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DROP HAMMER

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Fig. 1.

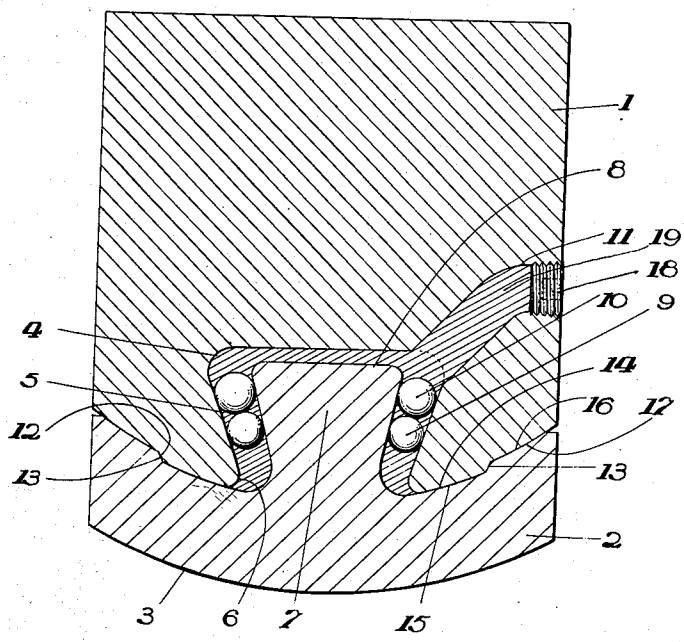
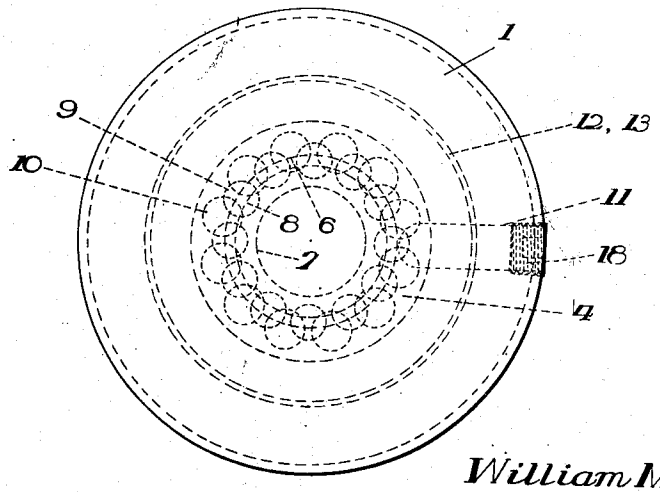


Fig. 2.



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DROP HAMMER

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11 Claims. (Cl. 241—291)

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This invention relates to an improved device of the type comprising a relatively heavy body or weight which is lifted to a suitable height and then dropped on material to be broken or crushed by the impact of the dropping weight. The body may be ball-shaped or cylindrical or polygonal. Such devices are referred to generically hereinafter as drop hammers.

Drop hammers of the above type are used, for example, in breaking stone in quarries and for many other analogous purposes. In use, the drop body wears away rapidly due to the high impact forces to which it is subjected and soon loses weight to the point where it has to be discarded in order to retain operating efficiency. In practice, nearly 50% of the weight of the original drop body is usually thrown away for this reason, with consequent substantial economic loss.

It is an object of the present invention to provide an improved drop hammer of the above type which is of multipart construction including a relatively heavy drop body or weight and a relatively light wearing shoe which is replaceable so that substantial operating economies can be effected.

Another object is to provide an improved drop hammer of the type characterized in the preceding object and wherein the body or weight and the shoe are securely connected and can be handled as a unit in a normal manner, but the shoe can be attached to or removed from the body quickly and easily.

Other objects will appear hereinafter as the description of the invention proceeds.

One embodiment of the invention has been illustrated in the accompanying drawings, but it is to be expressly understood that said drawings are for purposes of illustration only and are not to be taken as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawings,

Fig. 1 is a vertical section through a drop hammer embodying the invention; and

Fig. 2 is a plan view of the hammer.

The body or weight can be of any suitable size and shape, depending upon the conditions under which it is to be used. Thus the body may be spherical or ball-shaped or it may have a cylindrical, polygonal, or any other desired shape. The drawings show a body 1 of cylindrical shape which can be lifted by any suitable means (not shown) such as a crane or derrick of any known type. The body 1 is relatively massive or heavy

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in comparison with the wearing shoe to be described hereinafter, and its weight and inertia provide the major part of the impact force developed when the hammer is dropped onto the material to be crushed or broken.

Secured to the body 1 is a wearing shoe 2 covering the lower end of the body and providing a striking face 3 which delivers the impact forces to the material to be broken when the hammer is dropped. The striking face 3 may have any desired configuration, being here shown as substantially spherical in shape. The shoe 2 is relatively light as compared with the body 1, and takes all of the wear to which the hammer is subjected. When the shoe becomes worn, it can be removed from the undamaged body and replaced by a new shoe so that it is never necessary to discard any of the relatively heavy body 1 because of wear.

The connection between the body 1 and the shoe 2 is made by means of a tapered shank projecting into and secured in a tapered socket, the shank being formed on one of the parts and the socket in the other part. In the form shown, the socket is formed in the body 1 and the shank on the shoe 2, but the shank and socket can be reversed as will be evident by simply inverting Fig. 1 of the drawings and regarding the part 2 as the body and the part 1 as the shoe.

Referrnig to the preferred form shown in Fig. 1, a socket 4 is formed in the lower end of the body 1, said socket having tapered walls 5 which are inclined in such a way that the cross-sectional dimensions of the socket are larger at its bottom than at its mouth 6. The cross-sectional shape of the socket may be either oval or circular but is preferably circular so that the socket has the shape of a frustum of a cone the base of which forms the bottom of the socket.

The wearing shoe 2 is provided with a tapered shank 7 having a cross-sectional shape corresponding to that of the socket 4 and the taper of the shank is such that the largest cross-sectional dimensions of the shank are at its outer end 8, but this end is smaller than the mouth 6 of the socket so that the shank may enter the socket in assembling the two parts as shown in Fig. 1. In the preferred form shown in the drawings, the shank has the shape of a frustum of a cone the base of which forms the end 8 of the shank.

It will be seen that an annular space is provided between the tapered surface of the shank 7 and the tapered walls 5 of the socket 4. The degree of taper of the shank is less than that

of the socket so that the width of said annular space is least adjacent the mouth 6 of the socket and greatest adjacent the bottom of the socket. In other words, in the conical forms illustrated in the drawings, the inclination of the conical surface of the shank 7 with respect to its conical axis is less than that of the conical walls 5 of the socket 4 with respect to said axis.

With the parts assembled as above described, the body and shoe can be connected securely together by inserting a plurality of balls in the aforesaid annular space, these balls descending by gravity until they become wedged between the shank and the socket and thereafter preventing separation of the parts. The balls may be of any desired number and size. In the form shown, a series of balls 9 and a second series of balls 10 of larger size than the balls 9 form two series or courses in the annular space between the shank and the walls of the socket. Depending on the size of the balls, they may form two vertically separated series as shown in Fig. 1, or the balls of one series may be staggered with respect to and lie partially between the balls of the other series as shown in dotted lines in Fig. 2.

A suitable ball passage 11 communicates with the socket 4 adjacent its bottom whereby the balls can be inserted or removed. In the preferred form shown in the drawings, in which the socket is formed in the body 1, the passage 11 preferably extends from the socket to the outer surface of the body in an inclined position, and terminates in an internally threaded section adapted to receive a suitable closure member or plug 18.

The lower end surface of the body 1 which surrounds the socket 4, and the opposed upper surface of the shoe 2 which surrounds the shank 7, are preferably shaped correspondingly for engagement over substantially their entire area so that impact stresses may be uniformly distributed and absorbed. Preferably, also, one surface is provided with a projecting portion which engages in a corresponding recessed portion in the other surface whereby the shoe 2 and shank 7 are located with respect to the body 1 and the socket 4. For example, the lower surface of the body 1 is formed with a shoulder 12 and the shoe 2 is formed with a corresponding but oppositely facing shoulder 13, the section 14 of the surface of the body 1 thus projecting into a correspondingly recessed portion 15 of the shoe 2.

Preferably the meeting surfaces of the body 1 and shoe 2 are also shaped as surfaces of rotation around the conical axis of the socket 4 and shank 7. To this end the shoulders 12 and 13 extend circularly with respect to said axis. The surfaces 14 and 15 inwardly of these shoulders, and the surfaces 16 and 17 outwardly of said shoulders, may have any desired shape that is symmetrical about said axis, and as shown are spherical with respect to a center located in said axis.

In assembling the hammer, the two parts are placed together in the position shown in Fig. 1, the shoe being correctly located by reason of the shoulders 12 and 13 and the surfaces 14, 15 and 16, 17 being in engagement. The balls 9 and 10 are then fed into the socket through the passage 11 and allowed to seek their lowermost positions. Distribution of the balls around the circumference of the shank can be aided, if necessary, by relative rotation between the body and the shoe which causes the ball to roll between the shank and the socket.

It may sometimes be preferred to make further provision for holding the balls 9 and 10 in place, although this will not be necessary in many cases. Such additional provision can be effected, if and when desired, by partially or wholly filling the ball cavity between the socket 4 and the shank 7 and the ball passage 11 with some suitable material. The crosshatching 19 in Fig. 1 illustrates the case in which the cavity and passage are both filled with any suitable material comprising, for example, rubber, sponge rubber, a low melting metal such as lead, etc. In other cases it may be desired only to plug the passage 11 to prevent any of the balls from entering the passage, in which case the passage down to the point where it joins the cavity may be plugged with a bar of lead, a wooden dowel, a piece of rubber hose, or the like.

In the use of the hammer, the shoe tends to fall away by gravity when the body is lifted but is prevented from doing so by virtue of the balls and the taper of the shank 7. The balls being wedged in position during assembly, and when desired further secured in position by the material 19, the shoe is held fixed against the body at all times. In order to replace a worn shoe, it is only necessary to remove the balls as by inverting the hammer, removing the material 19, if present, and allowing the balls to roll out the passage 11, this being facilitated if necessary by relative rotation between the body and the shoe.

Thus it will be seen that the hammer in effect comprises an integral unit that can be lifted, dropped or otherwise handled in the manner normal to the use of devices of this type. However, the relatively large body is not directly subjected to impact and remains undamaged, whereas the wear is taken by the light shoe which can be removed and replaced whenever necessary. Consequently important operating economies are effected and at the same time substantially the entire designed weight of the hammer is always available. Furthermore, if desired the shoe can be made of any suitable wear resistant material to increase its life, while the body can be made of less expensive materials since it is not directly subjected to impacts and its primary function is merely to add weight to the hammer.

While only one embodiment of the invention has been illustrated in the drawings and described with particularity, it will be understood that the invention is not restricted thereto and that various changes can be made in the form, details of construction, and arrangement of the parts without departing from its spirit. Hence reference should be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A two-part drop hammer comprising a relatively heavy drop body and a replaceable wearing shoe, one of said parts having a tapered recess and the other having a tapered shank with an enlarged end extending into said recess, the degree of taper and the dimensions of said recess and shank being arranged to provide therebetween an annular space which decreases in width and in circumference toward the mouth of said recess, a plurality of balls in said annular space and having a diameter greater than the minimum clearance between the shank and recess, one of said parts having a ball passage communicating with said annular space, and means for closing said passage.

2. A drop hammer as defined in claim 1, the opposed surfaces of said parts which surround said recess and shank being correspondingly shaped for engagement with each other and one of said surfaces having a recessed portion and the other a projecting portion engaging said recessed portion to locate the parts relative to one another.

3. A drop hammer as defined in claim 1, said passage being plugged to prevent said balls leaving said annular space.

4. A drop hammer as defined in claim 1, said annular space containing plugging material engaging said balls and holding them in position.

5. A two-part hammer comprising a relatively heavy drop body and a replaceable wearing shoe, one of said parts having a frusto-conical recess with its smallest diameter at the mouth of said recess, the other part having a frusto-conical shank extending into said recess and having its largest diameter at its end, the inclination of the conical surface of said recess with respect to its conical axis being greater than that of the conical shank surface with respect to its conical axis, a plurality of balls in the space between said conical surfaces, and having a diameter greater than the minimum clearance between said conical surfaces one of said parts having a ball passage communicating with said space, and means for closing said passage.

6. A drop hammer as defined in claim 5, the opposed surfaces of said parts which surround said recess and shank being correspondingly shaped for engagement with each other and for relative rotation around the said conical axes.

7. A drop hammer having one part forming a relatively heavy drop body and another part forming a replaceable wearing shoe, one of said parts having therein a tapered recess and the other part having a tapered shank extending into said recess, said recess increasing in size toward its bottom and said shank increasing in size toward its end but being smaller than said recess to provide an annular space therebetween, the amount of taper of said shank being less than that of said recess so that the width of said annular space increases toward the bottom of said recess, a plurality of balls in said annular space and having a diameter greater than the minimum clearance between said shank and recess, one of said parts having a ball passage communicating with said space adjacent the bottom of said recess, and means for closing said passage.

8. A drop hammer as defined in claim 7, said passage being plugged to prevent said balls from leaving said annular space.

9. A drop hammer as defined in claim 7, said annular space containing plugging material engaging said balls and holding them in position.

10. A drop hammer as defined in claim 7, the opposed surfaces of said parts around said recess and shank being correspondingly shaped for engagement with each other.

11. A drop hammer as defined in claim 10, one of said opposed surfaces having a projecting portion and the other surface having a corresponding recessed portion, the engagement of said portions locating said parts relative to one another.

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