

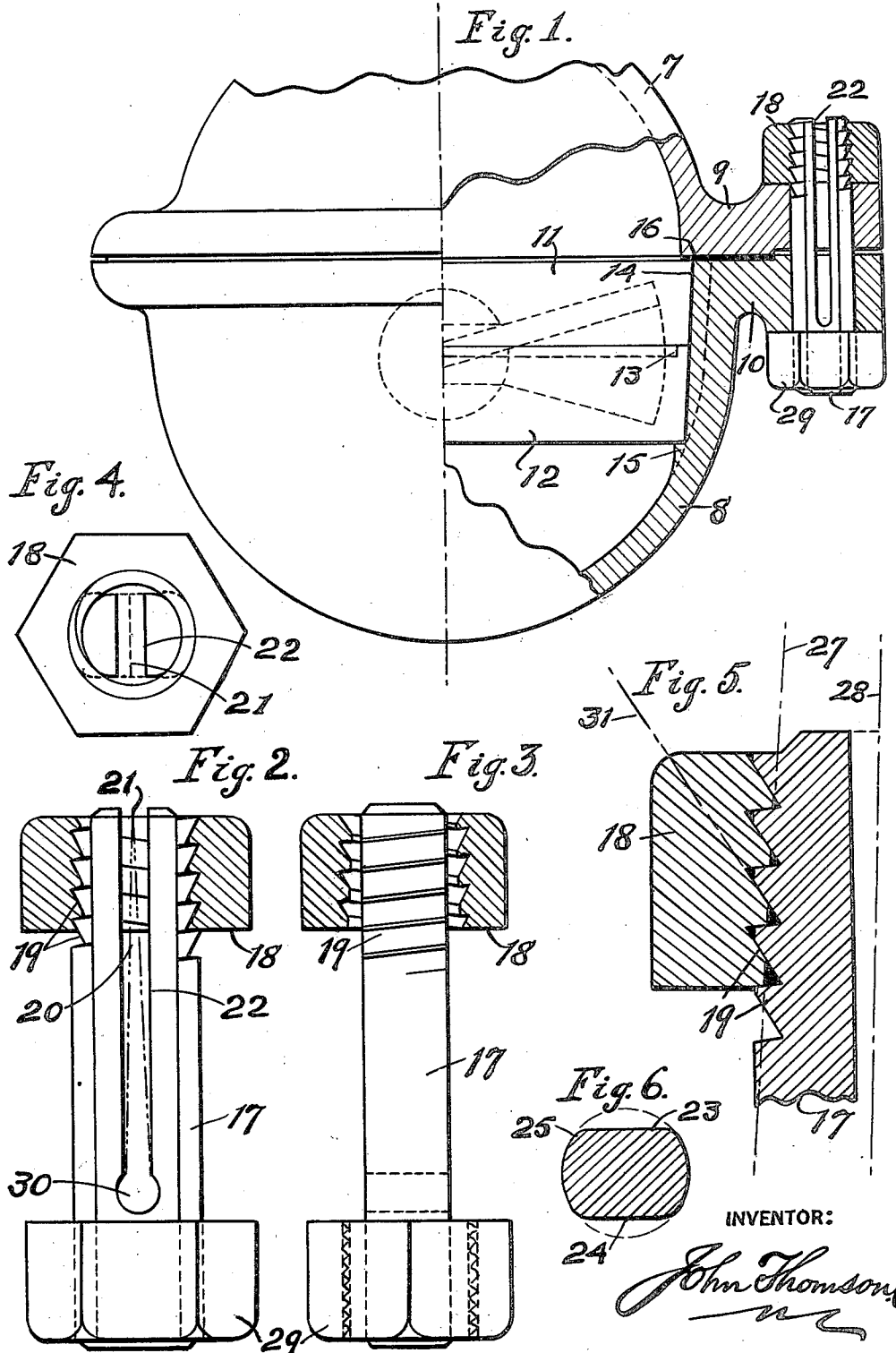
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WATER METER FROST BOLT

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UNITED STATES PATENT OFFICE.

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WATER-METER FROST BOLT.

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To all whom it may concern:

Be it known that I, JOHN THOMSON, a citizen of the United States, and a resident of the borough of Brooklyn, city and State of New York, have invented a Water-Meter Frost Bolt, of which the following is a specification.

This invention relates to water meters, particularly consisting in means, empirically termed a "frost-bolt," for preventing the operative parts of meters from being damaged when water therein is partially or wholly frozen, and also to avoid damaging the functioning means itself. The said term, "frost-bolt," is a unitary expression like that of the now common trade nomenclature, such as "frost-bottom," or "frost-protector."

It is believed that a very brief recitation of the prior and existing state of the art will here suffice. The present applicant was the original designer and exploiter of the disc water meter known by the trade-name of "Trident," in which the disc casing was formed of two parts provided with a horizontal snap-joint secured each to the other, and also held in place in a main casing, by a cast-iron head popularly known as a "frost-bottom." This head has arms, engaged by flange-bolts; whereby, when water within the meter freezes and the expansion thereof develops sufficient pressure, the following results ensue:

Usually, (a) two or three of the arms fracture, permitting the head to tilt outwardly; (b) the disc-casing is pushed downwardly, or it may be upwardly; and (c) the two sections of the disc-casing are slightly separated at the aforesaid snap-joint. Hence, the interior parts are neither broken nor deformed, and the application of a new head restores the meter to its former operative condition. Following the foregoing, this applicant applied a system of springs, acting against a head; whereby, when frozen, the said head was pressed outwardly and the disc chamber was shifted and separated; then, the ice having melted, the resilient springs automatically reset all of the functioning parts to their normal position.

The aforesaid system of "frost protection" has been universally adopted with but few, minor modifications; and it is indubitable that the industrial saving has amounted to

millions of dollars. However, it is yet possible to still further augment the advantages hitherto attained. Thus, in regular practice, water meters are subjected to a hydraulic test-pressure of say, 200 pounds to the square inch; therefore, the "frost bottom," or its equivalent element, must possess an additional margin of safety equal to not less than 25 to 50 pounds per square inch to prevent fracture or deformation of the "frost bottom" itself under the test-pressure; and this necessitates that the main casing of the meter shall be able to withstand an ice-pressure, without permanent deformation, some 25% to 40% greater than the test-pressure. As will shortly be pointed out, the recited objections are overcome or largely minimized by the present invention.

In the drawings, which constitute a part of this specification:—

Figure 1 is a diagrammatic sketch-view of a disc water meter wherewith to elucidate the principle of the recited system of "frost protection"; and also showing the "frost-bolt" in place, the scale of the latter being about full size, as applied to the house sizes of meters;

Figure 2 is a detached enlarged scale view of the bolt and its free co-ordinating nut, the latter being in section;

Figure 3 is a revolved view of the aforesaid bolt and its nut;

Figure 4 is a plan view, projected from Figure 2;

Figure 5 is a detached section, still further enlarged, to better illustrate a preferred form of the threads; and

Figure 6 is a transverse section of the bolt-rod in a form best adapted for inexpensive manufacture.

The principle here employed may be thus summarized: the employment of clamping bolts and nuts of such form and material that, when subjected to an adequate separating pressure, their threads will slip over each other; and then, when free to do so, may automatically resume their normal engagement without rupturing or deforming the co-ordinating surfaces and parts.

The upper member 7, and the lower member 8, denote the main casing of a disc water meter having flanges 9, 10, whilst the disc casing, also formed of two members, 11, 12, has a snap-joint 13. The disc and its ball are partially denoted in dotted out-

line. The disc chamber rests in a tapered side-bearing 14 in the lower portion of the main casing and is secured together, and to its seat 15, by an overlapping portion of the upper section of the main casing acting upon an interposed gasket, 16. Thus, when water within both the main casing and the disc casing freezes, if the two portions which constitute the main casing can separate sufficiently to allow for the ice-expansion (about $8\frac{1}{2}$ per centum) the disc chamber will be carried upwardly, and also slightly separated, without damage thereto.

The benign action just mentioned is now attained by the resilient pronged bolt 17, and its free nut 18, whose co-acting threads are preferably of ratchet, or saw-tooth form, their sloping surfaces, as 19, being their thrust-resisting portions. It will doubtless already be apparent that when the stress, or pull, is sufficient to cause the wedge-like surface of the nut-thread to sufficiently spring the bolt-prongs inwardly, as see dotted lines 20, 21, Figures 2 and 4, the threads are then free to separate each from the other of them to the extent of one of more pitch-spaces, as the case may be. Again, when free to do so, the prongs will snap back and the co-ordinating threads will re-engage when the nut can be turned down or up, from the shifted position.

But to realize the foregoing simple action, the following details must be observed, namely: The bolt, at right angles to the prong-slot 22, must be flattened, as 23, 24, and the sharp intersections should preferably be slightly rounded, as 25, Figure 6. The prong-slot should be of such a width that when the two upper edges come together, as see Figures 2 and 4, the outer corners of the bolt-thread, at the flats of the bolt, will just clear the inner edges of the nut-thread. Moreover, to avoid an undue width of the prong-slot, the bore of the nut should be tapered, as line 27, Figure 5, flaring outwardly from top to bottom; hence when the prongs are thrust inwardly, as to line 28, all of the edges of the nut-thread will be free to slip over those of the bolt-thread.

While the bolt and its fixed head, 29, could be formed as one part, it is advantageous to apply a separate head, in that the bolt-portion may be drawn in long rods to be then after threaded and slotted, after which the prongs may be heat-treated, or spring-tempered, to ensure a long period of resiliency. The said head may be threaded, as indicated, or it can be secured by riveting or welding.

Complete control is here afforded in the matter of adapting this bolt to function at any desired range of pressures; for example, as by the width of the slot; or by its length; or by weakening the prongs at their roots,

as by drilling a transverse hole thereat, 30, Figure 2; or by increasing or decreasing the angle of the threads, line 31, Figure 5, there shown at about 35° from the vertical.

This prong-bolt is in itself utilizable as in the instance of a stud-bolt, that is in holes tapped in a flange, whereby "frost protection" is readily applicable to large sizes of meters, which has not hitherto been the case.

Then, too, it is not necessary to provide, as in prior practice, an excessive margin of safety in the main casing; for the prong-bolts can be adapted to release at a pressure equal to or even less than, that of the usual hydraulic test-pressure. This is feasible because, when the test pressure is being applied, which is usually but once in the life of a meter, wedges may be inserted in the prong-slots to prevent them from functioning.

When the "go point", as in a "frost bottom," is very high, the excessive pressure lowers the temperature of transformation into ice within the meter; consequently, upon a sudden relief thereof, ice may be formed with explosive rapidity; but with a substantially lower "go point," ice formation proceeds more slowly; it is less likely to cause internal damage and the main casing of the meter may be considerably lighter.

It is not without pertinency to here observe that the operation of this "frost-bolt" is an interesting exhibit of the principle that "the friction of rest is greater than that of the friction of motion;" for, the prong-threads cling to the nut-threads without observable deflection of the prongs until well up to the "go-point" and then, once started, they move inwardly with but a moderate additional application of pressure although the side-tension of the prongs are becoming progressively greater.

The bolt may readily be formed with, say, four or six prongs; and such in fact has been tested; but, the two-prong form is unquestionably the preferable; for, among other reasons, a plurality of prong-slots so reduce the aggregate cross-sectional area of the prongs that the bolt and its nut must be so increased in their diameters as to be objectionable or even commercially unfeasible. So, too, ordinary V-threads may be employed, the Whitworth standard being the better; yet the ratchet or saw-tooth form is distinctly the preferable in that, if no more, and pitches being equal, the area of bearing surface is or may be the greater. Theoretically, any form of thread is operative whose resisting surface is disposed within an included angle of substantially less than 90° between the vertical and the horizontal; but, in practice, the most effective results will be attained between a swing of about 30° to 50° .

A contingent advantage of this frost-bolt

is that it serves to prevent needless and even destructive straining of the bolt and meter-flanges. Thus, if the nut is excessively turned down the prongs will spring inwardly and automatically release. In a normal application, all that needs be observed is to apply pressure until a slight inward movement of the prongs is observable, then "back-off" until they resiliently retrieve their normal position.

In sum, by thus utilizing one's earlier and well-proven separable system of parts within a water meter, which may be of the disc or other types, and applying this "frost-bolt" to the exterior casing, or head, as the case may be, a frozen meter, or any part therein, or of the "protector" itself, does not require removal; nor does an expert need be called to readjust it; for, once the ice is melted, anyone can turn down the nuts to place.

What I claim is:

1. A water meter frost-bolt comprised in prongs whose free ends are threaded and engaged by a co-ordinating nut, the cross-sectional form of the threads being like ratchet or saw-teeth and whose slopes serve as the strain-resisting surfaces.

2. In water meters, a frost-bolt in the form of two flattened prongs, the cylindrical portions of their free ends being suitably threaded to normally engage a continuous nut-thread, the inner bore of said nut-thread being tapered; whereby, when the prongs are sprung inwardly to an angle corresponding to that of said bore, all of the thrust-resisting surfaces of the threads are simultaneously disengaged.

This specification signed on this the 9th day of February, A. D., 1923.

JOHN THOMSON.