May 16, 1933. M. G. HAUSLER ET AL 1,909,352

SHOE FOR DRILLING SHAFTS

Filed Sept. 11, 1930

Fig. 1

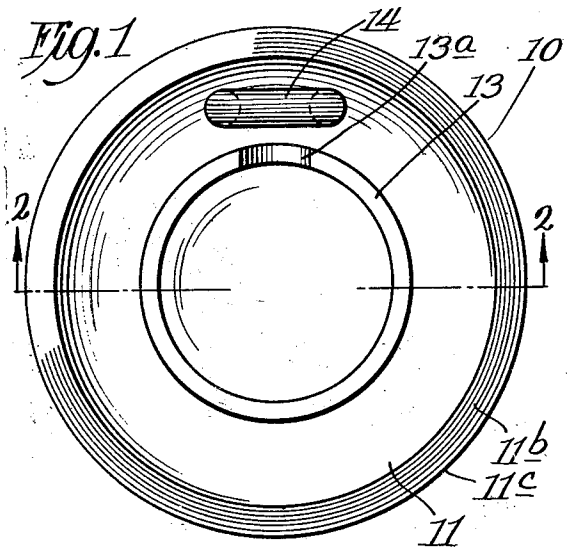


Fig. 2

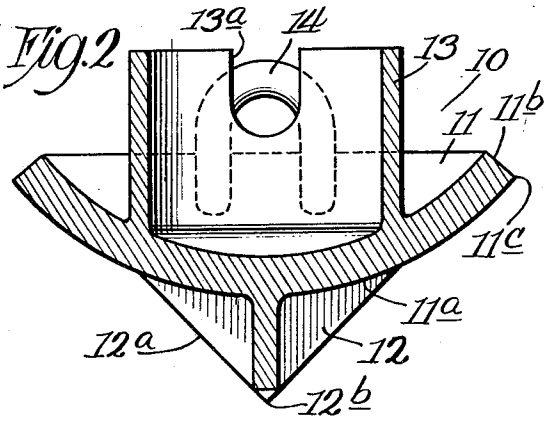


Fig. 3

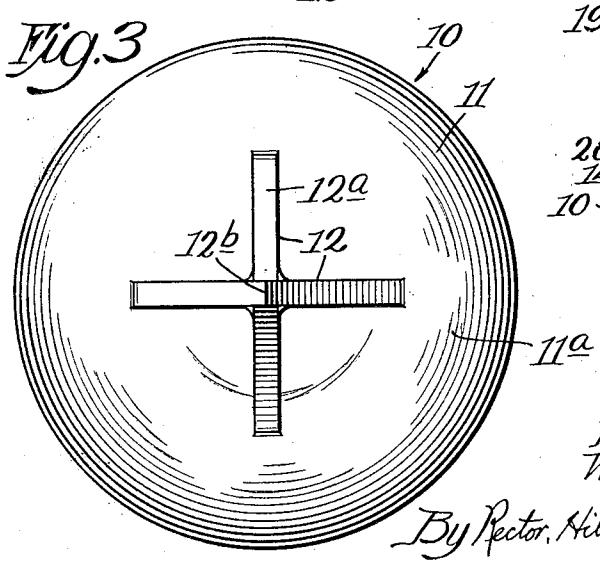


Fig. 4

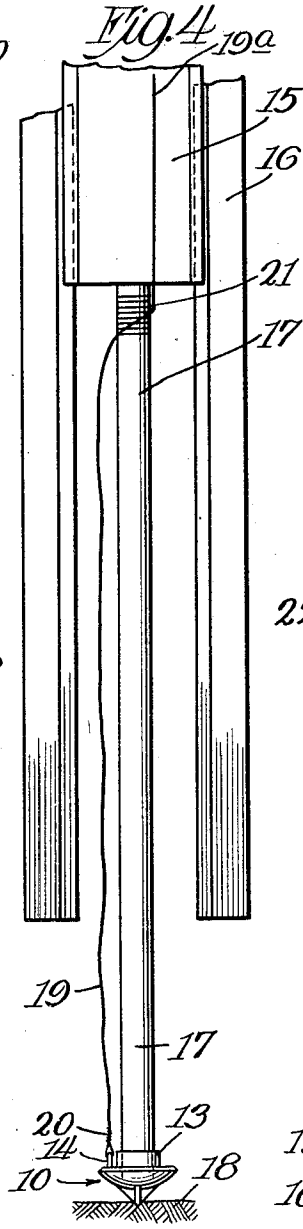
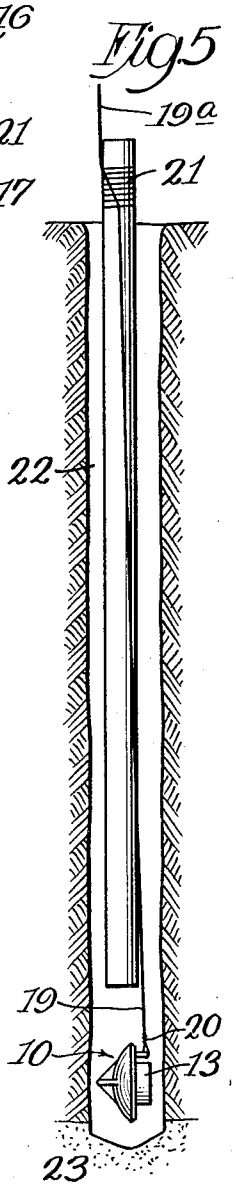


Fig. 5



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Patented May 16, 1933 1,909,352

UNITED STATES PATENT OFFICE

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SHOE FOR DRILLING SHAFTS

Application filed September 11, 1930. Serial No. 481,170.

This invention relates to a shoe for a drilling shaft and its purpose is to provide a hard metal shoe adapted to be attached to the bottom of a shaft which is driven downward through slag or other hard earthy materials in preparation for the subsequent driving of a wooden pile or the like through the hole thus formed into the earth below. Along the banks of rivers and harbors there is frequently found a layer of hard slag which is formed by the action of water upon cinders which are dumped into the water along the banks. This slag is very hard and cannot be penetrated by piles so that it is necessary to drill holes through it in preparation for the driving of piles into the earth below, during the construction of docks and the like. With ordinary drilling devices, it is difficult to drill a vertical hole of the proper dimensions through this slag, for example, or other hard formations which are found on the surface of river or harbor bottoms and many devices which have heretofore been employed in this work have been further unsatisfactory in that it has been necessary to leave them in the earth beneath the slag so that they have interfered with the subsequent driving of piles.

The principal object of the present invention is to provide a detachable shoe which may be mounted on the lower end of a vertical shaft so that the shaft and shoe may be driven vertically downward through the slag or other hard layer to form a hole of substantially uniform cross-section adapted to receive a pile. A further object of the invention is to provide a hard metal shoe adapted to be mounted on the lower end of a drilling shaft and embodying means for facilitating the penetration of the material being drilled and for maintaining the proper direction of movement of the shoe and shaft during the operation. Still another object is to provide an improved shoe for mounting on the lower end of a drilling shaft in combination with means for withdrawing the shoe from the hole when it has been drilled. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawing, in which one embodiment is illustrated. In the drawing,

Fig. 1 shows a top plan view of the improved shoe;

Fig. 2 shows a transverse section on the line 2—2 of Fig. 1;

Fig. 3 shows a bottom plan view of the improved shoe;

Fig. 4 shows a vertical section through the lower portion of a steam hammer or drilling machine illustrating the method of mounting the shoe on the lower end of the drilling shaft at the commencement of the drilling operations, and

Fig. 5 shows a vertical section through the walls of the drilled hole at the completion of the drilling operations showing the method of withdrawing the shaft and the shoe after the latter has been detached from the shaft.

As illustrated in the accompanying drawing, the shoe 10 comprises a circular plate 11 having a lower surface 11^a which is convexed downwardly and having an outer annular surface 11^b which extends inwardly at right angles to the surface 11^a, thus providing a circular edge 11^c which is comparatively sharp and which is adapted to engage the edges of the hole during the drilling thereof. The plate 11 is provided on its lower side with two integrally formed intersecting blades 12 which are united with each other at their points of intersection and which are substantially V-shaped in form so that their edges 12^a converge downwardly to a common point 12^b which is sharp so that it penetrates the slag or other hard material being drilled. The upper side of the plate 11 carries an integrally formed sleeve or socket 13 which is adapted to receive the lower end of the drilling shaft through its open upper end. A U-bolt 14 is secured in the plate 11 at one side of the socket 13 to be engaged by a cable or the like by which the shoe is withdrawn from the drilled hole and one side of the socket 13 is provided with a U-shaped recess or indentation 13^a which registers with the U-bolt 14 to facilitate the fastening of the cable to the shoe.

One method of using the improved shoe described above is illustrated in Figs. 4 and 5 where the reciprocating driven member 15 of a steam hammer or drilling machine is shown mounted to slide in parallel vertical guides 16 which engage grooves in the lateral edge thereof. The lower end of the member 15 is secured to the vertical drilling shaft 17 which is to be driven downwardly through the slag or other hard layer. At the commencement of the operations, the shoe 10 is fitted on the lower end of the shaft 17 with the blades 12 engaging the upper surface of the layer 18 of slag or other material which is to be penetrated. A cable 19 is attached at its lower end to the U-bolt 14 as shown at 20 and an intermediate part of this cable is preferably wound around and secured to the shaft 17 immediately below the reciprocating driven member 15 as shown at 21, after which the cable 19 is extended upwardly as shown at 19^a and permanently secured to some fixed part of the drilling machine or, if desired, to a part of the member 15. When the cable 19 is attached, a considerable amount of slack is left in it between the U-bolt 14 and the point 21 where it is attached to the shaft so that when the drilling is completed and the shaft 17 is raised, the shoe 10 will automatically drop off of the lower end of the shaft.

Having arranged the parts as illustrated in Fig. 4, the member 15 of the drilling machine is driven downwardly by the reciprocating hammer or other part applied to the upper end thereof and as the shaft 17 is driven thereby, the shoe 10 is caused to penetrate the layer 18 of slag or other hard material to form a vertical hole 22 as shown in Fig. 5. As the drilling continues, the blades 12 penetrate the bottom of the hole and maintain the shoe in proper upright position, thus guiding the shaft 17 and preventing lateral movement of the shoe. At the same time the sharp annular edge 11^c of the plate 11 determines the annular boundary of the drilled hole and facilitates the downward movement of the shoe without appreciable frictional resistance at the edge. When the hole has been drilled through the layer of slag to form a hole through which a pile may be driven into the earthy material 23 below, the shaft 17 is withdrawn from the hole and, at the commencement of this withdrawal, as indicated in Fig. 5, the shoe 10 drops off of the lower end of the shaft 17 and, due to the eccentric position of the U-bolt 14, the shoe tilts on its side so that the circular plate 11 of the shoe occupies a vertical position with the annular sharp edge 11^c engaging diametrically opposite portions of the wall of the drilled hole. The portion of the flexible cable 19 below the point 21 should be longer than the shaft 17, for example, two feet or more, to permit the shoe to be tilted readily to the position shown in Fig. 5 without interference with the lower end of the shaft. The shoe thus automatically assumes a position in which it may be conveniently withdrawn from the hole by the further upward movement of the shaft 17 and member 15 and during this withdrawal the opposite curved edges only of the plate 11 engage the wall of the hole so that there is a very limited frictional resistance to the removal of the shoe and it may be readily withdrawn without damaging the walls of the drilled hole. When the shaft and shoe have been withdrawn, the hole is in readiness for the driving of a pile and the apparatus is in readiness for being located in a new position for the drilling of another hole.

Although one form of the invention has been shown and described by way of illustration, it will be understood that it may be constructed in various other embodiments within the scope of the appended claims.

We claim:

1. The combination in a drilling machine, of a vertical shaft adapted to be driven, a one piece hard metal shoe of larger diameter than said shaft detachably mounted on the lower end of said shaft, and means for elevating said shoe simultaneously with the elevation of said shaft with said shoe detached.

2. The combination in a drilling machine, of a vertical shaft adapted to be driven, a one piece hard metal shoe detachably mounted on the lower end of said shaft, and means extending downwardly alongside said shaft and connected to said shoe for withdrawing said shoe edgewise from the drilled hole.

3. The combination in a drilling machine, of a vertical shaft adapted to be driven, a hard metal shoe normally mounted on the lower end of said shaft and adapted to become detached therefrom when said shaft is elevated, and a flexible member extending alongside said shaft and connected to said shoe for elevating said shoe after said shaft has become detached therefrom.

4. The combination in a drilling machine, of a vertical shaft adapted to be driven, a hard metal shoe having a socket to receive the lower end of said shaft, and a flexible member extending downwardly alongside said shaft and connected to said shoe at one side of said socket, said flexible member being of sufficient length to permit detachment of said shoe when said shaft is elevated whereby said shoe may be withdrawn edgewise from the hole by said flexible member.

5. A shoe for a drilling shaft comprising a circular body plate, a cylindrical socket member located centrally on the upper side of said plate to receive said shaft, and a fastening member carried by said body plate in an eccentric position thereon for attachment to a supporting member.

6. A shoe for a drilling shaft comprising a circular body plate having its lower surface convexed downwardly, a cylindrical socket member located centrally on the upper side of said plate, and a U-bolt secured to said plate at one side of said socket member, said socket member having a notch therein in registry with said U-bolt to facilitate the application to said U-bolt of a supporting member.

7. A shoe for a drilling shaft comprising a circular plate having its lower surface convexed downwardly and having an outer annular surface converging upwardly and inwardly to form a sharp outer annular edge, and means carried on the upper side of said plate for receiving the lower end of said shaft.

8. The combination in a drilling machine, of a vertical shaft adapted to be driven, a hard metal shoe engaged by the end of said shaft and adapted to become detached therefrom when said shaft is elevated, said shoe having a lesser vertical dimension than its transverse dimension, and means connected to said shoe for withdrawing it edgewise through the drilled hole when it becomes detached from said shaft.

In testimony whereof, we have subscribed our names.

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