No. 790,566. PATENTED MAY 23, 1905.

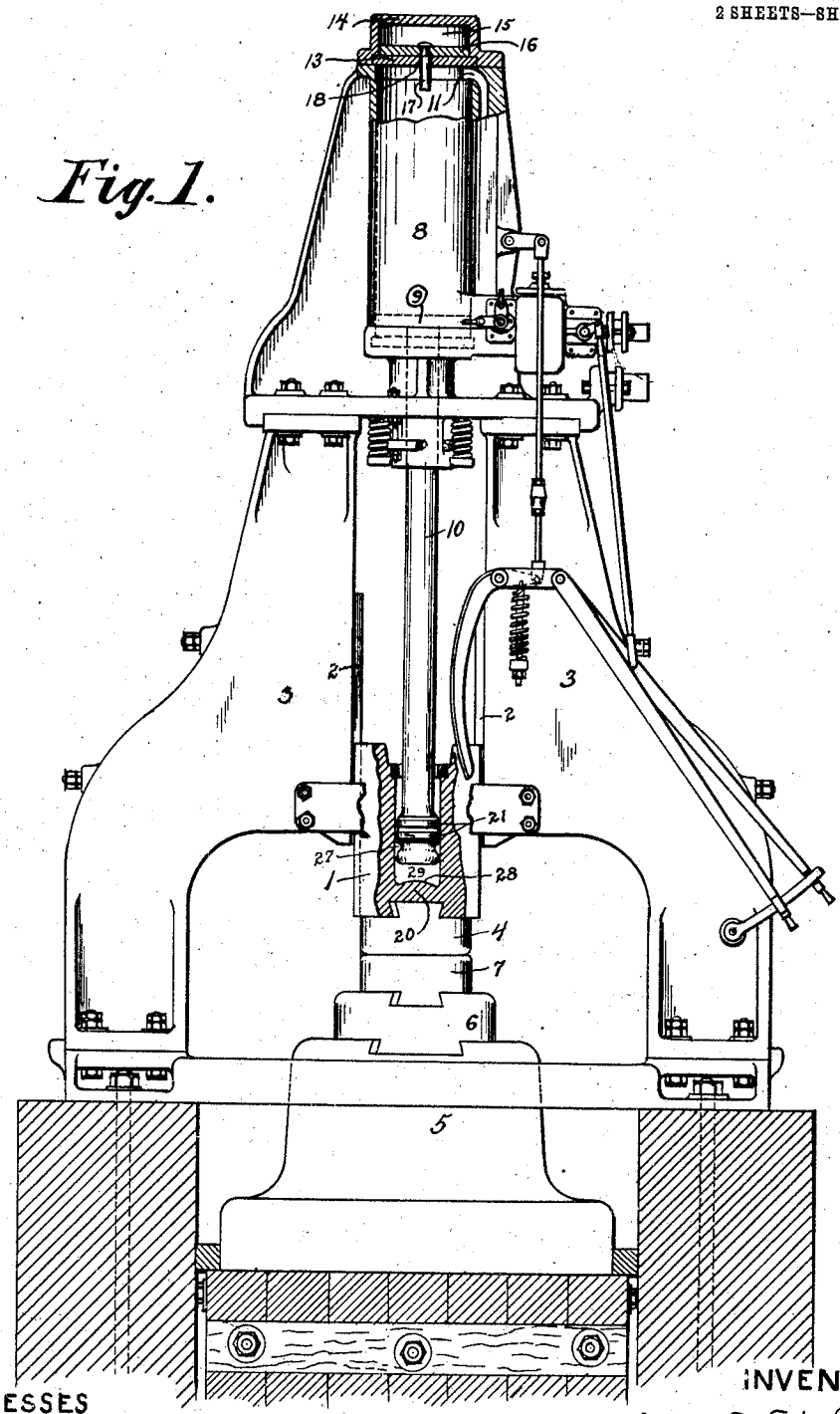
A. L. EICHER.

STEAM HAMMER.

APPLICATION FILED OCT. 12, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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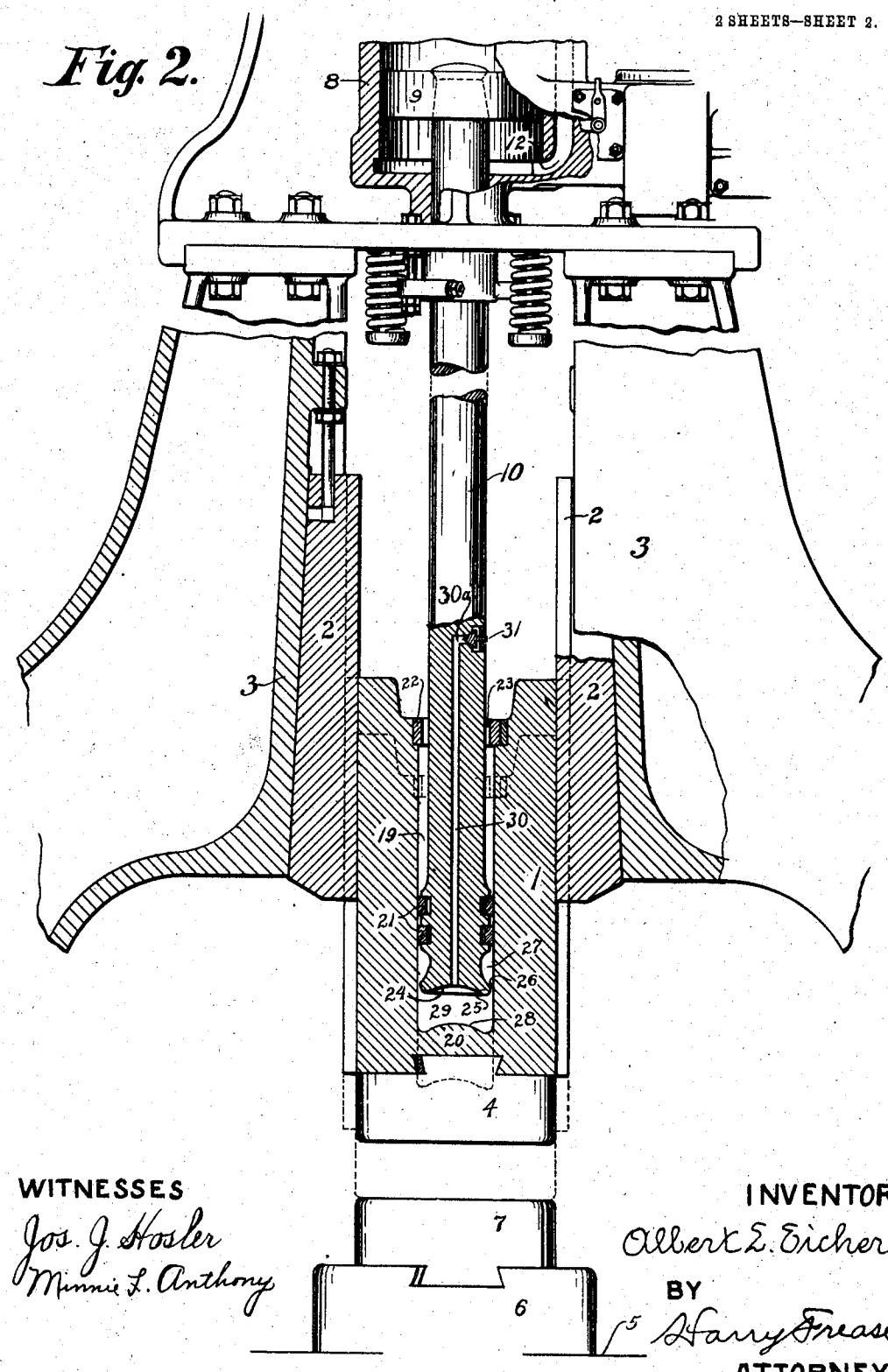
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

ALBERT L. EICHER, OF ALLIANCE, OHIO.

STEAM-HAMMER.

SPECIFICATION forming part of Letters Patent No. 790,566, dated May 23, 1905.

Application filed October 12, 1904. Serial No. 228,113.

To all whom it may concern:

Be it known that I, ALBERT L. EICHER, a citizen of the United States, residing at Alliance, in the county of Stark and State of Ohio, have invented a new and useful Improvement in Steam-Hammers, of which the following is a specification.

The invention relates to steam-hammers; and the general object of the improvement is to make a connection between the piston-rod and the hammer which will permit the hammer to give a substantially free blow and at the same time save the rod from the shocks and strains caused by the blow and rebound of the hammer and the consequent crystallization and breaking of the rod.

The present practice is to attach the piston-rod by tapering its lower end and forcing it into a similarly-tapered axial aperture in the hammer. This aperture must necessarily extend entirely through the hammer, so the end of the rod can be driven out from below in event it breaks off above, which circumstance quite frequently occurs. Such a rigid connection not only subjects the piston-rod to all the shocks and strains of the blow and rebound of the hammer, but makes it very difficult for the engineer, unless he be a more skilful one than is usually obtainable, to manipulate the valves of the steam-cylinder for properly placing the blow of the hammer both as to time and quality, which same largely depends on the relative time the steam is reversed with reference to the delivery of the blow of the hammer. These difficulties are overcome by the mechanism, construction, and arrangement illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of an ordinary steam-hammer with some parts in section, showing the general features of the invention, and Fig. 2 an enlarged sectional view showing the connection of the piston-rod in the hammer more in detail.

Similar numerals refer to similar parts throughout the drawings.

The hammer 1 operates vertically between the guides 2 of the frame 3 and has the detachable die 4 on its lower end. The anvil 5 is located beneath the hammer and has the die-block 6 attached thereon, and the die-block has the detachable die 7 on its upper side, which is arranged to receive the blow of the hammer-die.

The cylinder 8 is mounted on end directly above the hammer and is provided with the usual piston 9 with the attached rod 10 and the upper and lower ports 11 and 12, with the usual valves, levers, and connections for operating and controlling the same. The upper head 13 of the cylinder is provided with the cylindric dome 14, forming the cushion-chamber 15, in which the cushion-piston 16 is adapted to operate. The short piston-post 17 extends downward from the center of the cushion-piston through the aperture 18 in the cylinder-head, in which aperture the post is adapted to operate. The cushion-piston normally rests on the cylinder-head, and in this relation the post extends a short distance into the cylinder, so that the upper side of the engine-piston strikes the end of the post and is cushioned by the air or steam in the chamber 15 and is thereby prevented from striking the cylinder-head.

The elongated axial cylindric cavity 19 is provided in the hammer and extends from the upper end to a point near the lower end, but with the partition 20 between the cavity and the die-seat, so the same is not weakened. The piston-rod 10 is somewhat less in diameter than the hammer-cavity, into which it is inserted, and near the lower end of the rod are mounted one or more packing-rings 21, which completely close the cavity below them. The retaining-collar 22 is removably attached in the upper end of the hammer-cavity and serves as a stop against which the packing-rings will strike to prevent the piston-rod from being withdrawn from the hammer-cavity. This collar is put in place after the rod has been inserted in the cavity, and its inner diameter is made larger than the diameter of the rod, thus leaving the annular interval 23 between them. The retaining-collar is not designed to act as a stop on the packing-ring in the active operation of the hammer, but only when it is held for some time in an elevated position and the leakage of air past the packing-ring permits it to drop downward. From

this construction and arrangement it will be noted that there is no contact or connection between the piston-rod and the hammer, excepting only indirectly by the packing-rings. The lower end of the piston-rod is preferably formed with the bell-shaped concavity 24, with the rim 25 thereof extending near to but not quite touching the wall of the hammer-cavity, thus leaving only the constricted interval 26 around the rim, and between the rim and the packing is preferably provided the considerable annular recess 27, which serves as a reservoir to save the packing from excessive air-pressure or suction.

The bottom 28 of the hammer-cavity is preferably formed reversely similar to the lower end of the piston-rod, and the end of the rod is normally located at a short interval from the bottom of the cavity, thus forming the vacuum-chamber 29 in the lower end of the cavity. While the air in this chamber may occasionally be compressed, and thus act as a cushion, in the proper operation of the hammer it is more frequently expanded to form a quasi-vacuum, and for this reason I prefer to call it a "vacuum-chamber."

In the operation of the steam-hammer constructed and connected as described it is designed to reverse the steam an instant—that is, a brief interval of time—before the hammer delivers its blow, with the effect that the piston-rod is stopped and may be started upward when the hammer-die strikes the anvil-die or the intervening blank or forging, so that during this instant or interval the hammer moves downward independent of the piston-rod, which is either stationary or moving upward, and the increased separation of the end of the piston-rod from the bottom of the hammer-cavity creates a quasi-vacuum in the intervening chamber. While the suction caused by the quasi-vacuum does not act quickly or powerfully enough to materially affect the force of the hammer's stroke, it does develop energy enough to catch the hammer immediately on its rebound and to promptly carry it upward for another stroke, and the blow of the hammer thus freely given is more sudden, sharp, and snappy than is possible to be given by a hammer having a fixed or rigid connection with the piston-rod. In fact, it is almost impossible with such a rigid connection to surely deliver the most effective quality of a blow with the hammer, because if the steam is reversed too soon the hammer is arrested in its downward movement and started upward before the stroke is fully made, while if the steam is not reversed soon enough the stroke is heavy and too long sustained for the best results. On the other hand, with the free-rod vacuum-chamber connection there is quite a little leeway as to the time the steam must be reversed, which is covered by the elasticity of the connection. If, perchance, the steam is not reversed before the hammer strikes, the piston-rod is cushioned against the shock by compressing the air in the vacuum-chamber; but this situation need not arise if the parts are so proportioned that the engine-piston reaches the lower end of the stroke before the hammer makes its blow. Furthermore, by providing the annular interval 23 between the piston-rod and the retaining-collar the cylindric cavity remains open at the upper end, and there is no closed pocket in which air is caught and compressed and the free downward movement of the hammer thereby retarded when the blow of the hammer is delivered. In other words, there is nothing to restrain the free downward movement of the hammer when the piston has been reversed, excepting only the friction of the packing-ring in the cylindric cavity and the resistance of the air against expansion or rarefication in the closed cavity below the ring, which resistance is manifestly more sensitive and delicate than that of air in compression, and especially so if it is accompanied by such compressed-air resistance, which would be the case if the cylindric cavity were closed at the upper end as well as at the lower end. By these means there is thus obtained substantially the same quality or character of a blow by a steam-hammer that is delivered by a drop-hammer, with the additional advantage that the piston-rod on which the hammer is suspended is entirely free from any contact or connection with the hammer, excepting only the sliding contact of the packing-ring, which saves the rod from all longitudinal shocks, and this same contact, in connection with the entire freedom of the rod above, permits the hammer to oscillate sidewise in event the hammer strikes an uneven surface and saves the rod from all lateral strains, and as it is such lateral strains as well as longitudinal shocks that causes the piston to crystallize and break this danger and damage is avoided by the construction described herein. When the piston-rod acts to compress the air below it, the action is so quick that the bell-shaped lower end catches the air like a parachute and there is no opportunity for much air to escape through the constricted interval around the rim into the annular recess thereabove, and this recess acts as a supplemental cushion to keep the full force of the compression from the packing, and, reversely, when a vacuum is formed in the chamber below the end of the piston-rod the action is so quick there is no opportunity for much of the air in the annular recess above the rim to pass down through the constricted interval around it, so that the recess acts as a supplemental vacuum-chamber to save the packing from the full force of the suction.

While a small amount of leakage past the packing-rings does not materially affect the operation of the hammer, as described, because

of the quickness of its stroke, yet if the hammer is suspended on the piston-rod for an extended period such leakage will permit the hammer to gradually drop down along the rod until the retaining-collar is stopped against the upper packing-ring. For this reason I prefer to provide the axial port 30 in the piston-rod with the lateral branch 30^a, opening at a convenient point above the hammer, and to provide a suitable check-valve 31 to permit the air to exhaust from the vacuum-cavity, but to stop any air from entering therein. By this means the hammer can be readjusted to its proper place on the piston-rod by merely lowering it to a support on the anvil, when the rod can be pushed into its normal position by expelling the surplus air from the vacuum-chamber.

The means for providing a cushion for the steam-piston head at the upper end of its stroke illustrated and described, but not claimed herein, will be made the subject of another application for Letters Patent.

What I claim herein as my invention, and desire to secure by Letters Patent, is—

1. In a steam-hammer, the combination of a hammer having a cylindric cavity therein, a piston-rod in the cavity, and a packing-ring on the rod near its lower end and closing the cavity therebelow, the cavity being open at its upper end.

2. In a steam-hammer, the combination of a hammer having a cylindric cavity therein, a free piston-rod in the cavity, and a packing-ring on the rod near its lower end and closing the cavity therebelow, the cavity being open at its upper end.

3. In a steam-hammer, the combination of a hammer having a cylindric cavity therein, a piston-rod in the cavity, a packing-ring on the rod near its lower end and closing the cavity therebelow, the cavity being open at its upper end, and a retaining-collar in the cavity above the packing-ring loosely encircling the piston-rod.

4. In a steam-hammer, the combination of a hammer having a cylindric cavity therein, a piston-rod in the cavity having a bell-shaped lower end with a rim forming a constricted interval between the wall of the cavity and the rod, and a packing-ring on the rod near its lower end and closing the cavity therebelow.

5. In a steam-hammer, the combination of a hammer having a cylindric cavity therein, a piston-rod in the cavity having a rim on the lower end forming a constricted interval between the wall of the cavity and the rod, with an annular recess above the rim and a packing-ring on the rod above the recess and closing the cavity therebelow.

6. In a steam-hammer, the combination of a hammer having a cylindric cavity therein, a piston-rod in the cavity, a packing-ring on the rod near its lower end and closing the cavity therebelow, the cavity being open at its upper end, and means for exhausting air from the cavity when the rod is thrust inward.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

ALBERT L. EICHER.

Witnesses:
MINNIE F. ANTHONY,
HARRY FREASE.