March 7, 1933. G. McCORMICK ET AL 1,900,357

BOILER DROP PLUG

Filed Feb. 23, 1932

Fig. 2.

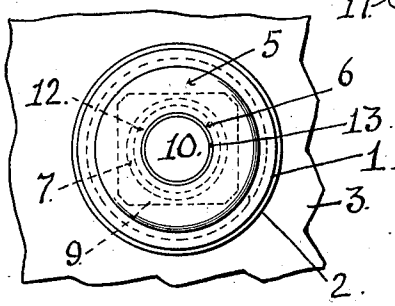

Fig. 5.

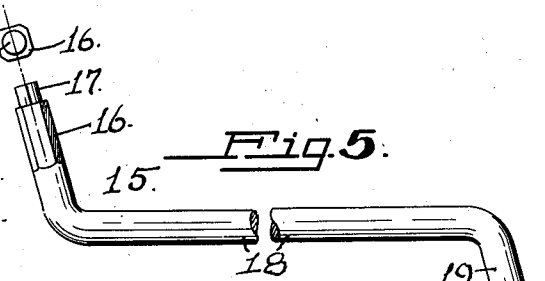

Fig. 1.

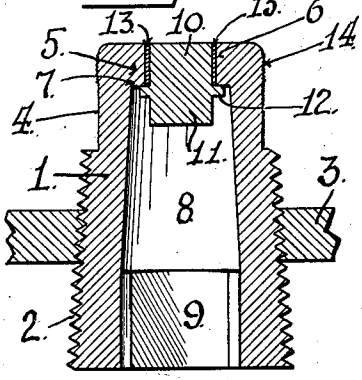

Fig. 6.

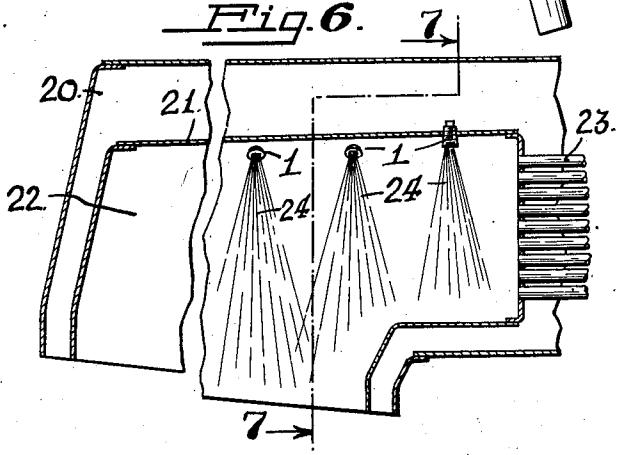

Fig. 3.

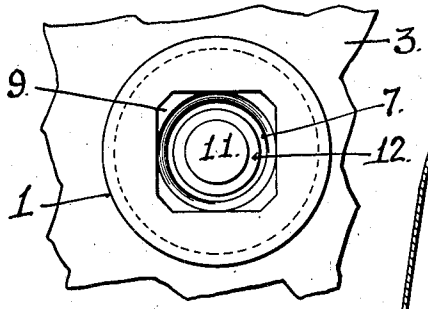

Fig. 7.

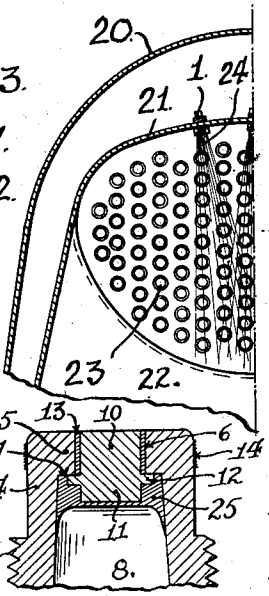

Fig. 8.

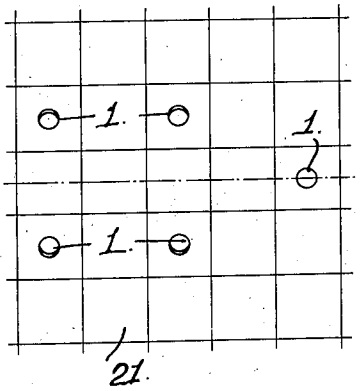

Fig. 4.

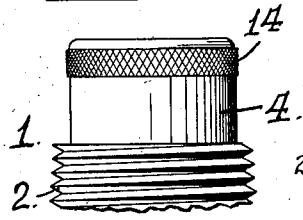

Fig. 9.

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UNITED STATES PATENT OFFICE

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BOILER DROP-PLUG

Application filed February 23, 1932. Serial No. 594,566.

Our invention relates to that type of boiler-plugs which comprises essentially a drop-plug member, releasable under predetermined temperature and pressure, in order to open direct communication between the steam space and the fire box, and thereby permit a jet of steam to pass into the fire box for a purpose and with an effect well known in the art.

These boiler plugs, though applicable to various forms of boilers, are especially useful in locomotive boilers. They are located in the crown-sheet of the boiler and comprise an open ended body member fitted through said crown-sheet, a drop-plug member normally closing the upper end of the body member, and a cementing member uniting said body and plug, and fusible under a given temperature or range thereof, to release said plug and allow it to drop through the body member and thereby open it to the passage of steam from the boiler into the fire box. The conditions under which the device thus functions, usually the unsafe lowering of the water level in the boiler, whereby the crown sheet is exposed to a dangerously high temperature; and the effect of the steam jet, either through audible warning, or in affecting the fire, are well known and will require only such reference to them as will give a full understanding of the nature of our improvement as hereinafter set forth.

One object of our invention is to provide a boiler drop plug of the type mentioned, which is simple and inexpensive in manufacture, capable of ready application, and is sensitive, reliable and positive in operation.

Another object is, by the use of a plurality of such drop plugs, to provide for steam jets in such number as will insure positive inhibitive effects as will be described.

To these ends, our invention consists in the novel construction, arrangement and combination of the several members of the device, and the application of said devices in plural numbers, as will be hereinafter described.

In the accompanying drawing, we have shown the device in its preferred form, it being understood that changes may be made without departing from the spirit of the invention as defined by the claims hereunto appended.

In the drawing, Fig. 1 is a vertical central section of our boiler drop-plug showing it fitted in a plate which represents a fragment of the crown sheet of a boiler.

Fig. 2 is a top plan, and

Fig. 3 is a bottom plan of the same.

Fig. 4 is a fragmentary side elevation of the upper portion of the body member.

Fig. 5 is a side view of the wrench for seating the body member in the crown sheet.

Fig. 6 is a vertical longitudinal section of a locomotive boiler showing the application of a plurality of our drop-plug devices thereto. Fig. 7 is a cross section on the line 7—7 of Fig. 6. Fig. 8 is a diagrammatic plan of a crown-sheet showing a plurality of our drop-plugs applied thereto.

Fig. 9 is a fragmentary vertical section showing a modified form of plug.

1 is a tubular, open-ended, body-member, made of metal, for example, bronze, or other suitable material. Its lower portion tapers upwardly and is externally threaded as shown at 2, said portion being tapped through and tightly seated in the boiler crown-sheet 3. The upper portion 4 of the body member projects above the crown-sheet and is preferably uniformly cylindrical, its upper end being inwardly flanged at 5 to form the top orifice 6 of the body bore, and to form also the internal shoulder 7 at the base of said orifice. From this shoulder, which, as shown, is of greater diameter than the orifice 6, the bore of the body member uniformly increases in diameter as shown at 8, towards its lower portion, which at 9 is angular in section to provide a wrench hold for the application of a wrench to properly seat said member in the crown sheet.

The bore of the body member thus comprises the top orifice 6 of relatively small diameter and appreciable depth, the internal shoulder 7 of a greater diameter than the

top orifice, the downwardly widening middle portion 8, and the angular sectioned wrench-hold lower portion 9.

The releasable closure or drop-plug member is a metallic body characterized exteriorly by three portions, namely a sealing head-portion 10, a tongs-handling foot portion 11, and an intervening seal-protecting flange 12.

In the normal assemblage of parts, the closure or drop-plug member, handled by a pair of tongs applied to its foot portion 11, fits its head portion 10 within the top orifice 6 of the body member 1, said head portion having a diameter sufficiently less than the diameter of said orifice to provide for the cementing member hereinafter mentioned, between their adjacent vertical surfaces, and having a depth equal to that of said orifice. The flange 12 of the drop-plug member lies directly under and against the internal shoulder 7 within the body bore at the base of the orifice 6, said flange having a diameter sufficiently great to span said orifice with appreciable overlap, but free of the body bore side wall. The foot portion 11 of the closure member lies within the body bore with enough clearance to provide for the tongs by which the plug is set in place. Between the adjacent vertical surfaces of the top orifice 6 of the body member 1 and the head portion 10 of the drop-plug member is the annular cementing member 13. This is composed of a suitable alloy, consisting of tin and lead or other composition adapted, under a predetermined temperature or range thereof to sufficiently soften or melt or fuse and thus weaken its adhesion, and permit the steam pressure in the boiler to force the plug member from its seat and drop it into the fire box, thereby opening the body member to the passage of steam from the boiler into the fire box, after the manner and according to the purpose of boiler plugs of this type.

With the foregoing description in mind, certain features of novelty and improvement may now be referred to.

First, as to the cementing member 13 and its positional relation. As a vertically disposed annulus applied to relatively extensive surfaces, there is assurance of normal adherence, resulting in a dependable deference of loosening function, to await the predetermined temperature and pressure, rather than a premature release, such as is more apt to occur with a horizontally disposed cementing member.

Second, by exposing the upper end of the vertically disposed cementitious annulus 13 directly within the boiler, there is additional assurance of the proper and timely effect upon said annulus as determined by the predetermined temperature, and this is in contrast with confining the cementing member wholly within the body member.

Third, the width of the flange 12 of the drop-plug member has an importance especially to be noted. By spanning the base of the top orifice 6 of the body member and seating itself with appreciable contact overlap upon the internal shoulder 7 of said body member, though with good clearance from the side wall of the bore of said member, said flange completely covers the lower edge of the cementing member 13 and protects said member from the direct heat of the fire and the corrosive action of the products of combustion, thus leaving said member 13 to be affected wholly by the predetermined temperature and pressure within the boiler. The covering of the lower edge of the member 13 by the flange 12 is thus in beneficial contrast with any assemblage of parts which may leave said member 13 exposed in any part directly to the heat and gases of the firebox.

Fourth, the clearance of the drop-plug member with respect to the bore of the body member, and the downwardly increasing diameter of said bore are such that when the drop-plug member is released and forced from its seat, it will drop through the body member without the slightest liability of catching or obstruction. In order to further insure this result, all surfaces are made as smooth as possible. The necessity of precision in the functioning of boiler plugs of the type herein described, has resulted in bestowing upon their manufacture and testing, extreme care. In this connection attention is now directed to Fig. 4. Near the upper end of the body member 1, the exterior surface of said member is knurled or otherwise chased as shown at 14. The purpose of this is informative. If the knurling or chasing shows a marring such as might result from a blow, a fall or other accident, it is possible that the shock may have extended to and injured the cementing member 13. Therefore, opportunity is afforded, before placing the plug in use, to exercise such precaution as the circumstance may call for. Because the fitting of the body member 1 into the crown sheet is necessarily overhead work, the angular wrench hold 9 lies in the base of the bore of the body member, and a wrench is provided for rendering the screwing up of the body member in the crown sheet a matter of some convenience. This wrench is shown in Fig. 5 and is indicated as a whole by the numeral 15. It comprises an angular wrench portion 16, adapted for engagement with the wrench hold 9 of the body member; an end projection 17, slightly smaller in diameter than the bore of the body member, said projection serving to guide and retain the wrench in position for re-entry into the wrench hold 9 as the body member is being screwed up; and a handle 18 set at an angle

somewhat greater than 90° with relation to the center line of the wrench fit, said handle having a hand grip 19 parallel with the wrench fit, to prevent applying too much force when screwing the body member into place.

In order to understand the application of our drop-plug and the manner of its use, reference may now be had to Figs. 6, 7 and 8, disclosing it in connection with the common type of locomotive boiler in which 20 is the boiler, 21 the crown-sheet, 22 the fire box, and 23 the flues. 24 indicates the steam jets.

It is to be noted by reference to Figs 6 and 8, the latter especially, that a plurality of the drop-plugs devices are fitted to the crown sheet 21, selectively distributed over the hottest portion thereof. The number of plugs will be in proportion to the gas area of the flues, or the horsepower of the boiler, in order to insure a sufficient volume of escaping steam issuing from the plugs, to fill the flues and fire box, thereby smothering the fire and cooling the interior of the fire box, including the fire box sheets, to such an extent that the engineer and firemen are prevented from continuing operation of the boiler with resulting catastrophe, as has been the case on previous occasions when, though the releasable drop-plug has fallen, the resulting sound has not been recognized, and operation continued until explosion resulted.

In the normal operation of a boiler, that is to say, when the water level therein is maintained at a proper height above the crown sheet, the cementing material or alloy securing the drop-plug member is protected by comparatively cool water covering the crown sheet and surrounding the upper portion of the device which projects above said sheet, in which portion the drop-plug and cementing alloy are located, thereby preventing them from becoming hot enough to weaken the alloy and permit the pressure to force the drop-plug down. Moreover, the space within the bore of the body member below the drop-plug is practically a dead air space, and this, together with the covering effect of the flange 12 upon the lower edge of the alloy, furnishes additional protection against premature heating.

When the level of the water is permitted, by carelessness or by failure of boiler feed devices, to fall below the normal and safe height above the crown-sheet, and the drop-plug devices are no longer protected by surrounding water, their heat will increase until the predetermined temperature is reached, whereupon the alloy will melt and the drop-plug member will be forced out from the body member and will fall into the fire box. The escape of the steam, as shown by the plurality of jets 24, will fill the flues 23 and the fire box 22 with steam in sufficient volume to break the draft, and smother the fire, as above mentioned.

Under certain conditions, particularly in the case of oil-fired boilers, in which the combustion of the fuel frequently results in the deposition upon the walls of the fire-box of a layer of hard cohesive carbon, we have found it desirable to cover the lower end of the drop-plug member with a body of fusible material, as illustrated in Fig. 9. This body of fusible material, indicated at 25, may be, and preferably is, the same alloy or metal that forms the cementing ring 13. It completely fills the space between the flange 12 and grip portion 11 of the plug and the walls of the body, and its lower exposed surface is preferably concave, as shown.

The object of the plug covering body of fusible material 25 is to prevent the deposition of carbon upon the lower exposed portion of the drop-plug member and in the space between it and the walls of the body, experiment having indicated that the presence of such carbon affects the reliability of release of the plug. Such carbon as may be deposited upon the exposed smooth surface of the fusible material 25, however, has no effect upon the release of the plug, because it is carried away by the initial melting of said material, which occurs slightly before the temperature of the cementing ring 13 reaches the melting point.

The fusible material 25 may be applied in any desired manner, preferably by dipping the preheated body, inverted, first into a bath of flux and then into the molten alloy up to the beginning of the threaded portion 2; and then dropping the plug member 10, also preheated and treated with flux, into the interior of said body while the latter is still partially immersed in the alloy. Upon lifting the body out of said alloy bath, the plug member descends to its final seat, with the cementing ring 13 held by capillary attraction between it and the body bore 6, and enough of the molten alloy is trapped above said plug to cover its inner end as indicated in Fig. 9, the concave surface of said covering body being formed by capillary action. Thus the entire assembly is accomplished in one simple operation.

We claim:—

1. A boiler drop-plug comprising a body-member having upon its exterior surface near one end a relatively easily disfigurable chased section, said body member having also a through bore, which for a distance inwardly from the end within said chased section, is cylindrical and of a diameter less than the diameter of the remainder of the bore, whereby an internal annular shoulder is formed; a drop-plug member having at one end a cylindrical portion adapted to fit

within the reduced end of the body-bore and having also a flange of greater diameter than said reduced end, said flange being seated against the internal shoulder of the bore, with peripheral clearance from the side wall of said bore; and a cylindrical fusible cementing member between the opposing surfaces of the reduced end of the body-bore and the portion of the drop-plug member fitting therein.

2. A boiler drop-plug comprising a body-member having a through bore, said bore at one end, for a distance inwardly from said end, being of a diameter less than the diameter of the remainder of the bore, whereby an internal annular shoulder is formed; a drop-plug member having at one end a portion adapted to fit within the reduced end of the body-bore and having also a flange of greater diameter than said reduced end, said flange being seated against the internal shoulder of the bore, with peripheral clearance from the side wall of said bore; a fusible cementing member between the opposing surfaces of the reduced end of the body-bore and the portion of the drop-plug member fitting therein; and a body of fusible material filling the clearance space between said plug flange and the body wall.

3. A boiler drop-plug comprising a body-member having a through bore, said bore having a smooth walled cylindrical portion of reduced diameter at its upper end and an enlarged portion at its lower end; an interior shoulder at the junction of said bore portions; a drop-plug member having a flange and a smooth cylindrical portion thereabove, said flange being seated against said shoulder and said cylindrical portion fitting within the cylindrical portion of said bore; and a cylinder of fusible cementing material filling the annular space between the smooth cylindrical surfaces of said bore and said plug.

In testimony whereof we have signed our names to this specification.

GEORGE McCORMICK.
FRANK E. RUSSELL.