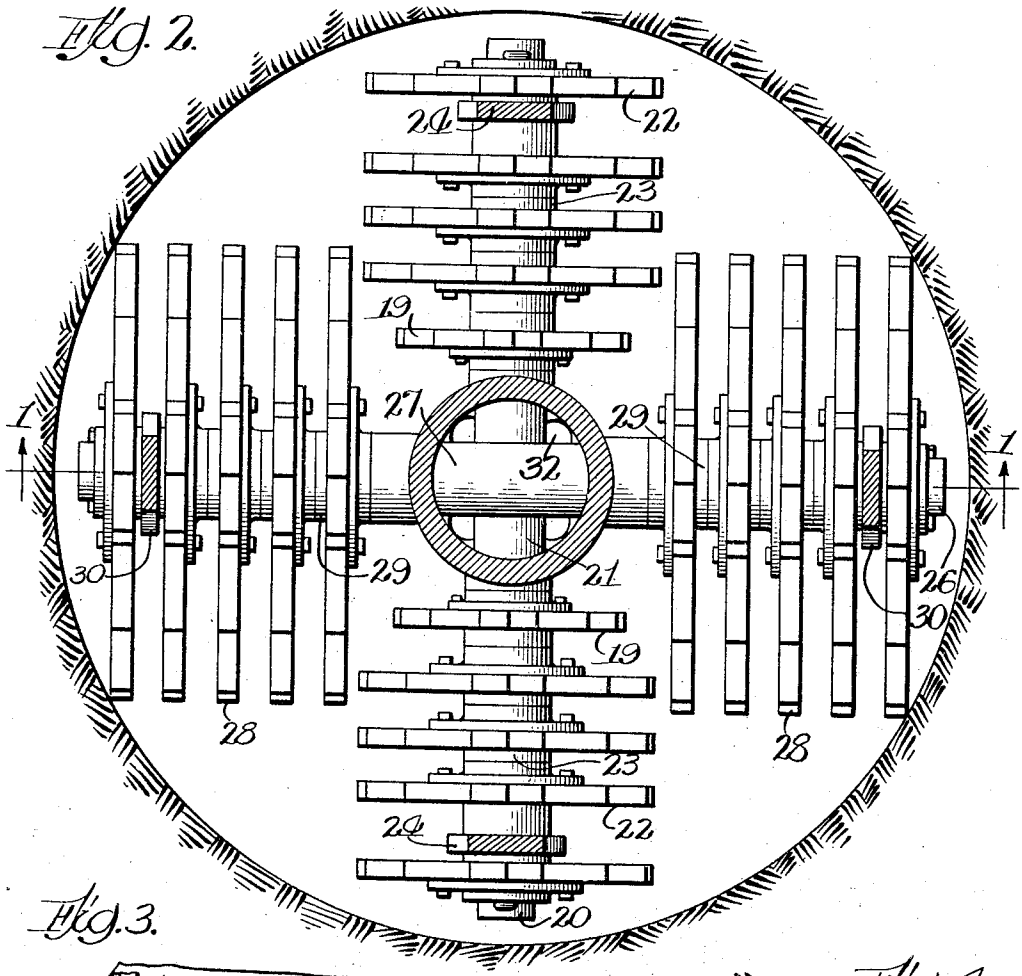


Fig. 3.

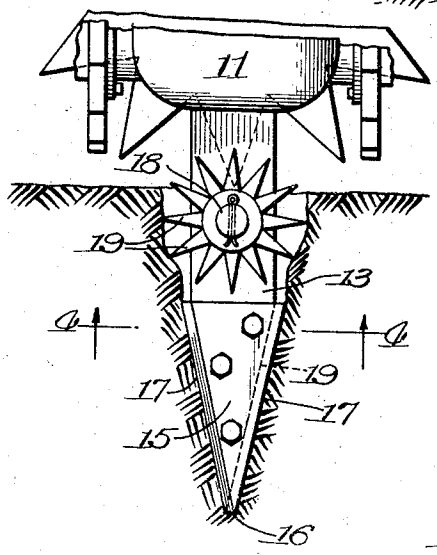
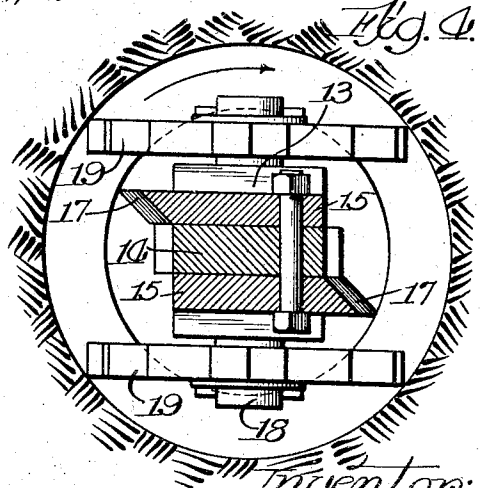


Fig. 4.



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Fig. 5.

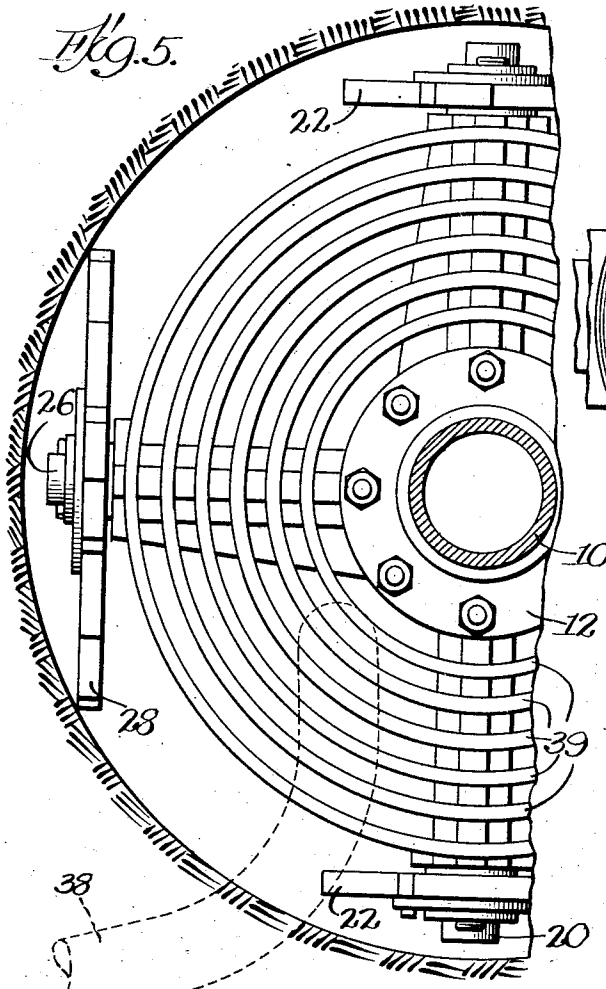


Fig. 6.

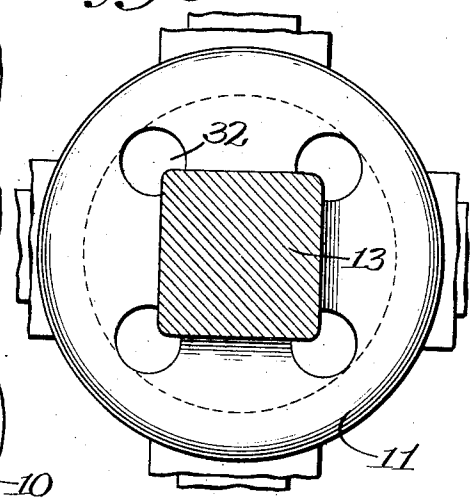


Fig. 7.

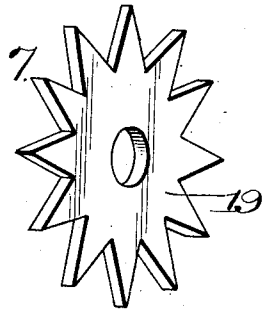
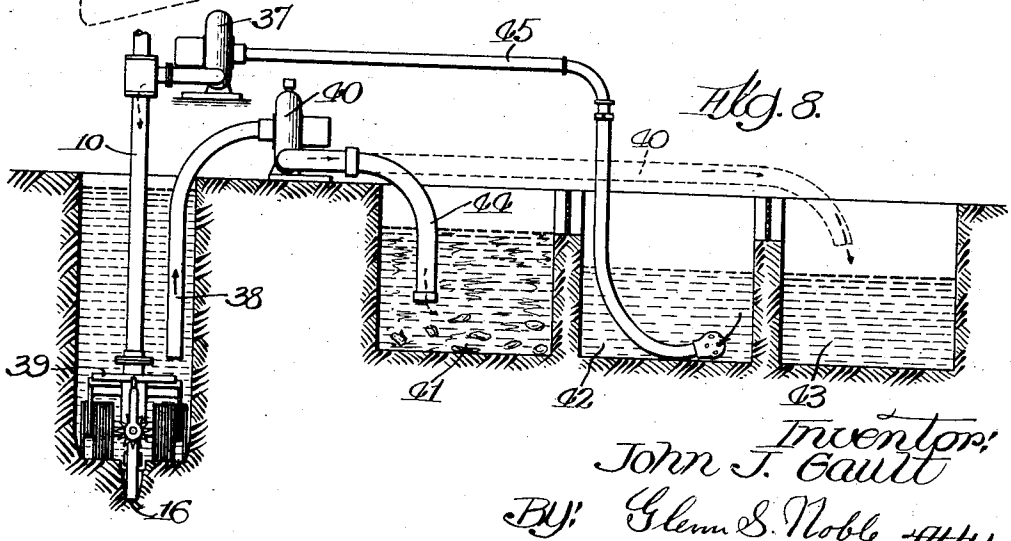


Fig. 8.



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UNITED STATES PATENT OFFICE

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DRILLING APPARATUS FOR LARGE WELLS

Application filed May 16, 1930. Serial No. 453,042.

This invention relates to the drilling of large wells, such as are frequently made from four to eight feet in diameter and upwards of one hundred feet or more in depth, such wells being commonly used for filling with concrete to provide building foundations. It includes not only novel mechanism for excavating and loosening material but also the method of operating and disposal of the excavated material.

The objects of this invention are to provide an improved method and apparatus for drilling wells; to provide an apparatus of this character which will be relatively simple in construction and durable and efficient in operation; to provide a drilling apparatus having a plurality of pointed or star shaped excavating devices; to provide a drilling apparatus having combined cutting and picking devices for attacking the material to be excavated; to provide means for excavating material under a head of water, whereby the water will tend to clean the excavating devices and will be thoroughly mixed or churned with the excavated material and suction or exhaust means provided for pumping the excavated material away from the cutters; and to provide such other novel features in construction and advantages in operation as will appear more fully hereinafter.

In the accompanying drawings illustrating this invention:

Figure 1 is a vertical sectional view of the drilling apparatus shown in position in a well taken on line 1—1 of Fig. 2;

Figure 2 is a sectional view taken on line 2—2 of Fig. 1;

Figure 3 is a detail showing the lower cutting devices taken on line 3—3 of Figure 1;

Figure 4 is an enlarged sectional view taken on line 4—4 of Figure 3;

Figure 5 is a sectional view taken on line 5—5 of Fig. 1;

Figure 6 is a sectional view taken on line 6—6 of Fig. 1;

Figure 7 is a perspective view of one of the cutting devices; and

Figure 8 is a somewhat diagrammatic view showing the method of operation.

As shown in these drawings, 10 is the drill pipe or hollow shaft which is made up of sections and suitable means provided for rotating the same. The drilling head 11 is secured to the lower end of the pipe in any convenient manner as by means of a flange coupling 12. The vertical or main portion of the head is hollow and preferably of somewhat larger diameter than the pipe 10. A substantial stem or projection 13 extends downwardly from the hollow portion and terminates in a V-shaped or spear shaped extension 14, as shown in Figures 1 and 4. Two flat cutting blades 15 are bolted to the extension 14, these blades being similar in shape to the extension and having sides which converge at a relatively sharp angle in order to provide penetrating points 16 at the lower ends thereof. One side of each of the blades is beveled and projects outwardly to provide a cutting edge as shown at 17, the whole making an exceedingly effective pilot bit.

A transverse shaft 18 is mounted in the stem 13 and is provided on either end with one or more cutting or excavating devices 19 which are rotatably mounted thereon. These excavating devices are preferably made star shaped, being provided with a number of relatively sharp points, as shown in Figure 7. These star cutters are preferably made of very hard steel or the like.

The cutter head 11 has a plurality of horizontally arranged shafts for supporting other excavating devices. One of these shafts 20 is mounted adjacent to the lower end of the cutter head and extends outwardly through the hollow portion thereof. This shaft is preferably mounted in a pipe or tube 21 which fits closely in the holes in the sides of the cutter head and serves as a bearing for the shaft as well as strengthens the device. A series of star shaped cutters 22 are mounted on this shaft at suitable distances apart and are held in spaced relation by means of spreaders 23. These star shaped cutters are similar to the cutters 19 heretofore described but preferably of larger diameter as shown. The outer ends of the shaft 20 are mounted in bearings 24 which comprise arms or projections extending downwardly from hollow radial arms 25 which are formed integrally

with the body 11 of the drill head and are parallel to the shaft.

The drill head has a second shaft 26 which extends through the body portion thereof and is arranged slightly above the shaft 20 and at right angles thereto. The shaft 26 is mounted in a pipe 27 which is securely fastened in the drill head and may be welded thereto if desired. The shaft 26 carries a plurality of star shaped cutters 28 which are arranged in spaced relation thereon being held by spreaders 29. These cutters are similar to the ones heretofore described but are of larger diameter than the cutters 22 so that they will cut or dig on the same plane as indicated in Figure 1. The outer ends of the shaft 26 are carried in bearings 30 which project downwardly from hollow radial arms 31 formed integrally with the body of the drill head 11 as shown in Figure 1. These arms are preferably on the same level with the arms 25. The central or body portion of the cutter head has a number of holes 32 in the bottom thereof, two of these holes being preferably arranged over each of the cutters 19 so that water will be forced downwardly onto these cutters and into the hole formed by these cutters and the pilot bit. The hollow arms 25 and 31 are provided respectively with slots or openings 33 and 34 which open downwardly in order to discharge water onto the series of cutters 22 and 28. The arms are also provided respectively with end holes 35 and 36 for discharging water downwardly around the outer periphery onto the cutters which may be arranged outside of the bearings as indicated. The water for this purpose is pumped downwardly through the pipe 10 into the cutter head by any suitable means such as the pump 37, as shown in Figure 8. While the discharge of water through the holes in the arms 25 and 31 may be effective in some cases, I have found that the principal benefit is derived through the discharge from the holes 32 which direct the water to the cutting areas and if increased pressure is desired for the discharge through these holes, the holes in the arms may be omitted.

In carrying out my improved method the cutter head is rotated to cause the excavating devices to loosen the material and it will be particularly noted that the cutter head and parts connected therewith as well as the pipe 10 are preferably made very heavy so that the points of the cutters will be forcibly pushed or driven into the material at the bottom of the well. It will be noted that when the material is hard as for instance, in hard pan or the like, the cutters will have a pounding action as they pass from one point to another thereby tending to rapidly grind and cut the material which is at once acted upon by the water passing through the openings downwardly to the bits or cutting devices. The water and excavated material will be churned so that the material is held in suspension around the cutter head. The water with this suspended material is drawn out through a pipe 38 which is arranged in the well and which is extended as the work progresses so that the lower end will be in close proximity to the cutter head as shown in Figure 8.

If desired guard rings 39 may be arranged above the arms 25 and 31 in order to prevent the pipe 38 from passing down between the arms and coming in contact with the cutters. The water and suspended material is drawn upwardly through the pipe 38 by means of a pump 40, such material being discharged into a sump 41. Two other sump holes 42 and 43 are also preferably provided adjacent to the sump 41. When the material is being discharged through the pipe 44 into the sump 41 the heavy particles are allowed to settle in the sump and the water will overflow, for instance into the sump 42 and this relatively clean water is drawn out through the pipe 45 by the pump 37 and forced downwardly through the pipe 10. A screen may be provided in the passageway between the sumps in order to screen the water passing therethrough. When the sump 41 becomes filled with sediment, the discharge pipe 44 may be moved to the sump 43 for instance, and the water permitted to overflow into the sump 42 and the material may then be excavated by means of buckets from the sump 41 so that it may again be used when the sump 43 becomes filled. In this manner the heavy particles which are loosened and held in suspension by the cutters are quickly drawn away and carried out of the well thereby leaving the cutters free to operate on relatively clear surfaces. It will also be understood that the wall is at all times preferably kept substantially full of water so that it will maintain a pressure on the side walls and also so that the pump 40 will only have a relatively short lift due to the head of the water above the mouth of the pipe 38. The cutters 22 are preferably arranged in staggered relation radially with respect to the cutters 28 whereby these smaller cutters will tend to break down the ridges or any material on the floor of the well which may project upwardly between the paths of the cutters 28. In this way all of the material will be sufficiently broken up so that it may be held in suspension in the water and drawn off by the discharge pump. The diameter of the well may be decreased or increased by shortening or lengthening the cutter supporting shafts and decreasing or increasing the number of cutters beyond the outer bearings 24 and 30.

From this description it will be seen that I provide a comparatively simple apparatus which will tend to rapidly excavate or loosen the material with a minimum amount of power

and with a minimum amount of wear on the excavating devices and also provide means whereby the heavier particles of excavated material may be withdrawn from the well so that they do not interfere with the cutting or drilling operations. It will also be noted that changes may be made in the construction of the apparatus or in carrying out the method of operation without departing from the scope of my invention and therefore I do not wish to be limited to the particular features herein shown and described except as set forth in the following claims in which I claim:

1. An apparatus for drilling large wells, comprising a rotatable pipe, a drill head secured to the lower end of said pipe and having a central hollow body portion with an integrally formed downwardly projecting stem, V-shaped drill points secured to the lower end of the stem, a shaft projecting through the stem above the drill points, rotatable cutters mounted on said shaft, a plurality of shafts projecting through the hollow central body portion of the head, rotatable cutters mounted on said shafts, tubular arms projecting from said body portion and having communication therewith, bearings at the ends of the arms for said shafts, said arms having downwardly and outwardly directed openings and the central body portion having downwardly directed openings for discharging water therethrough.

2. An apparatus as per claim 1 in which the lower end of the downwardly projecting stem is relatively narrow and substantially V-shaped with two similarly shaped cutting bits bolted thereto, each of said bits having an outwardly projecting cutting edge.

3. An apparatus as per claim 1 in which the shafts passing through the hollow central body portion are arranged at right angles to each other with one shaft in a plane slightly above the other shaft.

4. A drill head of the character set forth comprising an elongated hollow body portion having four integrally formed outwardly projecting hollow arms with depending bearings at the outer end thereof, two shafts extending through said body portion at substantially ninety degrees to each other and securely fastened therein and engaging respectively with pairs of said bearings, a plurality of star shaped cutters mounted on each of said shafts, the cutters on the lower shaft being of less diameter than the cutters on the upper shaft whereby they will all act on substantially the same plane, a pilot bit at the lower end of said body portion, said body portion and arms having openings for discharging water to the cutters and pilot bit.

5. In a drill of the character set forth, the combination of a central cylindrical body closed at its lower end and open at its upper end, the lower end having discharge holes therethrough, an integrally formed stem depending from the body, a pair of V-shaped pilot bits secured to the lower end of the stem, star shaped cutters mounted on the stem above the pilot bits and adapted to co-act therewith to cut a relatively small center hole, two cylindrical bearings arranged at right angles to each other and extending through the body, shafts mounted in said bearings and extending outwardly therefrom, star shaped cutters mounted on said shafts and arranged in staggered relation radially, integrally formed hollow arms projecting outwardly from the body portion above the respective shafts and having depending bearings for said shafts, discharge holes in said hollow arms for discharging water downwardly and radially and guard members arranged above said arms.

6. A drill head comprising a body having outwardly projecting arms with bearings depending therefrom, shafts extending through said body, each shaft engaging with a pair of said bearings, a plurality of rotatable cutters mounted on each of said shafts, the cutters on one shaft being of less diameter than the cutters on the other shaft and projecting downwardly to substantially the same cutting plane as the cutters on the other shaft, and a pilot bit on the lower end of said body.

7. A drill head comprising a body portion, shafts projecting outwardly from said body portion at different distances from the lower end thereof and arranged in different vertical planes, a plurality of star shaped cutters rotatably mounted on each of said shafts, the points of said cutters being spaced apart a sufficient distance so that they will strike blows when they engage with the material to be excavated, the cutters on the lower shaft being of sufficiently less diameter than the cutters on the upper shaft so that their lower engaging points will cut on substantially the same plane as the cutters on the upper shaft, another shaft carried by said body below the first named shafts and projecting outwardly a less distance than the first named shafts, a plurality of cutters mounted on the last named shaft adjacent to the body portion and adapted to cut on a smaller diameter than the first named cutters, and a pilot bit at the lower end of said body.

8. A drill head of the character set forth comprising an elongated hollow body portion, two shafts extending through said body portion at substantially ninety degrees to each other and securely fastened therein, a plurality of cutters mounted on each of said shafts, the cutters on the lower shaft being of less diameter than the cutters on the upper shaft, whereby they will all act on substantially the same plane, a pilot bit at the lower end of said body portion, said body portion

having openings for discharging water therefrom to the cutters and pilot bit.

9. In a drill of the character set forth, the combination of a central cylindrical body closed at its lower end and open at its upper end, an integrally formed stem depending from the body, pilot bits secured to the lower end of the stem, star shaped cutters mounted on the stem above the pilot bits and adapted to coact therewith to cut a relatively small center hole, two bearings arranged at substantially right angles to each other and extending through the body, shafts mounted in said bearings and extending outwardly therefrom, and star shaped cutters mounted on said shafts, said body having discharge openings for discharging water therefrom.

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