To all whom it may concern:

Be it known that I, CHARLES P. MINNING, citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Flexible Metallic Packing, of which the following is a specification.

To those versed in the art to which this invention appertains, it is well known that modern steam engineering has shown a marked tendency to and preference for high steam pressures, and that it has also become the practice to superheat the steam. Consequently, under the present conditions, serious difficulties have been encountered as regards the prevention of leakage and waste of steam from valves, piston rods and the like, and such leakage and waste incidental thereto have been a serious factor to reckon with in the maintenance of steam plants.

Owing to the high steam pressures maintained and also to the fact that it is customary in a great many instances, to superheat steam, manufacturers of the so called soft packing have found it difficult, if not practically impossible, to keep abreast with the tendency to increase the steam pressure under varying conditions, such packing, even when of the highest grade, being relatively expensive, and even if of the highest grade, rapidly deteriorating in service, thereby requiring replacement and replenishment at frequent intervals to stop the leakages that occur and the waste which is incidental thereto. The so called soft packing, then, has not been found satisfactory under the conditions hereinbefore specified, but the so called hard or metallic packing has not successfully supplanted the soft packing, owing to the fact that the hard packing, as heretofore ordinarily constructed, has not only failed to prevent leakage and its consequent waste, but has been found to be very expensive, and when designed for use in connection with valves, to cost more than the valve itself, which manifestly renders it unfit from a commercial standpoint, as the trade will not stand for any great increase in the cost of the valves.

It is quite evident that in order for a metallic packing to be adopted and a success, it must not only be durable and efficient, but at the same time capable of being cheaply constructed and easily assembled, and it is with these conditions in mind that I have produced the packing of the present invention.

It will thus be understood that my invention aims primarily to provide a hard or metallic packing for steam valve or piston rods and the like which will be of simple construction, durable and efficient in service, not liable to get out of order or require repairs or replacement and capable of being manufactured at a minimum cost and without waste of material, and with this main object and other subsidiary objects in view, as will more fully appear as the description proceeds, the invention consists in certain constructions, arrangements and combinations of the parts that I shall hereinafter fully describe and claim.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawing, in which,

Figure 1, is a sectional view of a portion of a steam valve embodying packing made in accordance with my invention. Fig. 2, is a similar view showing the packing used in connection with a piston rod. Fig. 3, is a bottom plan view of one of the packing cones or thimbles, and Fig. 4, is a detail view, on a reduced scale, of one of the spacing rings or distance pieces hereinafter referred to.

Corresponding and like parts are referred to in the following description and designated in the accompanying drawing by like reference characters.

In that embodiment of my invention illustrated in Fig. 1, my improved packing is shown as embodied in a steam valve, of which 1 designates the bonnet which is formed with a threaded bore 2 for engagement with the threads of the valve rod 3, said bore terminating at its outer end in a chamber 4 and the neck of the bonnet being externally threaded. The neck of the bonnet is exteriorly threaded at its end, as indicated at 5, for engagement by the internal screw threads that are formed within the cap 6 through which the valve rod 3 passes.

In carrying out my invention, I employ as a packing around the valve rod 3, a thimble 7, preferably of metal, although it may be composed of fiber or other suitable substances or material, such thimble be-
ing in the form of an inverted truncated cone, as clearly illustrated in the drawing, and being preferably thinner at its smaller tapered end where it directly surrounds and snugly fits and engages the valve rod 3, than at its outer portion, said thimble being provided at its outer end with an annular outstanding flange 9 adapted to fit upon the extremity or rim edge of the bonnet 1, whereby the thimble may be securely clamped thereupon by means of the screw cap 6.

From as much of the description as has preceded in connection with correlated views of the accompanying drawing, it will be understood that when the steam is turned on, whatever steam passes the threaded bore 2 and the circumscribed portion of the valve rod 3, will act upon the thin tapered and circumferentially continuous end 8 of the thimble 7 and will compress said end tightly against the valve rod, the higher the pressure of this steam, the greater being the compression effect and the tighter the fit between the thimble and the rod. As the steam flows into the chamber 4 and thereby compresses the inner tapering and relatively thin end of the thimble around the valve rod, the steam will impact against the outer end of the flange 9 of the thimble, and reacting will entirely fill the space in the chamber 4 exteriorly of the thimble and within the surrounding walls of the chamber, and consequently, the inner end of the thimble will be at all times compressed upon the valve rod and secure a steamtight joint.

If desired, I may use more of the packing thimbles 7. For example, as illustrated in Fig. 1, I have shown how two of these thimbles arranged in nested relation to each other, but held in spaced relation by means of a spacing ring 10 or the like interposed between the flanges of the two thimbles, the cap 6 directly binding upon the outermost flange, and thereby clamping both thimbles in place, together with the intervening spacing ring. It is to be understood that my invention is not limited to any number of these thimbles, but it is to be noted particularly that the conical surface of each thimble is continuous and unbroken throughout its extent and that preferably the inner tapering ends of the thimbles where they directly contact with and surround the valve rod are extremely thin in proportion to their outermost portions, although each thimble throughout is of relatively thin metal, whereby the steam acting thereupon may tightly compress the packing around the rod.

By the use of flexible metallic packing constructed and arranged as hereinbefore described, it will be seen that not only will the joint be maintained tight at all time and all leakage and its consequent waste of steam and the relative increase in the consumption of fuel prevented, as well as the necessity of losing time which is one of the disadvantages incidental to the use of soft packing and the necessary time required in repacking the valves, but in addition to these points, my invention obviates entirely the use of a gland such as is ordinarily used with a soft packing stuffing box, and furthermore, enables the valve rod to be made very short, whereby the liability to bend the same is practically precluded. For example, it is well known that with the use of soft packing, as heretofore ordinarily employed, it is necessary to make the valve rod relatively long so that the hand wheel or the like on the outer end thereof will be spaced a sufficient distance from the bonnet when the same is in closed position, to permit the gland-retaining cap and its component parts to be removed; this length of valve rod rendering the same liable to be bent when struck, and subsequently, unfit for service, whereas by the use of my invention and the consequent elimination of the necessity of removing the screw cap or the replacement or repair of the packing, the valve rod may be made very short so that when the valve is in closed position, the hand wheel designated 11 may come very close to the cap 6.

It is to be understood that my invention is not limited to the precise construction, arrangement and proportions of the parts described in the foregoing portion of the specification and its related views of the accompanying drawing; neither is the invention limited for use in connection with steam valves. For example, reference is to be had to Fig. 2 wherein the invention is illustrated in connection with a piston rod designated 12. In this view, 13 designates a ground bushing in the bottom of a cylinder casting, and 14 designates my improved metallic packing thimbles, of which there may be any desired number arranged in a series, as shown. The uppermost thimble of the series is held in properly spaced relation to the bushing 13 by means of a ring 15 of cast iron or the like, and the several thimbles are held in properly spaced relation to each other by means of split spacing rings 16 interposed between the outstanding flanges 17 of the thimbles. It will thus be understood that even if in the rapid reciprocation of the piston rod 12, any steam should leak past the first thimble in the series (which is a remote contingency), it will be stopped by the next in the series and so on, until finally, should any steam leak past far enough, it is evident that it will be so cool that it will condense, and will thereby not only assist in sealing the joint and prevent any leakage of the steam, but may practically assist in the lubrication of the rod. Preferably, in
this arrangement of parts, I tap the wall of the stuffing box within which the thimbles 14 are disposed, say, between the third and fourth thimbles in the series, and connect the opening, thus formed, with a condenser by means of a pipe 18; and, if desired, may tap the wall of the stuffing box at another point, say, between the fourth and fifth thimble in the series, and connect at this point, a pipe 19 leading from an oil pump or supply. As the spacing ring 16 between the third and fourth thimbles is split or cut, it is possible to create a partial vacuum in the space formed between said thimbles, and if any drops of water should find their way into this space, the pipe connection 18 will carry the leakage to the condenser, without impairing the vacuum, as the fourth thimble or cone in the series will take care of the same. Obviously, as the space formed by the fourth cone in the series and the fifth cone and the distance piece or spacing ring 16 therebetween, has the pipe connection 19 connected thereto and communicating thereto, the split in the distance piece will here be the means of keeping said space filled with oil circulating at a relatively low pressure, and consequently a very thin film of oil will be supplied to all parts of the piston rod, which will keep the rod and packing true and in perfect condition, while at the same time, the remainder of the thimbles or cones will continuously keep the rod wiped clean, so as not to carry the oil into the cylinder. But even without the oil, sufficient lubricant will be supplied in view of the fact that there will always be more or less condensation taking place which will lubricate said space. As the surface of contact is very small, as will at once be apparent, it will be easy to lubricate a piston rod arranged as illustrated in Fig. 2, either by oil or water in the manner described, and for the same reason, it will also be very much easier to keep the cones tight and they will last a very long time. And one of the greatest advantages will be the reduction in friction, owing to the small contact surface and the almost perfect lubrication that can be obtained. It is evident that by using packing of the character of mine, the pressure used in the engine will also supply just enough pressure to keep the cones tight, thereby regulating the friction automatically, whereas other packing, especially metallic packing, must be adjusted by spring tension or the like to at all times stand the full pressure, whether the engine be working at full pressure or not. With my invention, when the engine is stopped, the pressure on the cones will be nil. Besides soft packing has to be screwed or tightened from time to time by means of studs and nuts in order to adjust the tension and stop the leakage.

90 designates a cap which is similar in function to the cap 6 hereinbefore referred to and which engages the flange of the outermost cone or thimble 14 in the series, said cap being secured by said stud bolts or similar fastening devices to the wall of the stuffing box, as clearly illustrated in the drawing.

As a further advantage of my invention, as applied to steam valves, it is to be noted that with my device, it will not be necessary to machine the wall of the chamber 2 and only necessary to machine the extremity of the bonnet where the flange of the cone or thimble engages, whereas with the ordinary soft packing, it is necessary to machine the entire wall of the chamber in which the packing is received, thereby adding to the expense of the valve.

What I claim is:

1. As a new article of manufacture, the herein described hard packing thimble in the form of a truncated cone the wall of which tapers in thickness toward the smaller end and having an unbroken and perfectly smooth surface, the extremity and thinnest edge at the smaller end of the cone being adapted to surround and contact with a rod and every portion of the wall of said cone corresponding in thickness with all other portions thereof that lie in the same transverse plane, for the purpose specified.

2. In a device of the character described, the combination with a rod and a support therefor, provided with a passage through which the rod is adapted to move, of a flexible hard packing thimble of truncated cone form having a wall which tapers in thickness from the larger to the smaller end of the cone and having an unbroken surface surrounding said rod, the smaller end of the cone, where the wall thereof is thinnest, snugly fitting against the rod at all points, and means for holding said packing in place.

3. In a device of the character described, the combination with a rod and a support therefor having an opening through which the rod is movable, of a flexible hard packing thimble of truncated cone form carried by said support and formed with a relatively thin wall which decreases in thickness from the larger to the smaller end of the cone where the edge is of extreme thinness, said edge surrounding and contacting at all points with the rod, the wall of said cone being unbroken and continuous throughout.

4. As a new article of manufacture, the herein described flexible hard packing thimble in the form of a truncated cone the wall of which decreases in thickness from the larger to the smaller end of which is of extreme thinness, the wall of said thimble being entirely continuous and unbroken.
throughout and formed at its larger end with an outstanding and continuous and unbroken annular flange.

5. In a device of the character described, the combination with a rod and a support therefor provided with a passage through which the rod is movable, of a plurality of correspondingly formed flexible hard packing thimbles mounted within said support in nested relation to each other, said thimbles being of truncated cone form and each presenting an entirely unbroken surface around the rod with the smaller ends of the thimbles snugly engaging said rod, each of said thimbles having its wall decreasing in thickness from its larger toward its smaller end which latter is of extreme thinness, the thimbles being provided at their larger ends with outstanding flanges, and spacing rings interposed between said flanges, said rings being split, the support being formed with another opening distinct from the first named opening and designed for the passage of a lubricant into the support between two of the thimbles.

7. In a device of the character described, the combination with a rod and a support therefor provided with a passage through which the rod is movable, of a plurality of correspondingly formed flexible hard packing thimbles mounted within said support in nested relation to each other, said thimbles being of truncated cone form and each presenting an entirely unbroken surface around the rod with the smaller ends of the thimbles snugly engaging said rod, each of said thimbles having its wall decreasing in thickness from its larger toward its smaller end which latter is of extreme thinness, the thimbles being provided at their larger ends with outstanding flanges, and spacing rings interposed between said flanges, said rings being split, the support being formed with another opening distinct from the first named opening and a pipe connected to said opening, for the purpose specified.

8. In a device of the character described, the combination with a valve rod and support therefor provided with a passage through which the rod is adapted to move, of a hard packing thimble formed of metal and of truncated cone form, having a wall which tapers in thickness from the larger to the smaller end of the cone, the said thimble surrounding the rod and the wall of the cone-shaped portion of the thimble being continuous and smooth throughout and of a single integral formation whereby all joints are done away with, and means for holding said thimble in place.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES P. MINNING.

Witnesses:

E. P. TERRY,

JOHN A. W. DIXON.