

Dec. 6, 1932.

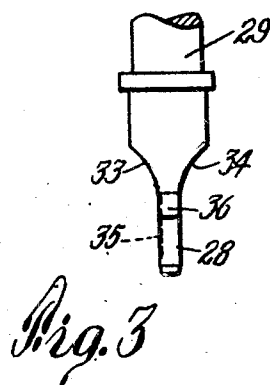
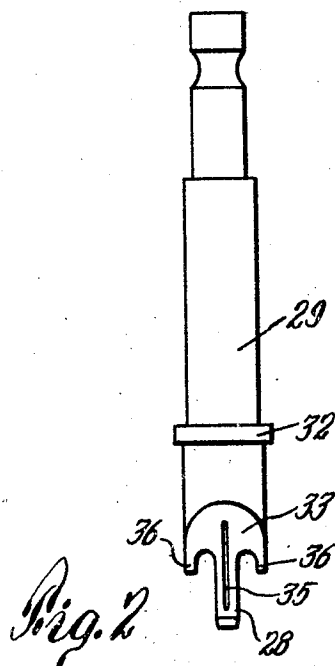
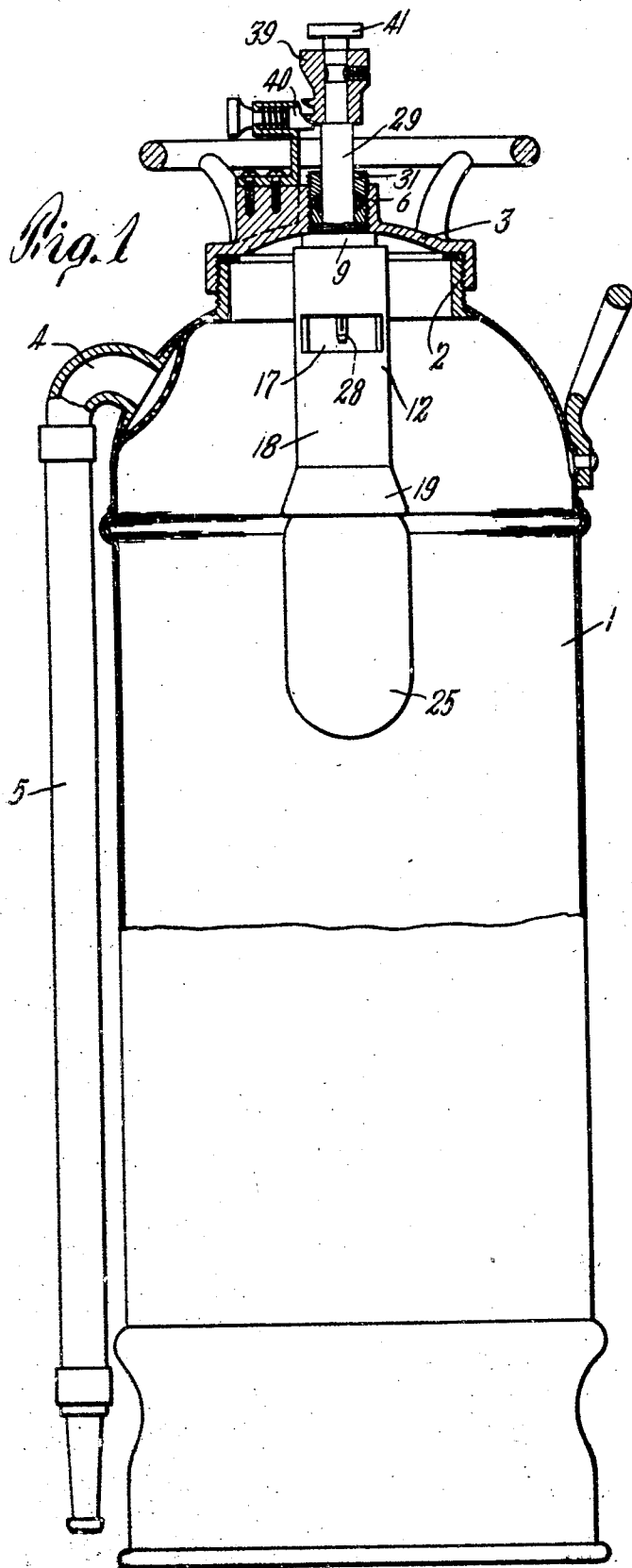
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1,890,140

FIRE EXTINGUISHER

Filed Nov. 2, 1931

2 Sheets-Sheet 1



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FIRE EXTINGUISHER

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2 Sheets-Sheet 2

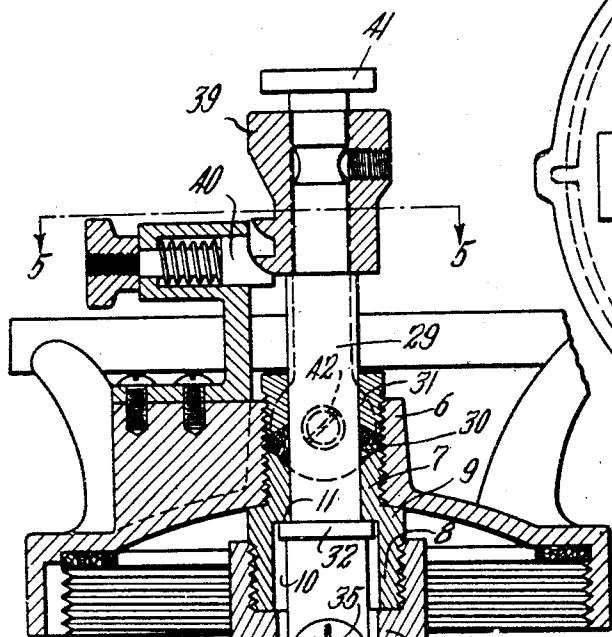


Fig. 4

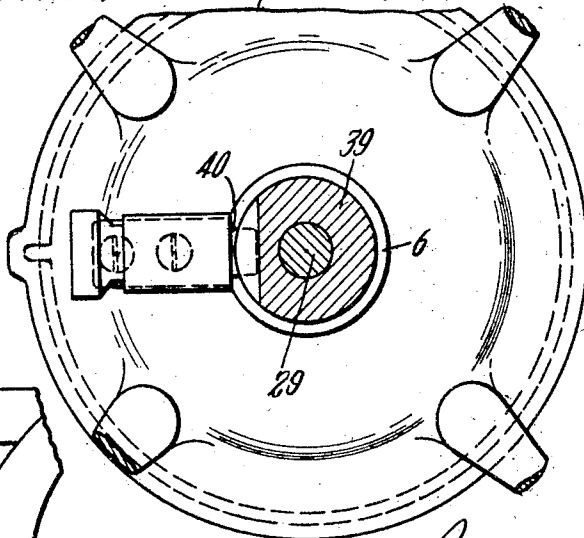
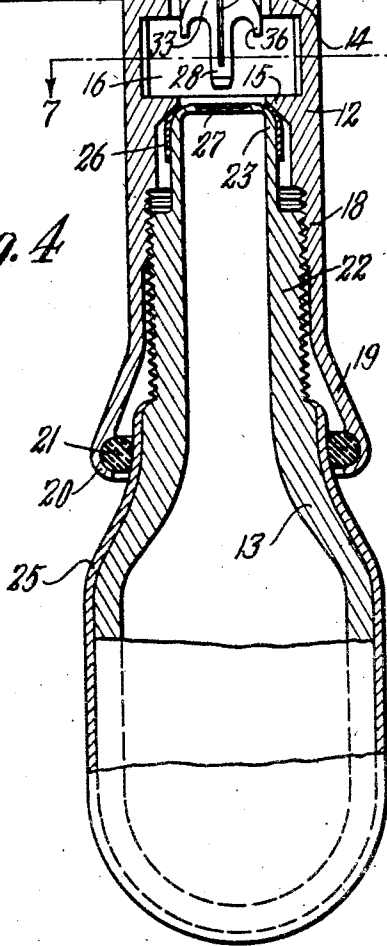


Fig. 6

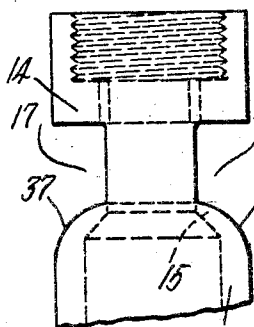


Fig. 7

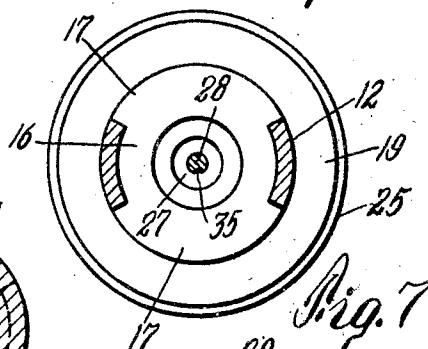


Fig. 8

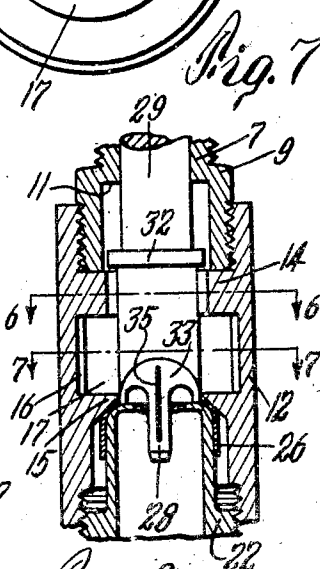


Fig. 9

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UNITED STATES PATENT OFFICE

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FIRE EXTINGUISHER

Application filed November 2, 1931. Serial No. 572,453.

This invention relates to fire extinguishers of the type which employ a compressed gas, originally confined in a sealed bottle, cartridge or other container within the extinguisher, and adapted to be released by puncturing the cartridge so as to expel fire quenching liquid with which the extinguisher is loaded. Preferably such cartridges are made of steel, sealed after filling by welding in accordance with inventions patented by me September 17, 1929, No. 1,728,171; April 8, 1930, No. 1,753,259; and February 3, 1931, No. 1,790,787.

Various quenching liquids may be used according to the conditions which the extinguisher may be required to meet. For some purposes it is important that the discharged liquid, after drying, should leave no electrically conductive deposit. This is especially important, for instance, in telephone exchanges where a metallic, or other conductive deposit from the liquid used in putting out a fire in the electric wiring of the exchange would be highly objectionable. Pure water is preferred for the quenching liquid in extinguishers used for this purpose, but water is a powerful solvent, and has a well known corrosive effect on ferrous metals.

One of the objects of the invention is to preserve the cartridge from the corrosive and solvent effect of water and other quenching liquids, for the purpose of preventing both solution of iron in the liquid, and pitting of the cartridge by the liquid which, continuing over an extended period, might so destroy or weaken the cartridge as to release its contents prematurely. This object is accomplished by providing the cartridge with a sheath of inert or non-corrodible material over so much of its exterior as comes into contact with the liquid. This constitutes one phase of the invention.

The compressed gas commonly used in cartridges of the type referred to is carbon dioxide, compressed to the pressure of liquefaction. In expanding through a minute orifice from the high initial pressure to the much lower pressure used for expelling the quenching liquid, the temperature of the compressed gas is greatly lowered, and may be

brought to the degree where solidification occurs. Another object of the invention is to prevent solidification of the gas by controlling its flow from the cartridge, and circulating the quenching liquid past the discharge point of the cartridge in such a manner that heat is supplied from the liquid in sufficient measure to prevent solidification of the expanding pressure gas, but not so rapidly as to freeze the liquid when such liquid is water. This second object is accomplished by a new form of punch for puncturing the cartridge and a new form and arrangement of guiding surfaces for the liquid adjacent to such punch, constituting another phase of the invention. Other objects and characteristics are set forth in the following detailed description of one embodiment of the invention with reference to the drawings.

In the drawings,—

Fig. 1 is a side elevation partly in section of a complete fire extinguisher embodying this invention;

Figs. 2 and 3 are elevations on a larger scale and at right angles to each other of the punch by which the gas cartridge is punctured;

Fig. 4 is a sectional view of the assemblage comprising the extinguisher cover, compressed gas cartridge, cartridge holder, and punch;

Fig. 5 is a plan view, and in part a horizontal section on line 5—5 of Fig. 4, of the assemblage shown in Fig. 4;

Figs. 6 and 7 are detail sectional views taken on lines 6—6 and 7—7, respectively, of Figs. 4 and 9;

Fig. 8 is a side elevation of a part of the cartridge holder, as viewed from the right or left of Fig. 4;

Fig. 9 is a sectional view similar to Fig. 4 of part of the cartridge, cartridge holder, and punch, showing the punch in its cartridge puncturing position.

Like reference characters designate the same parts wherever they occur in all the figures.

The extinguisher as a whole is of ordinary character consisting of a main body or shell 1 having a threaded neck or mouth fitting 2, on which a cap or cover 3 is screwed; and hav-

ing also an outlet fitting 4 equipped with a discharge hose 5. The cover is centrally apertured and provided with a reinforcing internally threaded rim or boss 6 on the outside. A bushing 7 is screwed into the passage in the cover and boss from the inner side of the cover. This bushing is formed with an enlarged, externally threaded, inner end 8 which provides a shoulder 9 limiting its penetration into the passage in the cover, and provides an interior chamber 10 and an inner limit shoulder 11. A cartridge holder 12 is secured to the enlarged end of bushing 7 and holds the compressed gas cartridge 13.

Holder 12 has a threaded cavity in its upper end to fit the bushing end 8, an internal shoulder 14 to abut against the end of the bushing, a second internal shoulder 15 to provide a sealing abutment for the end of the cartridge, a space 16 between the shoulders 14 and 15, wide openings 17 in its opposite sides communicating with space 16, an internally threaded sleeve portion 18 to engage external threads on the cartridge and a flaring skirt portion 19 at its lower end which, at the lower extremity, is provided with an internal retaining seat 20 for a packing ring 21. The holder is essentially a sleeve or tube open from end to end and having lateral openings only at the locations 17. Such openings, however, are wide, as wide as feasible having regard to the proportions and structural strength of the holder, in order to give free course for flow of the quenching liquid.

The compressed gas cartridge here illustrated is like one of the cartridges shown in my Patent 1,790,787, having a relatively large body portion, a contracted externally threaded neck 22, which is screwed into the threaded part 18 of the holder, and an integrally united cap 23 at its extremity; said cap being welded to the body of the cartridge after the latter has been charged with the pressure medium, as described in said patent. The transverse end wall of the cap is made of reduced thickness to permit penetration by a punch.

Practical considerations require the cartridge to be made of steel, while its bulk and the manner of its suspension causes its immersion in the quenching liquid, which ordinarily fills the body of the extinguisher nearly to the top thereof.

One of the features of the invention has to do with safeguarding the cartridge from corrosion by the liquid and preventing the liquid from taking into solution any of the substance of the cartridge. If the quenching liquid is water, it will corrode the cartridge and, when discharged, carry more or less iron with it, either in solution, or in the form of iron rust in suspension; which, upon drying out of the things against which the water has been thrown in putting out a fire, will leave a metallic deposit. Such a deposit is

very objectionable in many circumstances. Also if the extinguisher has occasion to stand a long time before use, the cartridge may become so deeply corroded and pitted as to become seriously weakened.

To avoid these defects I provide the cartridge with a sheath or shell 25 of inert material which envelops all of the exposed lower part of the cartridge body and extends into the holder within the packing 21. Such sheath is preferably made of lead, although it may be of other metal or non-metal which is non-corrodible by the water or other quenching liquid, and is preferably applied by being drawn or molded into cup form of a size to fit over the cartridge body, and then spun or swaged down closely around the tapered shoulders of the cartridge. It thus becomes essentially a part of the cartridge, in effect, an outer skin. I also provide a tubular gasket 26 of the same or equivalent material which closely surrounds the upper extremity of the cartridge and is tapered or curled over so as to come between the rounded corners of such extremity and the contiguous beveled face of the shoulder 15 in the holder. When the cartridge is screwed into the holder, the gasket is pressed tightly against the shoulder 15, and the packing ring 21, which is of resilient material, preferably rubber, is pressed tightly against the upper sides of sheath 25. The sheath covers all that part of the cartridge which is immersed in the liquid, and the packing excludes the liquid from the unsheathed part of the cartridge. It is to be understood that the extinguisher is never filled with liquid up to the level of the openings 17, so that the upper terminal wall of the cartridge is not exposed to the liquid. The gasket 26 is therefore provided primarily to prevent access of the liquid and pressure gas to the outside of the cartridge when the extinguisher is inverted in the course of being discharged. But any liquid which may slop over on top of the cartridge in careless handling of the filled extinguisher is held back by the gasket. The latter may be made as a thimble completely overlying the end wall of the cartridge, if desired to protect the end wall from slopped over liquid.

As a further protection to the cartridge I prefer to give those parts of it which are not enveloped by the sheath and the gasket a substantial plating of lead by electro-deposition.

In naming steel as the material of the cartridge, water as the corrosive liquid, and lead as the inert protective sheathing, gasket, and plating, I have not intended to limit the invention to these specific substances. On the contrary, I claim protection for the embodiment of the principles here involved in sheathings of other material than lead which are inert not only to water, but to other quenching liquids as well, for the pro-

tection of cartridges made of steel or other metals which may be corrodible by such liquids. It will be understood of course that the extinguisher shell, the cartridge holder, and other parts which are exposed to the liquid, are made of materials substantially non-corrodible by the liquid. Copper, or alloys containing a large percentage of copper, are suitable in most circumstances for the manufacture of such parts.

When the extinguisher is to be used, it is inverted, and the end wall 27 of the cartridge is punctured by a punch 28. The punch is carried by the inner end of the spindle 29, preferably being made integral with such spindle, which is adapted to slide through the bore of the bushing 27, and protrudes from the cover. It is packed against leakage by packing 30 compressed between the end of bushing 7 and a gland 31 screwed into the outer end of the passage through the boss 6. A shoulder 32 on the spindle within the recess 10 cooperates with shoulder 11 to limit outward movement of the spindle. The punch is cylindrical through most of its length and is tapered to a slightly smaller diameter at its extremity, so that in being forced through the cartridge wall 27 it punches a hole nearly as large as its main diameter, and then enters the hole, enlarging it, and making a tight fit with the walls of the hole. The punch spindle is much wider in diameter than the punch (in the ratio of 16 to 3 more or less), and its opposite sides adjoining the root of the punch are beveled to make concave faces 33 and 34 (see particularly Figs. 2 and 3). A narrow and shallow groove 35 is cut in the middle of one of these faces, as 33, extending down the adjacent side of the punch far enough to be brought well into the cartridge upon full penetration of the punch. This groove provides the only outlet for the compressed contents of the cartridge, and is made with such dimensions, having regard to the initial pressure of the gas, the pressure required to expel the quenching liquid, and the rate of outflow of such liquid, that it will release the gas from the cartridge slowly enough to limit the pressure applied to the liquid and maintain a nearly constant pressure thereon throughout the discharge. Penetration of the punch into the cartridge is limited by projections 36 on the spindle at either side of the punch, which are arranged to abut on the end of the cartridge when the punch has penetrated to the desired distance.

Relationship of the groove 35 to the face 33, and of the latter to the open space 16 within the holder, has an important effect in the functioning of the apparatus. The generally used and preferred pressure medium is carbon dioxide at the pressure of liquefaction. When allowed to expand adiabatically through a small orifice from that pressure to the much lower pressure sufficient for expel-

ling the quenching liquid, carbon dioxide freezes and form crystals which block up the orifice. This objectionable effect is prevented by the arrangement here described, for, when the extinguisher is inverted, the liquid has free access to the punch which it surrounds, and is continuously entrained by the stream of gas flowing through the groove, whereby a stream of the liquid having a relatively high temperature is caused to flow in contact with the punch and the gas, supplying heat enough to prevent solidification of the gas in the orifice. That is, the liquid surrounding the punch is not stagnant, but is continually replaced by fresh unchilled liquid which not only prevents solidification of the gas, but also, when the liquid is water, prevents freezing of the water. In order to facilitate such flow of the liquid, the corners between the outer surface of the holder and the ledge 15 are rounded on curves 37 of large radius at the openings 17, as shown in Fig. 8.

The punch spindle has a sliding fit within the shoulder 14, by which it is closely surrounded, as shown in Fig. 6. Grooves 38 are formed between bearing segments of the shoulder. On the outer end of the spindle a knob 39 is attached which cooperates with a latch bolt 40, and is normally protected by a guard bail 41 pivoted at 42 to the cover boss 6. These latter accessories may be of any desired character and are not material to the invention claimed herein.

What I claim and desire to secure by Letters Patent is:

1. A fire extinguisher adapted to hold a fire-quenching liquid, a tubular holder depending from the top of the extinguisher having an interior shoulder and lateral openings to the space above said shoulder, a compressed gas cartridge having a neck portion received in the lower end of the holder and a body portion protruding therefrom liable to be immersed in the quenching liquid, the upper extremity of said cartridge being then adjacent to said shoulder, a non-corrodible gasket pinched between said extremity and shoulder, and a non-corrodible sheath enveloping the body portion of the cartridge, extending upward within the holder in liquid-tight engagement therewith.

2. A fire extinguisher including a steel cartridge containing compressed gas having an integrally welded sealing cap at its upper end adapted to be punctured for release of the pressure gas, a tubular holder depending from the top of the extinguisher enveloping the upper part only of the cartridge in screw-threaded connection therewith and having an internal shoulder for engagement with the upper end circumference of the cartridge, a lead gasket pinched between said end circumference and shoulder, a lead sheath enveloping the bottom and sides of the cartridge and extending upward into the holder, and a

packing ring in the lower part of the holder in liquid-tight contact therewith and with the exterior of said sheath.

3. A fire extinguisher invertible for use having a body shell adapted to be substantially filled with liquid and including a cover portion at its normally upper end, a tubular holder depending from said cover portion open at its lower end to receive the discharging end of a gas cartridge and having a lateral opening to its interior at a relatively high level, a compressed-gas cartridge secured in the lower part of the holder having a closed upper end, penetrable by a punch, located near the level of said lateral opening, and a punch in the holder normally withdrawn from said closed end but adapted to be advanced through the same, and having gas and liquid guiding means in its side arranged to provide a course for flow of gas and to entrain liquid through the lateral opening into contact with the punch.

4. A fire extinguisher comprising a shell adapted to be substantially filled with quenching liquid and having a cover portion, a tubular holder depending from said cover portion, a compressed-gas cartridge secured in the lower part of said holder and provided with an upper end wall adapted to be penetrated by a punch, the holder having a lateral opening extending upwardly from approximately the level of said end wall, a punch spindle extending through said cover portion and being movable endwise therein toward and away from the compressed gas cartridge and having on its inner end a punch of less diameter than the spindle normally withdrawn from the cartridge and adapted to be advanced through the end wall thereof, the spindle having a cut away inclined surface in its side tangent to one side of the punch and containing a groove which extends along the adjacent side of the punch far enough to provide a channel for flow of gas from the cartridge when the punch is passed through the end wall of the cartridge; said groove and inclined surface serving in conjunction with the gas flowing from the cartridge to entrain a stream of the liquid in heat-transferring contact with the gas when the extinguisher is put to use in inverted position.

5. In a fire extinguisher as set forth in claim 4, the holder having the corner between its outer surface and the lower boundary of said lateral opening beveled to facilitate flow of the liquid, when the extinguisher is inverted, into close proximity with the entrance point of the punch into the cartridge.

6. A punch for fire extinguishers of the character set forth comprising a spindle having a coaxial punch extension at one end of smaller diameter than the spindle, a side of the spindle adjacent to the punch being formed to provide an inclined surface tangent to the punch, and having a straight

groove in the corresponding side of the punch extending longitudinally thereof and along the central part of said inclined surface.

7. A fire extinguisher adapted to hold fire quenching liquid, a tubular holder open at its inner end extending inward from the top of the extinguisher, a compressed gas cartridge having walls entirely enclosing its charge and adapted to be punctured at one end to release the charge, such end of the cartridge being received in the inner end of the holder while the body of the cartridge protrudes therefrom, and the holder having an outlet for gas released from the cartridge, means to prevent entrance of the quenching liquid past the said end of the cartridge into the space between the cartridge and the enveloping walls of the tubular holder, a sheath or skin of material non-corrodible by the quenching liquid applied to the cartridge so as to envelop its protruding body and extend into the holder in liquid sealing contact with a surrounding part thereof, and means for puncturing the end of the cartridge within the holder; said holder having an outlet for the released gas opening to the liquid-holding space of the extinguisher above the normal liquid level.

In testimony whereof I have affixed my signature.

ARTHUR C. BADGER.