No. 706,290. Patented Aug. 5, 1902.

A. J. ZWART.

METALLIC PACKING.

(Application filed Mar. 5, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

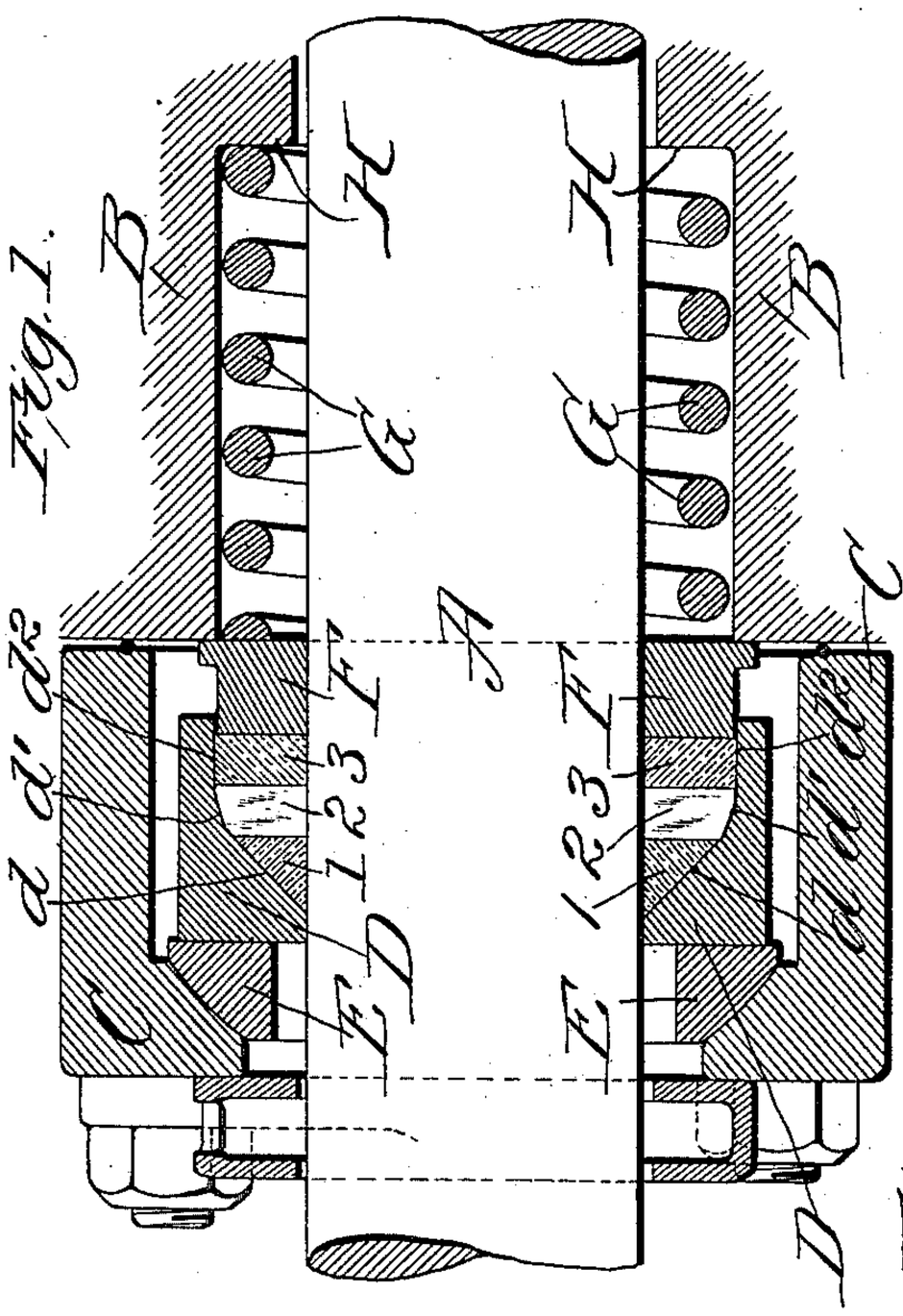


Fig. 2.

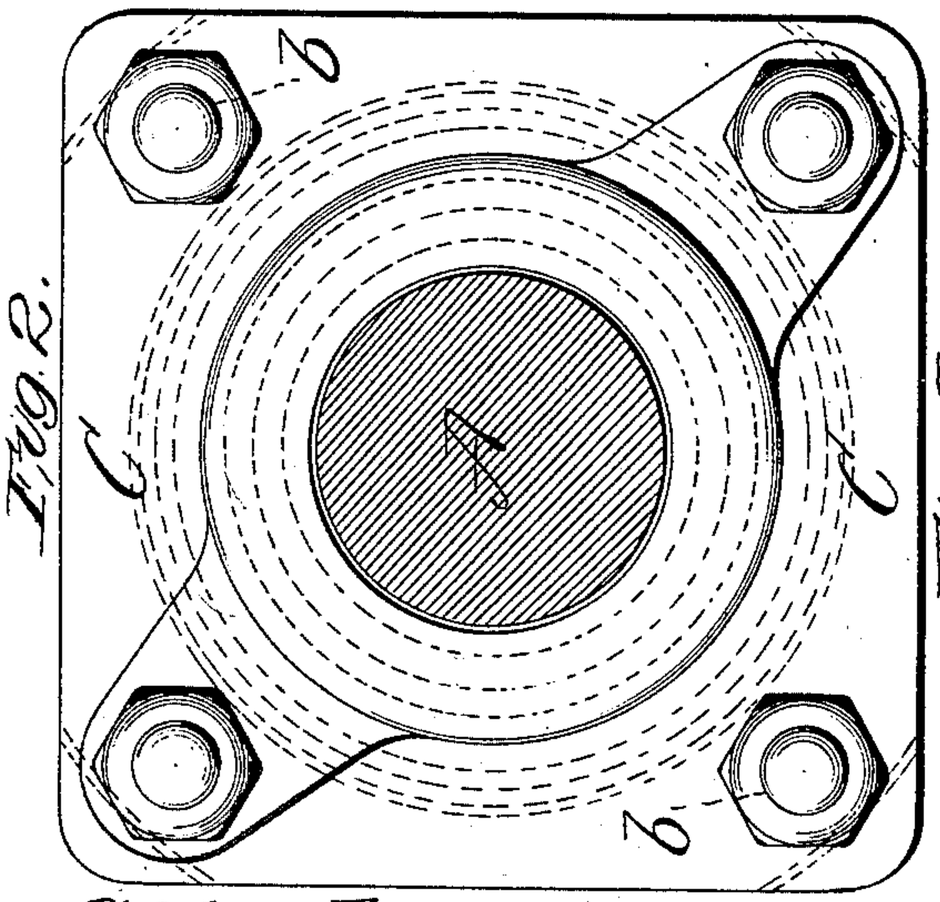


Fig. 8.

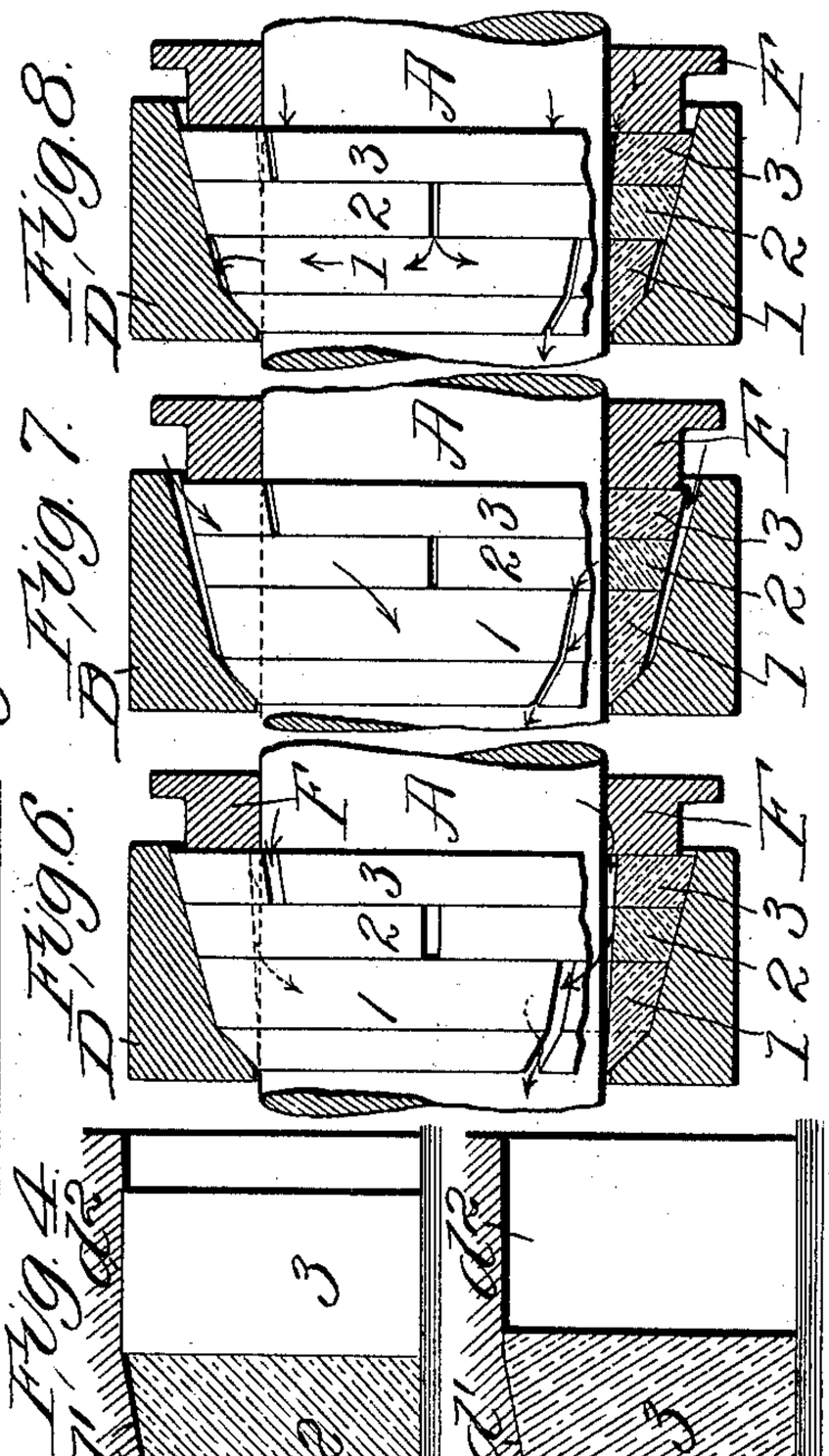


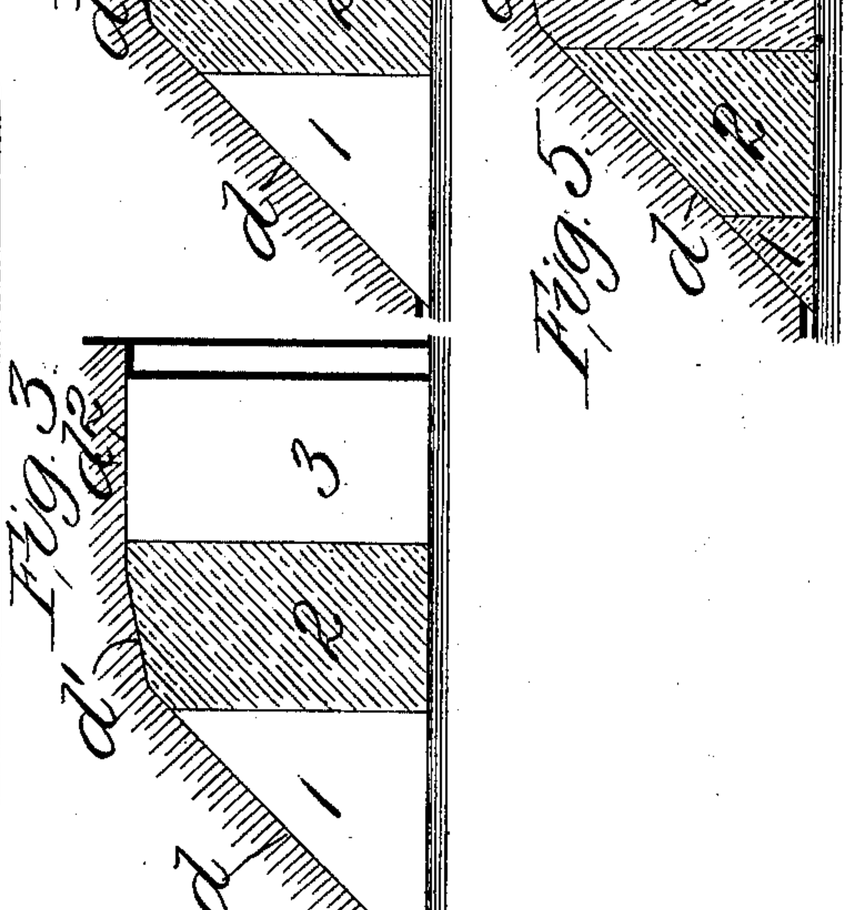
Fig. 7.

Fig. 6.

Fig. 4.

Fig. 5.

Fig. 3.



Attest.
Jno. H. Jeffers.
H. L. Amer.

Inventor:
Albert J. Zwart.
By Bakewell & Cornwall,
Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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2 Sheets—Sheet 2.

Fig. 9.

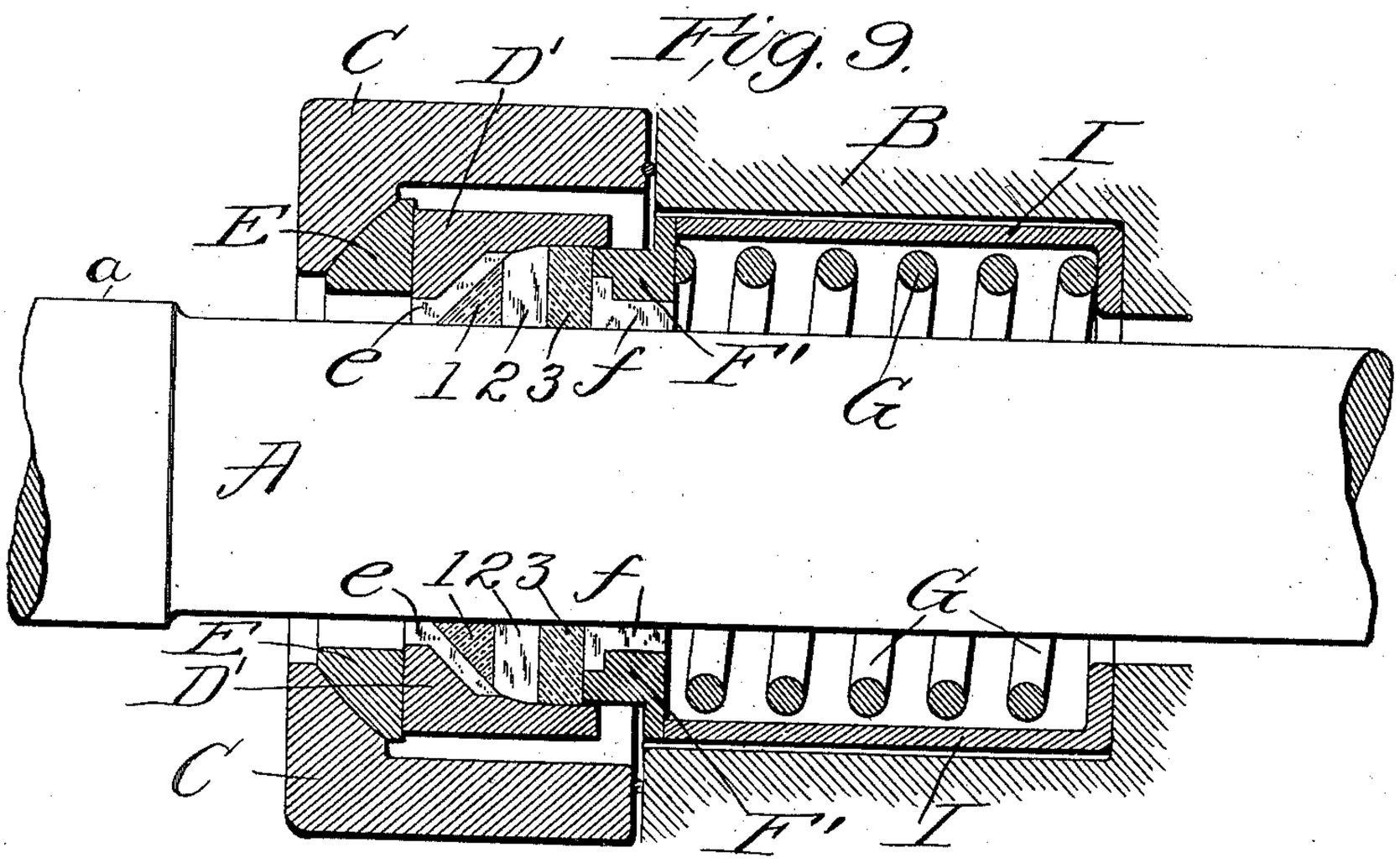


Fig. 10.

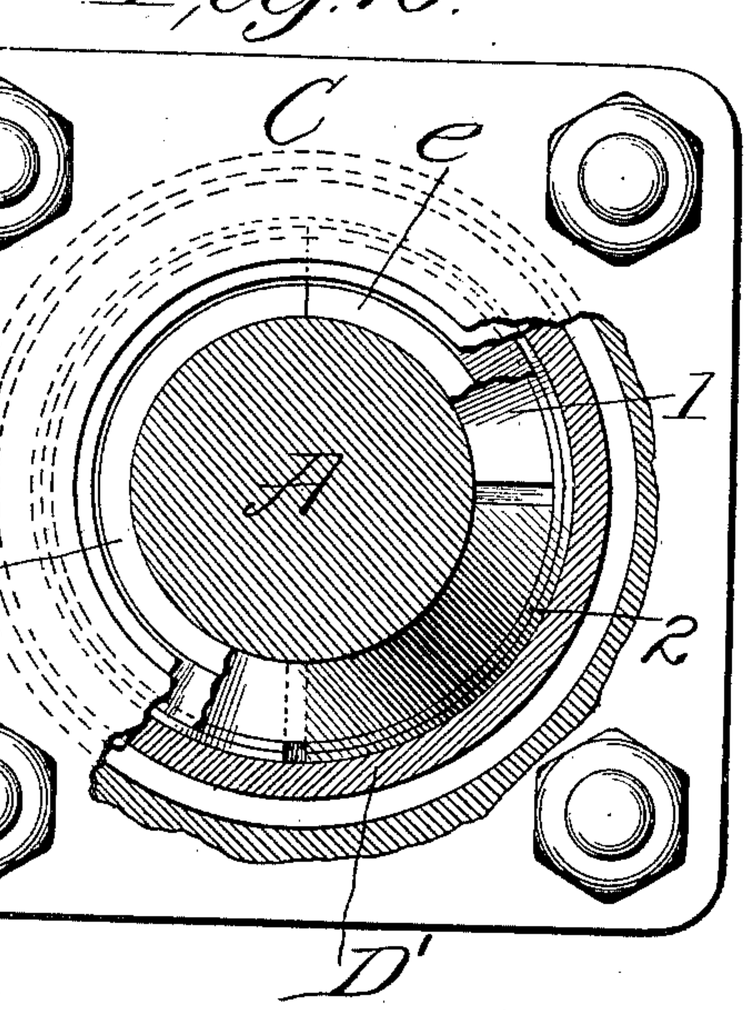
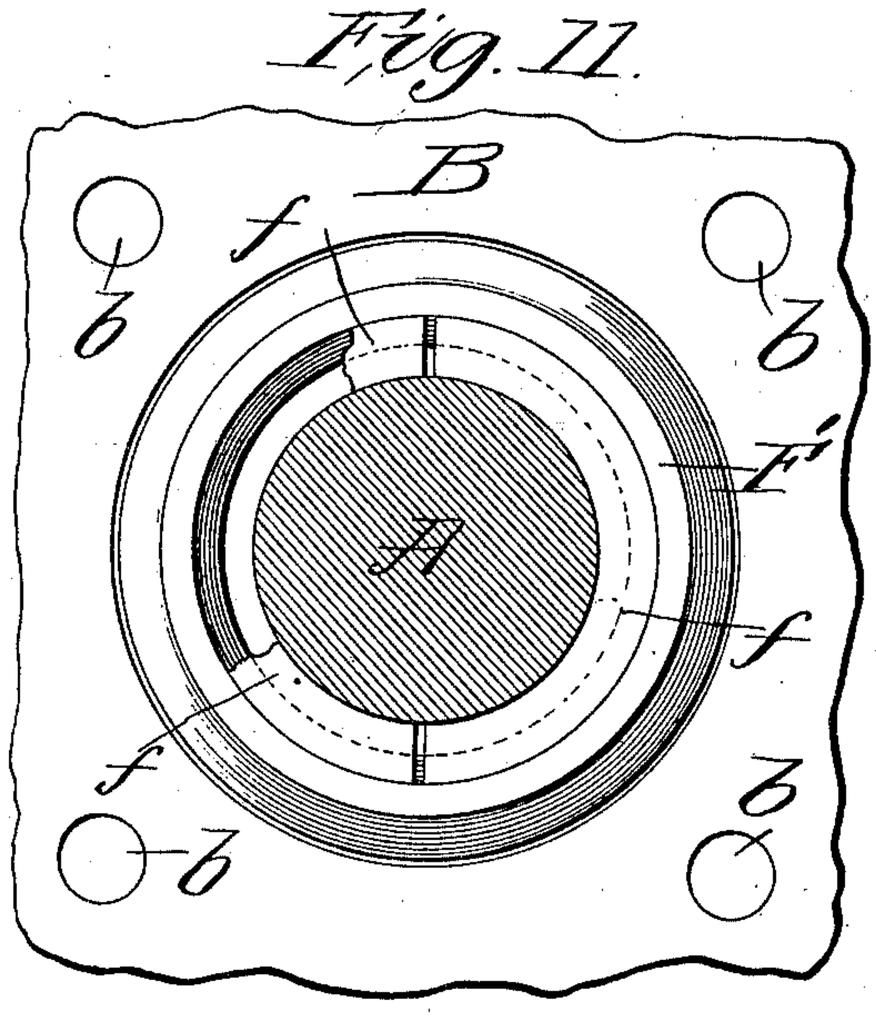


Fig. 11.



Attest:
W. A. Scott.
H. L. Amer.

Inventor:
Albert J. Zwart,
by Bakewell & Cornwall,
Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALBERT J. ZWART, OF CHICAGO, ILLINOIS.

METALLIC PACKING.

SPECIFICATION forming part of Letters Patent No. 706,290, dated August 5, 1902.

Application filed March 5, 1901. Serial No. 49,878. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. ZWART, a citizen of the United States, residing at the city of Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Metallic Packing, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional view through my improved metallic packing. Fig. 2 is an elevational view of the outer face of the packing-case, showing position of the stud-holes and the rod in section. Figs. 3, 4, and 5 are detail sectional views showing the movement of the metallic wearing-rings through the various bores of the vibrating cup as they wear in service. Figs. 6, 7, and 8 are sectional views showing the effect of rod vibration hitherto on the metallic wearing-rings which it is desired to obviate. Fig. 9 is a sectional view of my improved metallic packing as applied to rods having enlarged diameter at the cross-head fit. Fig. 10 is a sectional view, partly in elevation, certain of the parts being broken away to more clearly illustrate the wearing-ring. Fig. 11 is an elevational view of the follower-ring such as is illustrated in Fig. 9.

This invention relates to a new and useful improvement in metallic packing for valve-stems and piston-rods, the object being to so construct the vibrating cup as to provide therein a succession of conical bores supplemented by a cylindrical bore for the purpose of producing in connection with metallic wearing-rings working within the vibrating cup and in conjunction therewith a steam-tight or air-tight joint for the passage of reciprocating rods.

While my invention involves chiefly the construction of a vibrating cup in conjunction with metallic wearing-rings, an important feature for the continued service of steam or air tight packing resides in the construction of the vibrating cup in such a manner as to extend beyond the third ring, so as to admit entrance of the follower, as illustrated, which latter shall at the beginning and at all times during service snugly fill the annular space between the rod and the inner wall of the vibrating cup through a section of the latter's cylindrical bore.

Another object is to so construct the packing that it may be applied to a rod having an enlarged end for its fit into the cross-head or other connection, the packing proper of necessity being fitted to that part of the rod having a smaller transverse section than such enlarged diameter.

With these objects in view the invention consists in the construction, arrangement, and combination of the several parts of my device, all as will hereinafter be described and afterward pointed out in the claims.

In the drawings, A indicates the rod (having in Fig. 9 an enlarged diameter for the cross-head fit); B, the stuffing-box projection as usually cast integral with the cylinder-head; C, the supplementary stuffing-box or packing-case, held in position against the face of the stuffing-box by means of studs through the bolt-holes *b b*, Fig. 2.

D, Fig. 1, represents the vibrating cup bored to produce the annular conically-bounded cavities *d* and *d'* and the cylindrically-bounded annular cavity d^2, the face of the vibrating cup at its outer end with reference to the cylinder having a bearing against what may be designated the "ball-ring" E, which has its inner end faced true and ground against the contacting face of the vibrating cup for the purpose of minimizing the resistance to the vibratory motion of the rod offered by the bearing of the vibrating cup on this face and at the same time preserving a steam-tight joint between the faces.

D', Fig. 9, represents a vibrating cup bored so as to admit the passage of the enlarged cross-head fit *a*, with a divided bushing *e e*, so as to be properly introduced into position, said bushing fitting into the front end of the vibrating cup.

1, 2, and 3 represent metallic wearing-rings, ring 1 being beveled on its outer face when initially applied at an angle to coincide with the corresponding bore in the vibrating cup. Ring 2 has its front edge started into the smaller or foremost conical bore, while its outer wall fits and coöperates with the corresponding second conical bore in the vibrating cup, tapered at a considerably-reduced angle with reference to the rod from the angle produced by the first conical bore. The bore of the vibrating cup beyond the second de-

scribed conical bore is made cylindrical, and the rear edge of ring 2 passes a short distance into this cylindrical bore. Ring 3 has a plain outer wall coinciding with but not completely filling the remaining length of the cylindrical bore.

F, Fig. 1, represents a spring-pressed follower the transverse section of which snugly fills the annular section between the rod and remaining cylindrically-bored section of the vibrating cup.

F′, Fig. 9, represents a follower whose internal diameter is such as to be easily introduced over the enlarged diameter *a* of the rod A and the split liner-blocks *f f*, fitting within the follower F′, Fig. 9, being shouldered therein and bearing against the rod.

The usual spring G is employed to maintain a forward thrust by the follower and upon the rings 1, 2, and 3 to force them into the cones, the compression of said spring being between the follower F and the projection within the stuffing-box of the cylinder-head casting H.

I represents a stuffing-box bushing for the purpose of reducing the bore of the stuffing-box B when necessary to serve as a back member to the follower.

Piston-rods have heretofore been packed with metallic wearing-rings seated within and coöperating with the vibrating cup, and in considering the improvement sought after it may be explained that (*a*) owing to the high steam-pressures of the present day and (*b*) the excessive rod vibration due to excessive wear of the cross-head connection between reciprocating parts conditions are encountered which it is the purpose of my invention to effectively surmount.

(*a*) Under high steam-pressures referred to the forward thrust of the follower F upon the metallic wearing-rings 1, 2, and 3 has heretofore been great enough to produce a severe wedging effect of the rings in the cone or vibrating cup, resulting in an excessive friction and consequent wear at the inner bearing-face of ring 1 on the rod and an equivalent rapid deterioration of the rings. This wedging effect may be reduced by increasing the angle at which the conical bore in the vibrating cup D ascends from the rod; but it is obvious that the greater the angle thus employed the greater will be the circle to which the conical bore *d* will extend over the rod, and consequently the greater will be the outside diameter of the vibrating cup; but the extent to which the vibrating cup may thus be enlarged is limited by the diameter of the circle on which the stud-bolts at *b b* are placed by the engine-builder. There are therefore fixed limitations which must be considered in securing a suitable construction of vibrating cup. With this limitation as to available diameter explained a second consideration is to obtain a taper in the cone which at the greatest diameter permissible under the restriction noted above will permit of ring 2 entering the conical cavity *d* simultaneously with its occupation by ring 1 without reducing the available width of conical cavity *d* for the insertion of ring 1 to a suitable width, permitting also of such proportionate width of rings 1, 2, and 3 in their relation to each other as will be found necessary by further reference to their operation hereinafter. I employ, therefore, a conical bore *d* and further reduce the tendency of forward feed of ring 2 upon ring 1 by a second conical bore *d′*, the angle at which said tapers are made being estimated to produce an outside diameter of the vibrating cup practically to the extent of and within the limits prescribed. Rings 1, 2, and 3 are made up in sections, a space being left between the contiguous ends thereof, these sections breaking joints with each other.

Referring to Fig. 3, the steam-tight contact between the faces of rings 1 and 2 and the steam-tight joint effected between the periphery of both within the same conical bore *d* is supplemented after a short service by a similar contact and bearing between rings 2 and 3 within conical bore *d′*, as in Fig. 4, it being estimated that the wear of the internal diameters of the rings in their initial position, as in Fig. 3, will be such as at first to permit of a rapid conformity of their bearing-surfaces to the surface of the rod and consequent rapid initial movement into smaller sections of the cones, coincident with which the contiguous ends of the two sections of ring 1 will have abutted each other, thereby producing in ring 1 a closed or solid arch bearing on its outer wall against the abrupt taper of cone *d* as a further resistance and lessening the susceptibility of ring 1 to the following thrust of rings 2 and 3. In this condition the jamming or flow of metal of rings 1, 2, and 3 in their heated or semifused state produces the continued steam-tight joint on the rod with a minimum wedge of friction upon the rod.

Referring now to Fig. 5, my previous reference to "proportionate width" between the rings is obvious. Ring 2 is represented entirely within conical bore *d* with ring 3 having also practically entered to form its steam-tight contact in the same cone against the joints of contiguous ends of the two sections of ring 2 and a similar contact between their periphery and conical bore *d*, this simultaneous occupation of conical bore *d* having ensued prior to the possibility of ring 1 by its entire disappearance having left exposed a possible open joint at the ends of the two sections of ring 2. At this period in the service another plain-faced ring corresponding in size and shape to ring 3 will necessarily be introduced within the cylindrical bore of the vibrating cup in advance of the follower.

(*b*) In regard to the effect of rod vibration I have made use of illustrations in Figs. 6, 7, and 8 to represent the effect of same hitherto on metallic wearing-rings. When rings 1, 2, and 3 are new and first placed in service,

they practically bear at all points against the contiguous conical bores and surface of the rod. Under conditions of locomotive service largely predominant and of comparatively recent development the vibration of the rod in delivering its impact to the metallic wearing-rings effects a battering-out or enlargement of their internal diameter, particularly of rings 2 and 3, as shown in Fig. 6, so that steam may follow along the rod and find egress between the ends of the split ring 1. If the movement of rings 2 and 3 is inward upon the rod, as shown in Fig. 7, then although the space immediately around the rod (shown in Fig. 6) may be closed it follows that a corresponding space is unoccupied between the outer walls of the rings and the cone of the vibrating cup, so that steam still has admission to the split of ring 1 and thence to the atmosphere. Another and subsequent position of the rings is shown in Fig. 8, wherein ring 1 has been forced forwardly, the front edge being crowded in upon the rod so as to cause said ring to occupy practically a canted position, the wear being greatest at the front inner face thereof. Under this condition rings 2 and 3 will naturally follow, and while they more nearly fill the space between the vibrating cup and the rod, Fig. 8, yet the vibration of the rod will batter the rings so as to form a leakage, particularly along the inner surface of ring 3, the steam escaping through this path along the rod and through the open joints between the segments of ring 2 up to and around the periphery of that portion of ring 1 situated in the second cone and around to the splits of ring 1 and out to the atmosphere. These conditions have been found to exist in actual service, and it is the purpose of my present invention to obviate the same, producing a packing which shall be steam-tight when initially introduced and at all times thereafter in service. To prevent the impact upon the metallic wearing-rings of the rod in its vibration, I extend the cylindrical bore of the vibrating cup beyond ring 3, so as to provide a cylindrically-bounded annular space between the rod and inner wall of the vibrating cup as a path for the forward ring-compressing movement of the follower F. By such adaptation of a follower close fitting to the rod and with similar contact with the inner wall of the vibrating cup the lateral thrust of the rod in its vibration is delivered directly to the follower thus closely confined and thence to the vibrating cup without the intervention of the soft rings. The entire packing, therefore, follows the rod in its vibratory motion, obviating the disturbance of the steam-tight fit of the metallic wearing-rings between the rod and varying bores of the vibrating cup, it being understood that the follower is of brass or other metal not susceptible under the conditions to the battering effect of the vibration in question.

An additional feature of the efficiency arising from my construction exists in the fact that the succession of conical bores described, which permits of following metallic wearing-rings entering always full sectioned into reducing-cones in their forward path, (shown in Fig. 4,) thus distributing the wedging impact upon the rod over a greater length of bearing-surface thereof, offers greater resistance to the passage of water. This is important from the fact that the liability of water reaching the forward or ring 1 is reduced, eliminating thereby or reducing the liability of injury to the internal bearing-surface of ring 1 through the forced passage of such water. In special cases (where the limitations hereinbefore referred to as to diameter permissible for a vibrating cup externally may be increased) my construction would cover a succession of two cones or more with a final cylindrical bore in the vibrating cup. In vertical stationary steam-engines and marine engines, where this leakage of water is particularly objectionable, the opportunity for an increased diameter of vibrating cup is sometimes obtainable.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a piston-rod or valve-stem and packing-case therefor, of a single vibrating cup containing a plurality of conical bores and one final cylindrical bore, wearing-rings within said bores, the combined length of said rings being less than the combined length of said bores, and a follower snugly fitting between said rod and the interior circumference of said cylindrical bore and longitudinally movable therein; substantially as described.

2. The combination with a piston-rod or valve-stem and packing-case therefor, a vibrating cup, and a wearing-ring in said cup, of a follower fitting about said rod and in said cup and bearing snugly and directly between said rod and the interior circumference of said cup, whereby said follower connects said rod and cup and causes them to move together during the vibration of said rod; substantially as described.

3. The combination with a rod having an enlarged diameter at its extremity and a packing-case therefor, of a vibrating cup having a split bushing, said vibrating cup being bored to provide two or more conically-bounded, and one cylindrically-bounded conical cavities around the rod, metallic wearing-rings, a combination sliding face and ball-seated ring, a follower, a spring, and a stuffing-box bushing against which said follower bears; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 1st day of March, 1901.

ALBERT J. ZWART.

Witnesses:
WM. H. SCOTT,
GEORGE BAKEWELL.