No. 669,110. Patented Mar. 5, 1901.

A. WORTHINGTON.

HAND HOLE COVER.

(Application filed June 15, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

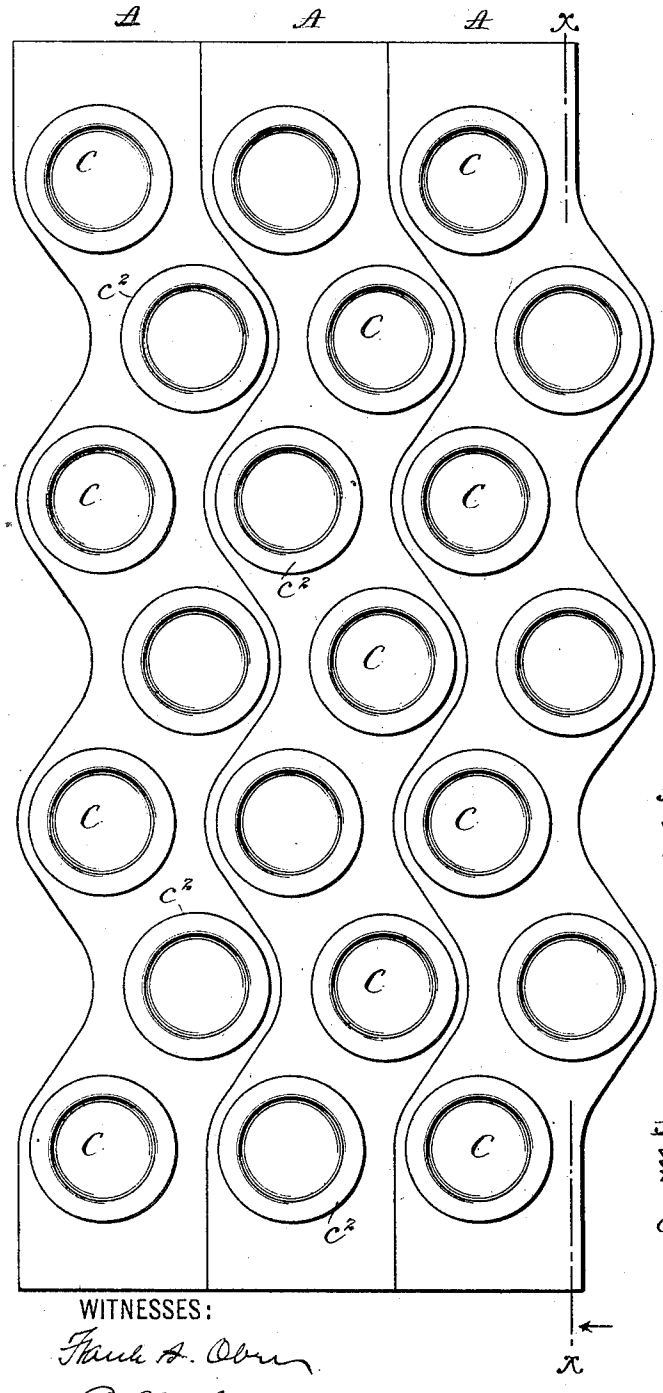


Fig. 6.

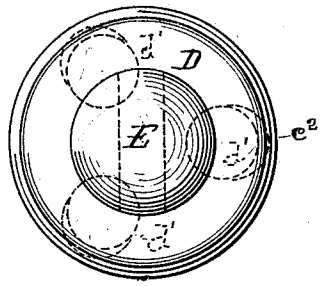


Fig. 5.

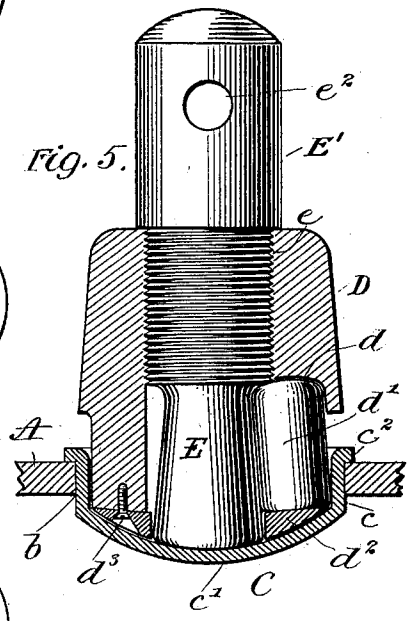
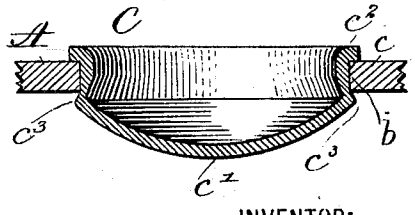


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

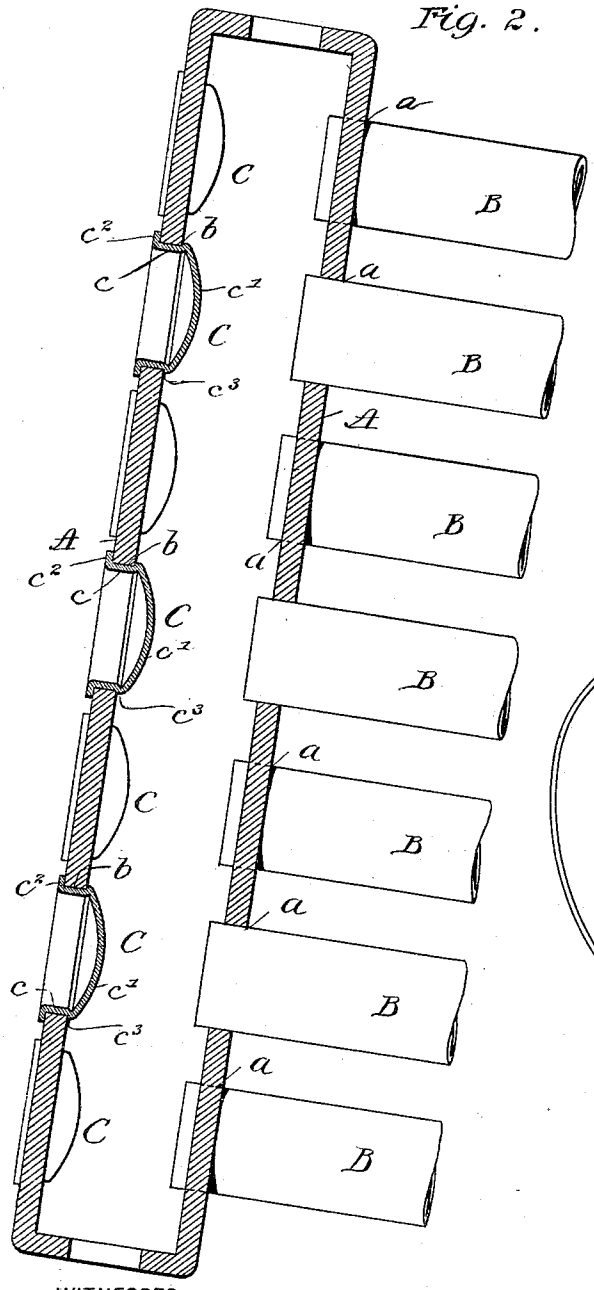


Fig. 7.

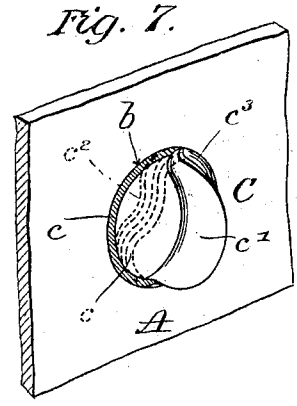
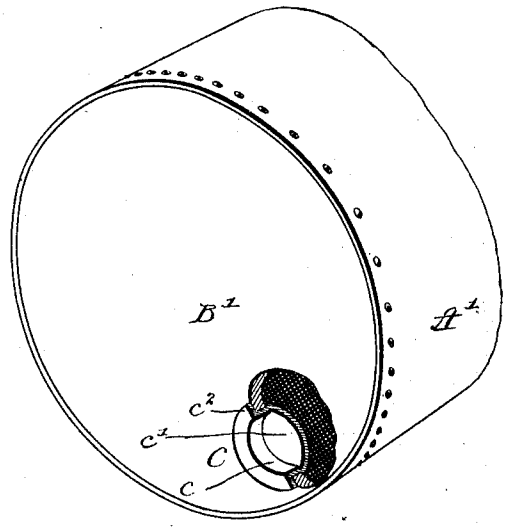


Fig. 3.



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HAND-HOLE COVER.

SPECIFICATION forming part of Letters Patent No. 669,110, dated March 5, 1901.

Application filed June 15, 1900. Serial No. 20,406. (No model.)

To all whom it may concern:

Be it known that I, AMASA WORTHINGTON, a citizen of the United States, and a resident of the borough of Brooklyn, in the city of New York, county of Kings, and State of New York, have invented a certain new and useful Improvement in Closing Devices for Hand-Holes and other Similar Apertures, of which the following is a specification.

My invention, while applicable generally to the closing of holes and apertures in vessels that are provided with thin metal walls, is designed more especially for use in the closing of hand-holes and other apertures in boilers, tanks, and other similar structures. In the closing of holes and apertures of these characters as heretofore practiced it has been the custom to employ either a screw-plug which, inserted within the hole or aperture, engaged with an appropriate screw-thread formed therein, or else a cap or cover which extended over the same and was firmly clamped in that position by a bolt or screw, and a cooperating cap or bar disposed in proper relationship thereto. The means thus employed, while serving to close the holes or apertures, have been found more or less objectionable in practice, principally because of the fact that when the former was employed it soon became rusted or corroded in places and could not be removed when desired, while when the latter was made use of difficulty was experienced in closing the holes or apertures with a sufficient degree of tightness to prevent the escape of the contents of the vessel, when composed in whole or in part of steam or gas, without endangering the screws or bolts. To obviate these objections and provide a closing device which shall be simple and inexpensive in construction, as well as efficient and reliable in operation, are the objects of my invention.

With these ends in view my invention consists in the peculiar combination and arrangement of the closing device with the hole or aperture to which it is applied, all as will hereinafter more fully appear.

Referring to the accompanying drawings, which form a part of this specification, Figure 1 is an end elevation of three sections of a sectional water-tube boiler with my invention applied thereto; Fig. 2, a vertical sectional side elevation of one of the headers of such section and a portion of its coöperating water-tubes, taken in the plane $x\ x$ of Fig. 1 and looking in the direction indicated by the arrow in that figure; Fig. 3, an isometric projection of one of the ends of an ordinary cylindrical shell-boiler with a portion of the head broken away and with my invention shown applied thereto in axial section; Fig. 4, a sectional edge view of one of my closing devices and a portion of the wall or plate in which it is expanded and secured, taken axially of the former; Fig. 5, a similar sectional edge view of one of the closing devices before being expanded and a portion of the wall or plate in which it is to be secured, taken axially of the former, with a side elevation, partly in section, of a mechanism by which the expanding of the closing device may be effected; Fig. 6, a top or plan of the closing-device-expanding mechanism shown in Fig. 5; and Fig. 7, an isometric projection of one of my closing devices and a portion of the wall or plate in which it is secured, showing the manner of cutting and distorting the former when its removal is required.

In all the figures like letters of reference are employed to designate corresponding parts.

A indicates a number of headers, and B a number of tubes, of a sectional water-tube steam-boiler, which is or may be of any ordinary or preferred construction. Of these the headers A are preferably constructed in the form of a rectangular tube of the required length and are provided in the back of each with a series of holes a for reception of the end of the tubes that coöperate therewith. In some instances these headers are constructed straight, in which cases the holes a in the back of each are disposed in a vertical line, whereby to bring the tubes appropriate thereto in a vertical series with one arranged above the other. In the drawings, however, I have shown them as constructed of a longitudinal zigzag form, with the holes a in the back of each arranged in a similar order, whereby to bring the tubes of each header into two vertical rows, with the tubes of one row opposite the spaces between the tubes of the other, and either of these constructions may be employed as preferred. The holes a being thus disposed in either of the orders

specified, the ends of their respective tubes B are secured therein and a steam and water tight joint formed between them by expanding the latter until they completely fill such holes, and their outer projecting extremities are made slightly larger than the interiors thereof. To permit of this expanding operation being effected, as well as of the removal and replacement of one or more of the tubes when required, the headers A, in addition to the holes *a* in their backs, are each provided with a corresponding series of hand-holes *b* in their fronts, which, constructed somewhat larger in diameter than that of the tubes, are severally disposed in axial coincidence therewith and with the holes *a* with which they respectively coöperate. When the boiler as thus provided is in working condition, these hand-holes *b* are closed, and it is to the means for closing the same and other similar apertures that my present invention more particularly appertains. The means which I employ for the purpose consists of a cup-shaped stopper C, which is constructed of appropriate ductile material, but preferably of soft steel, and is composed of a cylindrical body *c*, that is made of the proper size to fit the hole or aperture in which it is to be employed, with a spherical-shaped closed bottom *c'* and a radial flange c^2 extending outward from and around its upper edge, as shown in Fig. 5. As thus constructed the cup-shaped stopper is inserted in the hole or aperture to be closed and therein expanded by forcing its cylindrical body portion outward against the interior of the same by pressure applied to its own interior until a bead c^3 is formed on its exterior against and on the side of the wall of the header A or other plate opposite that from which it is inserted, as shown more clearly in Fig. 4. By this means, as will be seen, the exterior of the stopper is forced out into close contact with the edges of the hole or aperture at all points and a tight and efficient closing of such hole or aperture thereby effected, while the contact of the bead c^3 with one side of the wall or plate and the flange c^2 on the other firmly holds and binds it therein.

For expanding the cup-shaped stopper in a hole or aperture when required various means may be adopted. Of these the form which I have found the most convenient in practice is shown in Figs. 5 and 6, wherein D indicates a carrier, which, constructed in tubular form and of a size to enter the interior of the stopper to be expanded, is provided in its lower portion at equal distances apart with chambers *d*, that are formed longitudinally therein around its central orifice and extend through to both the interior and exterior thereof, where they appear in the form of longitudinally-disposed slots. Within the chamber *d* as thus formed and arranged are received and carried the rolls *d'*, which, while capable of a limited outward and inward movement therein radially to the axis of the carrier D, are yet held from axial displacement therefrom by a cap d^2, that is detachably fastened over the lower ends of their chambers *d* by screws d^3 engaging with the carrier D, as shown.

When the device is in condition for insertion into a stopper C, the outer surface of the rolls *d'* will not protrude outward from their respective chambers *d* beyond the outer surface of the carrier D; but in effecting the expansion of the stopper they will be gradually forced outward beyond that surface as they are carried around within the former. For forcing these rolls outward and effecting their rotation while thus employed the conical plug E is made use of, which, bearing against their inner sides, is formed upon or secured to the lower end of a shaft E', that extends axially through the carrier D, in which it is threaded by suitable male and female screw-threads *e* and *e'*, respectively. By this construction and arrangement of parts, as will be seen, the forcing outward and rotation of the rolls *d* when the expansion of a stopper is being accomplished will be simultaneously effected by simply rotating the shaft E in the proper direction, which may be accomplished by any convenient means—as, for instance, by a rod or lever inserted in the hole e^2—when the unscrewing of the same from the carrier D will raise the conical plug E in rear of the rolls, and thereby not only force them outward progressively against the interior of the stopper, but impart to them a rotary motion upon their own axes, the effect of which will be to carry them around within the same and effect its expansion. While thus the expansion of the stopper to fill the interior of the hole or aperture is being effected, the lower outer corners of the rolls, in consequence of the inward inclination of such rolls due to the form of the conical plug and their contact therewith, will cause the material of the stopper beneath the wall or plate to be forced outward beyond the same, and thereby form the bead c^3 below it, as shown. The closing devices having been thus applied in the closing of a hole or aperture, its removal therefrom may be effected by cutting through the material of the spherical bottom *c'* for a sufficient distance around its outer edge near where it joins the body *c* with a chisel or otherwise and forcing the part thereof that is detached inward, as shown in Fig. 7, when the cylindrical body portion *c* from which the bottom is severed, with its outer radial flange c^2, may be bent inward or distorted, as illustrated by dotted lines in that figure, and the stopper thereupon readily removed.

While in Figs. 1 and 2 I have shown the closing device C as applied to a sectional water-tube boiler, it is not restricted thereto, but may be employed in connection with tanks and other forms of vessel, and in Fig. 3 I have illustrated it as applied in the closing of an aperture in the head of an ordinary cylindrical steam-boiler, in which A' indi-

cates the boiler-shell, B' the head, and C the closing device applied to a hole in the latter.

From the foregoing it will be seen that I produce a simple, cheap, and efficient closing device for holes and other apertures, which is capable of general application to all forms of vessels and structures that are provided with thin walls or shells.

In the above the closing device or stopper has been described as inserted from the outside of the structure and in that position expanded with the bead c^3 on the inside thereof; but it is to be understood that this is merely illustrative, and that where the structure is of a form to permit it may be inserted from the inside of the same, if so preferred.

Having thus described my invention and specified certain of its applications, I claim and desire to secure by Letters Patent of the United States—

1. A cup-shaped closing device for hand-holes and other apertures constructed of soft ductile material, and comprising a cylindrical body and a closed bottom, substantially as described.

2. A cup-shaped closing device for hand-holes and other apertures constructed of soft ductile metal, and comprising a cylindrical body, a closed bottom, and an outwardly-extending flange around its upper edge, substantially as described.

3. The combination, with the walls of a vessel or other structure provided with a hole or aperture, of a cup-shaped closing device constructed of ductile material expanded within the hole or aperture so as to close the same and form a bead thereon on the side of the walls opposite to that from which the device is inserted, substantially as described.

4. The combination, with a steam-boiler provided with a hole or aperture in its walls, of a cup-shaped closing device constructed of ductile material expanded within such hole or aperture, and provided with a bead on the side of the wall opposite to that from which it is inserted, substantially as described.

5. The combination, with the header of a sectional water-tube boiler provided with a hand-hole therein, of a cup-shaped closing device constructed of ductile metal expanded in such hole so as to close the same and provided with a bead around the portion inserted within the header, substantially as described.

6. The combination, with the header of a sectional water-tube boiler provided with a hand-hole therein, of a cup-shaped closing device constructed of soft ductile metal expanded in such hole so as to close the same and provided with both a bead around the portion inserted within the header and an outward radially-extending flange on the portion without the same, substantially as described.

In witness whereof I have hereunto set my hand this 11th day of June, 1900.

AMASA WORTHINGTON.

Witnesses:
WM. H. APPLETON,
R. F. SWEENY.