(No Model.)

J. A. & J. HOPKINSON.

WATER GAGE.

No. 481,493. Patented Aug. 23, 1892.

Fig. 3.

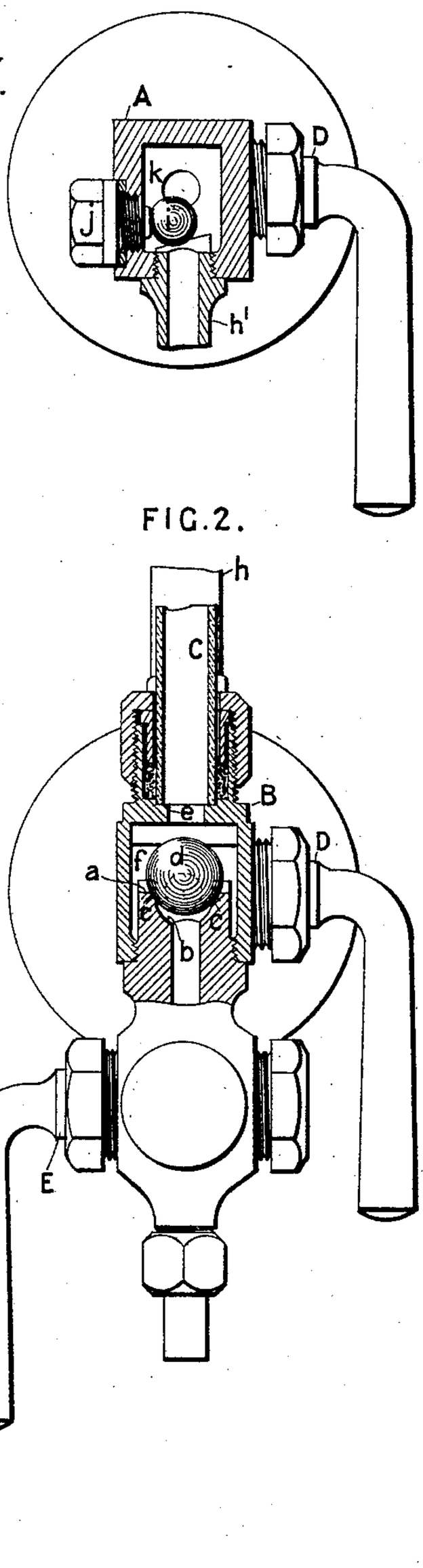

Fig. 1.

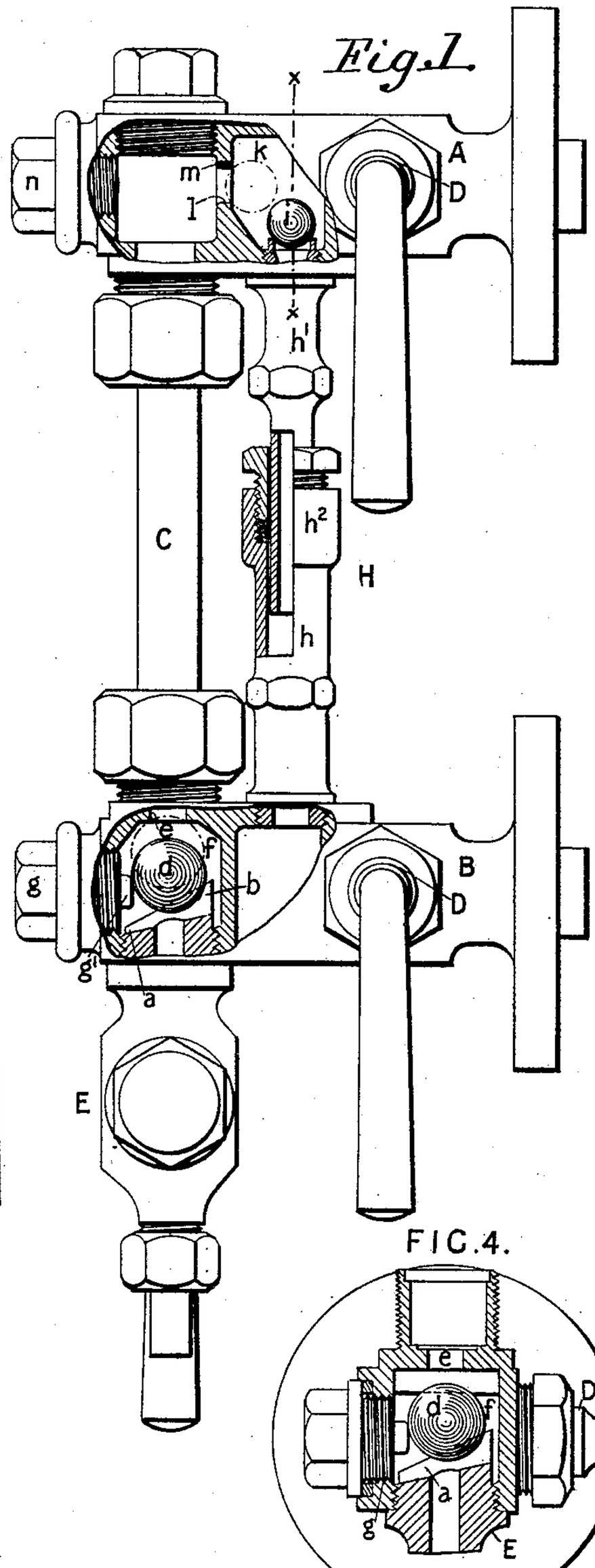

FIG. 2.

FIG. 4.

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UNITED STATES PATENT OFFICE.

JOHN ADDY HOPKINSON AND JOSEPH HOPKINSON, OF HUDDERSFIELD, ENGLAND.

WATER-GAGE.

SPECIFICATION forming part of Letters Patent No. 481,493, dated August 23, 1892.

Application filed December 8, 1891. Serial No. 414,421. (No model.) Patented in England January 27, 1890, No. 1,435, April 22, 1890, No. 6,141, and November 25, 1890, No. 19,196.

To all whom it may concern:

Be it known that we, JOHN ADDY HOPKINSON and JOSEPH HOPKINSON, engineers, subjects of the Queen of Great Britain, and residents of Huddersfield, in the county of York, England, have invented certain new and useful Improvements in Water-Gages, (for which we have obtained Letters Patent in Great Britain, No. 1,435, dated January 27, 1890; No. 6,141, dated April 22, 1890, and No. 19,196, dated November 25, 1890,) of which the following is a specification, reference being had to the accompanying drawings.

Our invention relates to water-gages of the kind or class wherein automatic valves are employed, which in the case of breakage of the gage-glass will immediately close the passages and thus prevent the escape of water and steam.

Our said invention is designed to increase the efficiency of such water-gages; to permit the ready removal of the valve and thus facilitate the inspection of the same and the cleaning of the ways or passages without the necessity for taking the gage to pieces, and to afford large and practical thoroughfares or ways for the flow of the water and steam to the gage-glass. Moreover, in our improved gages a heavier ball can be used in the water-arm than in gages as heretofore constructed, whereby we insure that it shall not be possible to trap or indicate a false water-level in the gage-glass, as will be hereinafter fully explained.

An important feature of our said invention is the employment, in combination with a spherical valve or ball, of an inclined surface arranged within the body of the gage-cock in such a manner that while the gage is working the ball-valve will rest thereon, and will be retained within the gage-cock by a suitable screw or cover provided for the purpose. When the said screw or cover is removed, the ball will roll down the inclined surface and out of the gage-cock through the hole, which is opened by the removal of the said screw or cover. The ball is kept in its place resting against the end of the screw-plug, which is all that requires to be removed to release the valve. The said surface or floor for the ball has, moreover, slots, grooves, or apertures so arranged that there is a comparatively large free passage for the water underneath the ball-valve, thereby insuring the lifting of the said ball-valve to its seat by the rush of water when the gage-glass breaks. Moreover, the said slots or apertures are so arranged that the passages of the water-gage are not obstructed by the said surface or floor, and free access is afforded to the said ways or passages for cleaning the same. The said inclined surfaces are in some instances formed upon an extension of the drain-cock or try-cock. In other instances the said inclined surfaces are cast or otherwise attached to the interior of the gage-cock or on a loose plug constructed to screw into the gage-cock from below. The object of having these surfaces inclined is that the ball when the plug is removed will roll out automatically. They may be arranged at any desired angle of inclination or if in any case it should be found convenient to arrange them horizontally they may be so arranged so long as suitable provision is made for removing the ball from the gage and for the free passage of the water past or below the ball while the same is resting on the said surfaces.

Our invention also comprises placing such a ball and seating in the steam-arm of the gage.

In automatic water-gages as heretofore constructed there is an element of danger arising from the possibility that under some circumstances the automatic valve will cut off communication between the boiler and the gage-glass at a time when free communication between them is essential to the proper action of the gage. This danger arises from a preponderance of pressure in the lower or water-arm over and above that in the upper or steam arm, such preponderance being due to the head of water in the boiler above the level of the water-arm.

Another object of our invention is to construct a water-gage so arranged in respect of its automatic valve in the water-arm that the weight of the said valve in relation to the maximum pressure tending to keep the

valve closed shall be such that if the valve is thrown to its seat from any cause while the gage-glass is intact and empty or partially empty of water it will not remain in that position, but will immediately drop from its seat, and will thus automatically restore the connection between the water-arm and the gage-glass. The pressure tending to keep the valve to its seat is chiefly due to the preponderating column of water. By the "preponderating column of water" we mean a column having a length equal to the head of water in the boiler above the level of the valve and an area equal to that of the valve-seat.

In water-gages as heretofore constructed a ring, washer, or annular piece has in some instances been employed in the top or steam arm having a hole of considerable less area than that of the way or thoroughfare of the gage. This ring or annular piece is intended to diminish the area of the orifice for the escape of steam in case of breakage of the gage-glass. Such an arrangement is, however, very objectionable, as the said ring or annular piece forms a permanent contraction of the steam-thoroughfare. It, in fact, measures the capacity of the gage. One part of our present invention is intended to obviate the defects arising from this arrangement and to afford, under the normal conditions of working, a clear thoroughfare equal in area to the full area of the gage while permitting only a greatly-diminished flow or escape of steam in case of breakage of the glass. We are thus enabled more effectually than heretofore to blow through the top arm and glass with the steam from the boiler, while in case of breakage of the gage-glass the steam-cock can be shut with safety. Moreover, in our improved water-gage the valve is so arranged that it is not thrown to its seat when blowing through the top or steam arm, but only closes the thoroughfare when the gage-glass breaks.

In the accompanying drawings we have shown how our said invention may be conveniently and advantageously carried into practice.

Figure 1 is a side elevation, partially in section, of a water-gage constructed according to our invention. Fig. 2 is a front elevation, partially in section, of the lower or water arm. Fig. 3 is a section on the line *x x*, Fig. 1, and Fig. 4 shows a slight modification, hereinafter described.

Like letters of reference indicate corresponding parts throughout the drawings.

A is the upper or steam arm, and B the lower or water arm, of the gage, the said arms being connected by a gage-glass C in the usual manner.

D D are the plug-cocks, and E is the try-cock. The try-cock is lengthened beyond the screwed portion which screws into the water-arm B, and its upper end is inclined to form a sloping floor *a*. The said floor is provided with a deep groove or channel *b*, which forms two ledges with parallel edges *c*. A ball *d*, for closing the orifice *e*, leading to the gage-glass, is placed in a cavity *f*, provided in the water-arm, and rests on the said edges *c* and is free to roll up and down the said edges. The said groove or channel *b* is amply large to insure the lifting of the ball to its seat by the rush of water when the gage-glass breaks.

For retaining the ball in position on the inclined edges *c* we provide a screw-plug *g*, screwed into the front of the gage-cock, the said plug having a projecting end *g'*, against which the ball rests. When the said plug *g* is removed, the ball will roll down the inclined edges *c* and out of the gage-cock at the hole opened by the removal of the said plug The water-passages in the gage-cock may then be cleaned in the usual manner. It is obvious that the hole through which the ball may be removed need be but slightly larger in diameter than the said ball. Therefore in an ordinary sized water-gage we are enabled to employ a ball of much larger size than heretofore. The said ball can be inserted and removed through the hole usually provided for permitting the cleaning of the water ways or passages. The ball, moreover, is retained on the inclined surfaces in such a position that it does not obstruct the usual thoroughfares of the water-gage and it will roll out automatically when the screw which retains it in the gage is removed. Moreover, the ball, by reason of its resting upon inclined edges, will be very efficient in its action. The weight of the ball *d* is so proportioned in relation to the area of the passage *e*, leading to the gage-glass, that it shall always be able to overcome the preponderance of pressure in the water-arm above that in the steam-arm due to the head of water in the boiler above the level of the water-arm, which preponderance of pressure tends to keep the valve to its seat—that is to say, to the mouth of the passage *e*—should it be thrown thereto when the gage-glass is intact, but empty or partially empty of water.

A further advantage arising from our invention is that the valve, being much heavier than in gages heretofore constructed, there is less liability of the same to adhere to its seat by reason of dirty or bad water.

We wish it clearly understood that we do not limit ourselves to any precise or particular ratio or proportion of the diameter of the ball to the area of the tube or column of water. It is the weight of the ball relatively to the pressure due to the preponderating column of water that we have to ascertain and determine—that is to say, whatever may be the height or weight of such column or the area of the tube and seat-aperture, the ball must, according to our invention, be of such a weight as to overcome the maximum pressure tending to keep it to its seat, except when the glass is broken, as above set forth.

As shown in Fig. 4, we sometimes provide a screw-plug in the side of the gage, and in this instance the floor on which the ball rests will

be inclined only toward the side of the gage provided with such screw-plug. When this construction is used, we provide a cleaning-plug at the front of the gage in order that the water-passage may be cleaned out from the front.

In addition to the connection formed by the gage-glass we also connect the upper and lower arms by means of a supplementary pipe or tube H, of metal or other suitable material. This pipe is preferably constructed in two sections h h', one of which is arranged to slide within the other, a stuffing-box and gland h^2 being provided to prevent leakage at the joint and to allow of expansion. The said sections are screwed or otherwise attached the one to the upper arm and the other to the lower arm of the gage, each at a point between the gage-glass and the plug-cock. This construction of tube allows of accommodation to suit gage-glasses of different lengths. As shown in Fig. 1, the connection through this tube between the top and bottom arms is under normal conditions closed or partially closed by a valve or ball i, resting on the top of the tube h'. The upper end of the said tube is preferably inclined, as shown in Fig. 3, and the ball is retained thereon by a screw j, and it is obvious that the ball may be taken out at the side of the gage when the said screw is removed. Moreover, the said ball or valve lies within a deep recess k, formed in the upper arm so as to allow of an unobstructed thoroughfare between the boiler and the gage-glass above the ball. Therefore on opening the bottom or try cock E and closing the plug-cock D of the water-arm a full discharge or "blow-through" of the steam is insured through a way or thoroughfare the area of which is equal throughout to the full area of the orifice through the plug of the steam-cock D, just as though no automatic valve were in the top arm. Should the gage-glass break, the ball or valve d in the bottom arm is immediately forced against its seat—that is, against the orifice e—and thereby prevents the escape of water, while the pressure from the bottom arm acting through the aforesaid supplementary tube on the under side of the ball or valve i in the top arm and assisted by the escaping steam, forces this ball or valve against a seat l, formed by the edge of the thoroughfare leading to the gage-glass, thereby closing the communication between the boiler and the glass and preventing the escape of steam. Instead, however, of allowing the steam-thoroughfare to be entirely closed by the ball i, we prefer to provide a small subsidiary hole or by-pass m in the valve-seat in order to restore equilibrium of pressure after the gage-glass has been replaced or at any other time while the glass is intact, so that the ball then will fall from its seat and restore the full area of thoroughfare. In our improved water-gage the ordinary straight thoroughfare through the plug of the steam-cock is all that is necessary, and the said plug does not require to be turned into any special position for the purpose of restoring it to the working position, as in some water-gages heretofore constructed, while access to the thoroughfares of the gage for cleaning the same is obtained by simply removing the cleaning-screws g n in the ordinary manner.

The auxiliary or supplementary pipe or tube connecting the top and bottom arms is an essential feature of this part of our invention. We do not confine ourselves to any special construction or arrangement thereof, providing it connects the steam and water arms in such a manner as to allow the pressure from the water-arm to act on the ball or valve i in the steam-arm to drive it or assist in driving it against its seat in case of breakage of the gage-glass.

What we claim is—

1. The combination, with a gage-cock and a spherical valve or ball for closing the water-orifice when the glass breaks, of an inclined floor for supporting said valve or ball when in its normal position and a screw-plug having an extension for maintaining the ball or valve in position on the said floor, said inclined floor being so arranged with relation to said screw-plug that upon the removal of said screw-plug the valve or ball drops out of the gage-cock, substantially as described.

2. In a water-gage, the combination, with a water-arm, of a try-cock having a portion thereof formed with an inclined elongated hole or aperture above the ordinary passage of the try-cock, a ball which rests on the edges of the said inclined elongated opening, and a screw-plug for maintaing said ball in position, said inclined floor being so arranged with relation to said screw-plug that upon the removal of said screw-plug the ball will drop out of the gage-cock, substantially as described.

3. In a water-gage, the combination, with a ball for closing the water-orifice when the glass breaks, of a grooved or like floor whereon the said ball rests, said floor being stationary or immovable with respect to the gage, and a lateral support for maintaining the ball in position, as set forth.

4. The combination, with the lower or water arm of a water-gage, of a ball-valve for closing the water-orifice when the glass breaks, said valve being of greater weight than that of a column of water of sectional area equal to that of the seat of the said valve and of a height equal to the length of the gage, substantially as described, for the purpose specified.

5. In a water-gage, the combination, with the gage-glass and the steam and water arms, of an extensible supplementary tube connecting said arms and located at a point between the gage-glass and the gage-cocks, as set forth.

6. In a water-gage, the combination, with a gage-glass and the steam and water arms, of a tube connecting the said arms supplementary to the gage-glass and a ball-valve in the steam-arm, as set forth.

7. In a water-gage, the combination, with a gage-glass and the steam and water arms, of a tube connecting the said arms supplementary to the gage-glass and a ball-valve resting in a recess on the top of the said supplementary tube, as set forth.

8. In a water-gage, the combination, with a gage-glass and a tube connecting the steam and water arms, supplementary to the gage-glass, of a ball-valve resting on a seat on the top of the said tube and so arranged that it can be taken out of the gage, as set forth.

9. In a water-gage, the combination, with a gage-glass, of a tube connecting the steam and water arms supplementary to the gage-glass, said tube being constructed in two parts, one adapted to slide within the other and having a stuffing-box and gland, as set forth.

10. In a water-gage, the combination, with a gage-glass and a tube connecting the steam and water arms supplementary to the gage-glass, of a ball resting on an inclined support formed on the upper end of the said tube, as set forth.

In testimony whereof we have hereunto signed our names in the presence of two subscribing witnesses.

JOHN ADDY HOPKINSON.
JOSEPH HOPKINSON.

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