July 18, 1933. J. URBANEK ET AL 1,918,354

HYDRAULIC BRAKE FOR DROP HAMMERS

Original Filed May 10, 1928

Fig.1

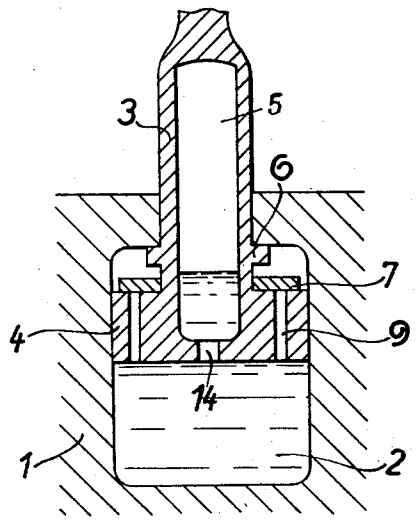


Fig.2

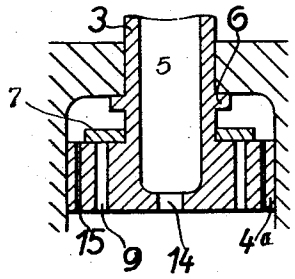


Fig.3

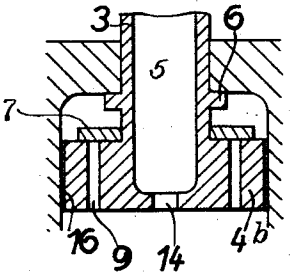


Fig.4

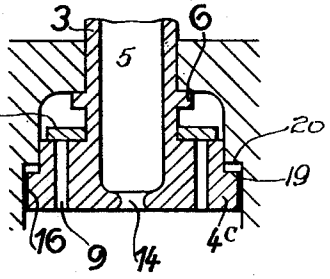
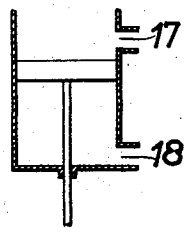


Fig.5



Julius Urbanek
Arthur Schneider
INVENTORS
by Otto Schmid
their Attorney

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UNITED STATES PATENT OFFICE

JULIUS URBANEK, OF VIENNA, AUSTRIA, AND ARTHUR SCHNEIDER, OF DUSSELDORF, GERMANY

HYDRAULIC BRAKE FOR DROP HAMMERS

Original application filed May 10, 1928, Serial No. 276,577, and in Austria May 31, 1927. Divided and this application filed October 16, 1929. Serial No. 399,990.

This invention relates to a hydraulic brake for the tup rod of drop hammers.

Drop hammers are known in which the tup rod, for example, board, toothed rack, piston rod together with the piston and the like, are movable relative to the tup, and in which the momentum of the rod accumulated during the drop is dissipated by a brake. Drop hammers are further known in which the momentum of the rod movable relatively to the tup is accumulated in a steam or air chest of the tup cylinder, and in which the upward movement of the rod is checked by a hydraulic brake in the tup, which brake is only effective during said upward movement.

Both of these constructions have disadvantages. The first mentioned construction leads by the use of an elastic driving medium such as, for example, steam, compressed air or the like to undesired high relative speeds between rod and tup causing the carrier owing to its violent stoppage, to be adversely affected, while the last mentioned construction requires a very long path of retardation which mechanically is unsatisfactory.

It is also old in the art to provide the tup with a hydraulic brake having two pistons, the lower one of which is operative only upon descent of the tup rod against the tup, while the upper piston becomes operative mainly upon the ascent of the tup rod against the tup and prevents impacts between the tup rod and tup. Although this construction provides, theoretically, the best law of motion for the relative movement of the tup rod and tup, it is a very expensive construction by reason of the partly conical, grooved bore in the tup. These disadvantages are obviated by the more economical construction of the device according to the present invention. The present application is a division of our co-pending application, Serial Number 276,577, filed May 10, 1928.

The invention is illustrated in the accompanying drawing, in which, Figures 1 to 4 are fragmentary vertical sectional views of several forms of the device and Figure 5 is a diagrammatic view of a prior art construction well adapted for the application of the present invention thereto.

The simplified construction of our invention dispenses with the substantially constant braking power during descent of the tup rod against the tup and also dispenses with the gradually retarded movement of the tup rod against the tup during relative ascent; it makes use of a longer braking path, but is substantially simpler and more economical in construction.

Referring to Figure 1 of the drawing, 1 denotes the tup having a cavity or bore 2 wherein reciprocates a plunger 4 which is connected by means of a piston 3 with the tup rod, which may be a board, a rack, a piston or the like. The plunger 4 is traversed by ducts 9 which may be closed by the valve 7. During the up stroke the tup is entrained by the collar 6 on the piston 3. The latter is provided with a chamber 5 for reception of the braking fluid displaced by the piston.

The several figures of the drawing illustrate the tup rod in the highest position in relation to the tup. This relative position is also maintained during the descent of the tup rod. Upon impact the tup suddenly comes to rest, but the tup rod and with it the piston 3 and plunger 4 continue to descend. As a result, the fluid under the plunger is displaced being forced partly through the ducts 9 into the space above the plunger and partly through the opening 14 into the chamber 5. The relation between the size of the ducts 9 and opening 14 is such that only so much fluid can escape through opening 14 as can be displaced by piston 3 in its action, as an immersion plunger. In this manner, we prevent the formation over the plunger 4 of an empty space which, upon initiation of the power for the stroke, would necessarily result in strong impacts between the tup rod and tup.

During the up stroke of the tup, the braking fluid must return to the lower side of the plunger 4 so that prior to the down stroke the highest position of the tup rod illustrated in the drawing may be again attained. Inasmuch as the ducts 9 are closed by the valve 7 during the ascent of the plunger 4, other paths must be provided for the return

flow of the fluid. This may be achieved by allowing a certain amount of play of the plunger 4^b in the bore 2 as shown in Fig. 3, or as shown in Figure 2 by providing certain ducts 15 in plunger 4^a which are not covered by the valve or, as shown in Figure 4, by forming grooves 16 in the periphery of the plunger 4^c.

All of these means provide a constant throttling action and, consequently, also constant relative speed of the tup rod and tup. This speed must be of such magnitude that, prior to its down stroke, the plunger has reached its highest position. Where the braking path is long, this speed becomes so great that the collar 6 does not contact with the tup head sufficiently gently and to avoid undesirable brusqueness of contact, the construction of Figure 4 is provided. In this figure, the plunger 4^c is provided with a shoulder 19 which cooperates with a corresponding step 20 in the tup cavity; this arrangement, independently of the ducts 15 or the grooves 16, provides a very effective throttling action of the fluid over the plunger during the latter part of the ascent of the tup rod. In this manner, gentle contact of the collar 6 against the tup head is assured, despite adequately high speed of ascent of the plunger.

All of these means provide a constant throttling action and, consequently, also constant relative speed of the tup rod and the tup. This speed must be of such magnitude that, prior to its next stroke, the plunger has reached its highest position. Where the braking path is long, this speed becomes so great that the collar 6 does not contact with the tup head sufficiently gently and to avoid undesirable brusqueness of contact, the construction of Figure 4 is provided.

The construction according to Figure 5 is a particularly suitable formation of steam or air cushion for use with the simplified construction of brake. Superposed outlet and inlets 17 and 18 respectively, communicate with the cylinder, so that it is over-run upon the stroke of the piston, a cushion being formed beneath the piston and its nature being dependent upon the height of the outlet 18 above the lower cylinder cover.

We claim:

1. In a power hammer comprising a tup having a cavity containing braking liquid, a tup rod piston having a chamber therein and a plunger carried by the tup rod piston, braking means for said power hammer comprising an opening in the plunger providing communication between said cavity and said chamber, ducts in said plunger remote from the periphery thereof and providing paths for the passage of braking liquid from the space below the plunger to that above it, additional ducts adjacent the periphery of the plunger and providing paths for the passage of braking fluid from the space above the plunger to that below it, and a valve of sufficient area to overlie the first mentioned ducts but of insufficient area to overlie the second mentioned ducts.

2. In a power hammer comprising a tup having a cavity containing braking liquid, a tup rod piston having a chamber therein and a plunger carried by the tup rod piston, braking means for said power hammer comprising an opening in the plunger providing communication between said cavity and said chamber, ducts in the plunger providing paths for the passage of braking fluid from either face of the plunger to the other, a valve for closing certain of said ducts, and coating projections on the plunger and tup wall to throttle the liquid escaping from above the plunger during the latter part of the plunger ascent.

JULIUS URBANEK.
ARTHUR SCHNEIDER.