

(No Model.)

2 Sheets—Sheet 1.

R. SCHWARTZKOPFF.

SAFETY APPARATUS FOR STEAM BOILERS.

No. 254,887.

Patented Mar. 14, 1882.

Fig 3.

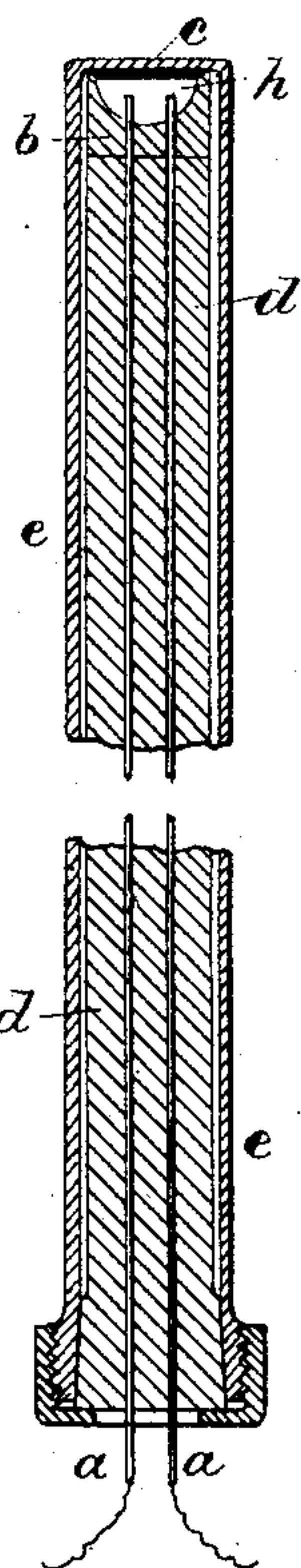
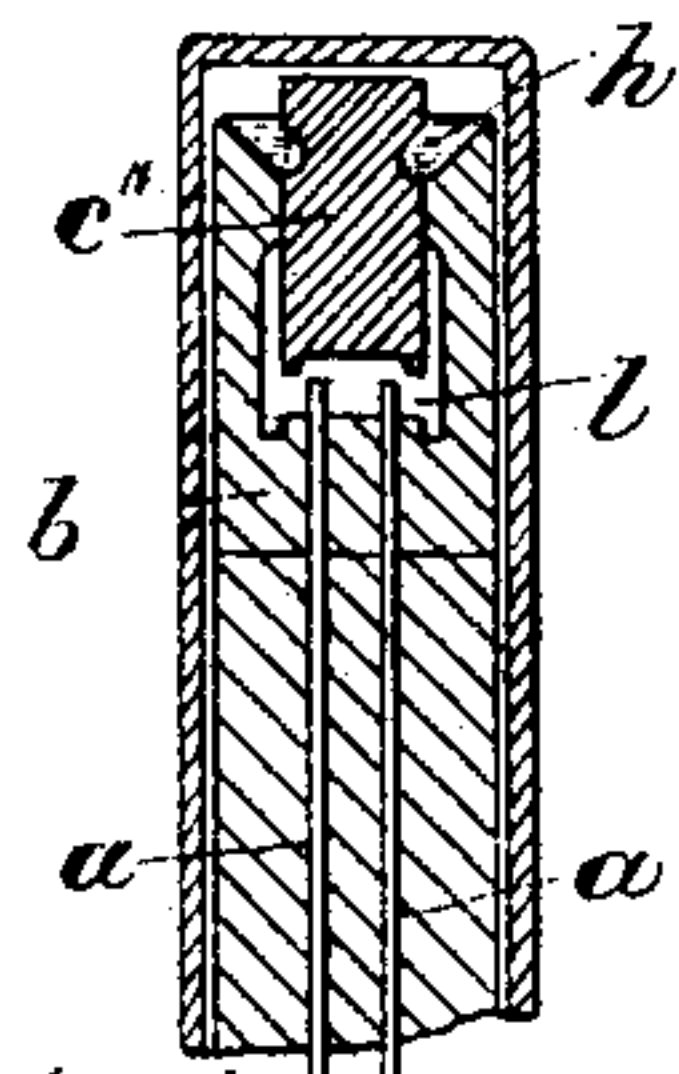


Fig 4.



Attest:
H. E. Knight.
L. M. Hopkins.

Fig 1.

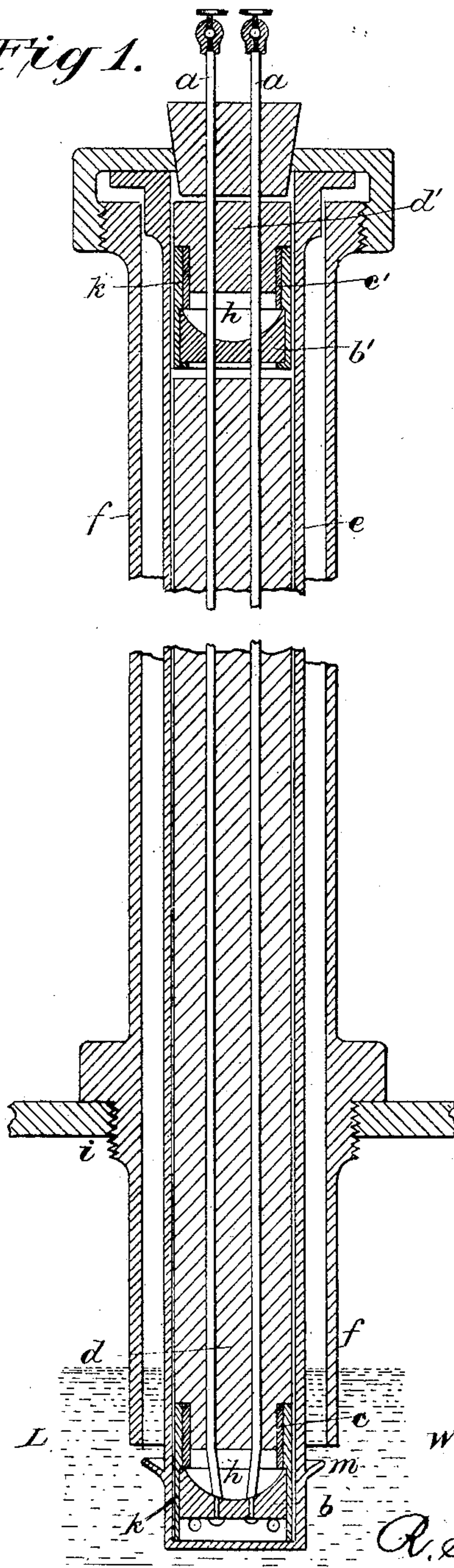
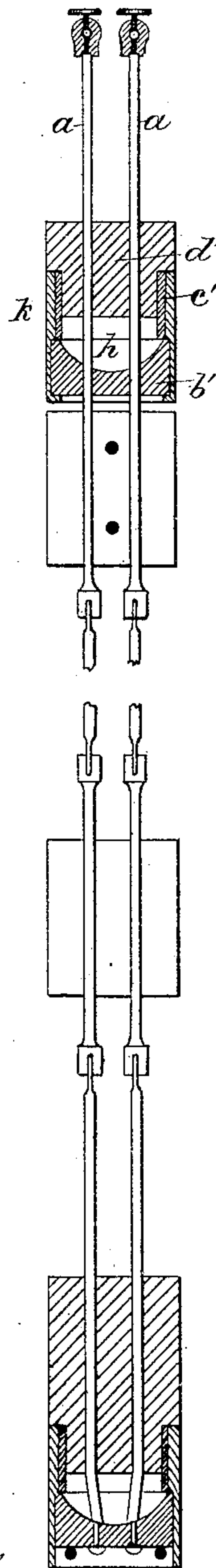


Fig 2.



Inventor:
R. Schwartzkopff
By: Knight Bros
attys.

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Fig. 5.

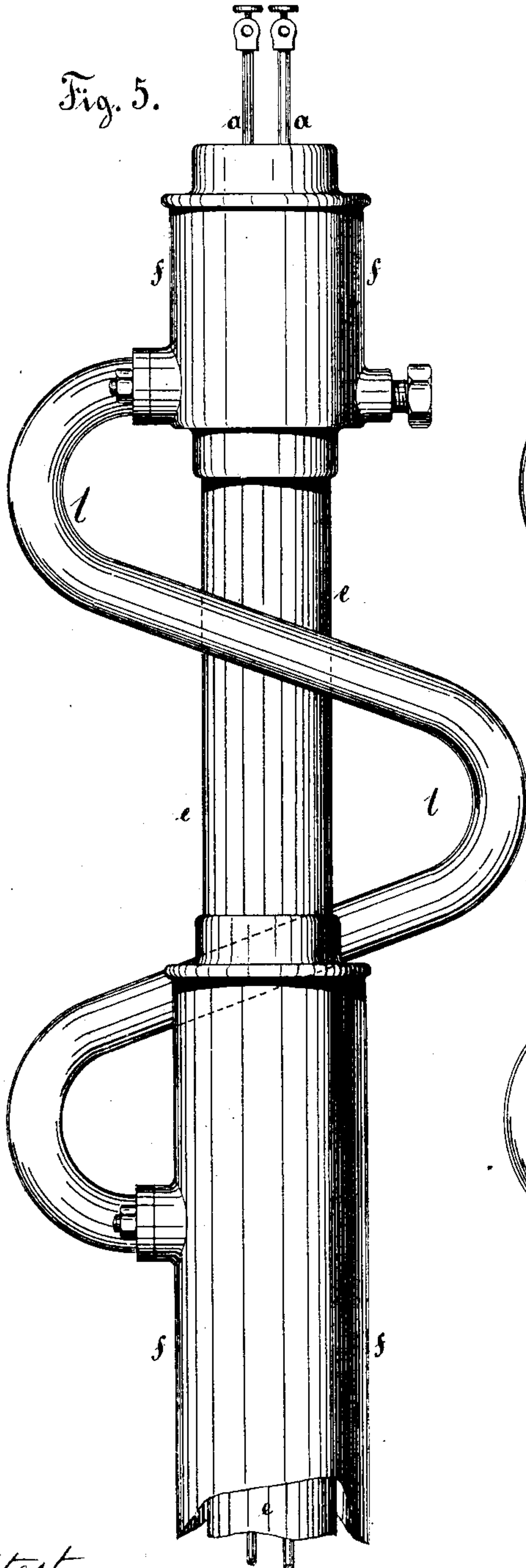
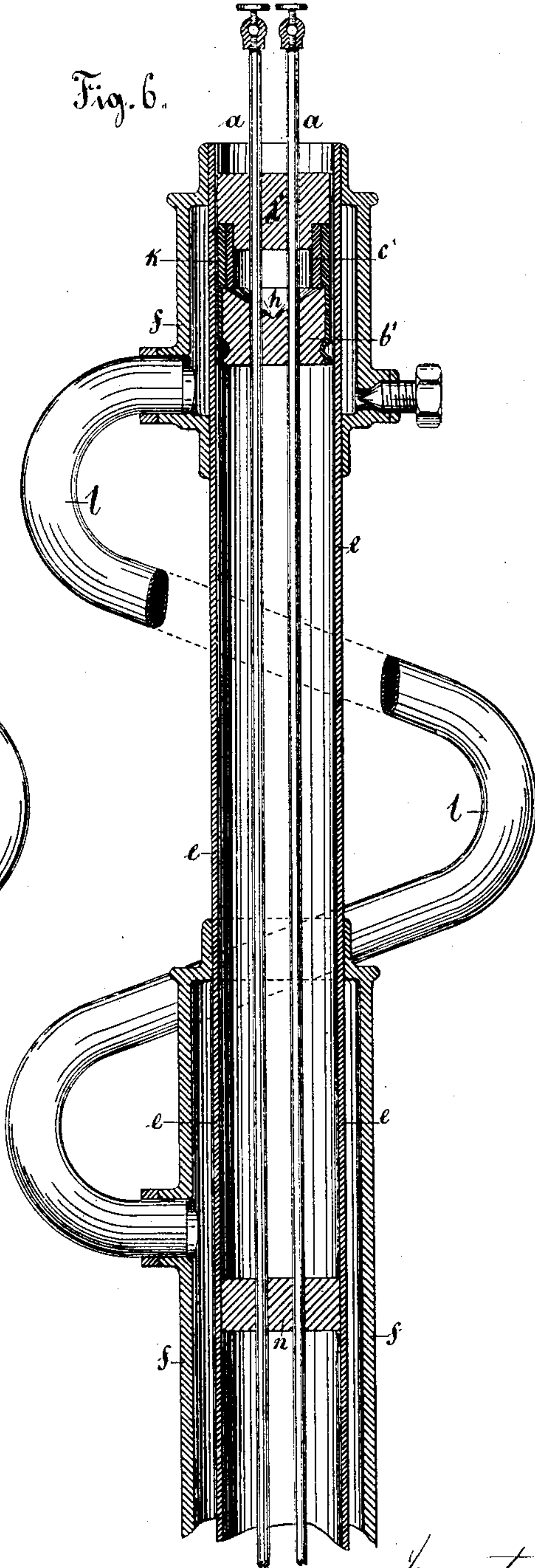


Fig. 6.



Attest
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L. M. Hopkins.

Inventor:
R. Schwartzkopff
By *[Signature]*

UNITED STATES PATENT OFFICE.

RICHARD SCHWARTZKOPFF, OF BERLIN, GERMANY.

SAFETY APPARATUS FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 254,887, dated March 14, 1882.

Application filed October 18, 1881. (No model.) Patented in Germany August 10, 1880, and April 30, 1881, in France May 4, 1881, in Belgium May 4, 1881, in Great Britain May 5, 1881, and in Austria July 4, 1881.

To all whom it may concern :

Be it known that I, RICHARD SCHWARTZKOPFF, of Berlin, Germany, engineer, have invented an Improved Safety Apparatus for
5 Steam-Boilers and for other Purposes, (for which I have received a patent in Germany August 10, 1880, No. 12,591; in Great Britain May 5, 1881, No. 1,953; in France May 4, 1881, No. 142,670; in Belgium May 4, 1881, No.
10 54,552; in Austria July 4, 1881, Tome XXI, folio 1,384, and an additional patent in Germany April 30, 1881, No. 15,634,) and of this invention the following is a specification.

The subject-matter of my invention consists
15 in an apparatus by means of which an electric current is established for the purpose of giving a signal, or of causing any other suitable effect when the lowest admissible water-level or a certain maximum temperature resulting
20 either from an excess of pressure or from retarded ebullition occurs in a steam-boiler, the electric contact being made by the melting of an easily-fusible metal. The apparatus may, however, also be used for controlling tempera-
25 tures in other cases, and, in a somewhat modified form, even such temperatures as are below the point of fusion of metallic alloys. This apparatus is represented on the annexed two sheets of drawings.

30 Figure 1 is a vertical section of the apparatus arranged for controlling the temperature as well as the water-level in a steam-boiler. Fig. 2 shows a modification of parts thereof. Fig. 3 is a simplified arrangement adapted to
35 indicate a certain maximum of temperature not being below the point of fusion of metallic alloys. Fig. 4 represents a modification of the latter arrangement applicable for temperatures lower than the foregoing. Figs. 5 and 6
40 are respectively an outside view and a vertical section of the upper portion of a modification of the first arrangement.

The apparatus represented by Fig. 1 consists
45 of two metal tubes, *e* and *f*, of different diameter, the narrower tube, *e*, being inserted concentrically into the wider tube, *f*. Both tubes are so connected together at their upper end that the annular space between them is hermetically closed at the top, whereas the inside

tube, *e*, which should project with its lower
50 end from the outside tube, *f*, is closed at the bottom. The tube *f* is fixed in such a manner in the crown of the boiler that its lower edge is at the height of the lowest admissible water-
55 level, L W. Its length outside of the boiler must be such as to allow its upper end to remain comparatively cool, four feet being ordinarily sufficient for this purpose. Within the
inside tube, *e*, there are two insulated conducting-wires or thin rods, *a a*, by preference of
60 copper, which carry two cups or hollow disks, *b* and *b'*, of porcelain or other suitable insulating material, the cup *b* being near the bottom of the tube and the cup *b'* near its top. Each of these cups is placed in a metal ring, *k*,
65 somewhat longer than the cup, so as to form a projecting rim of the same. The wires traverse the upper cup and pass into the lower one, which is fixed to their ends. For the purpose
of preventing the wires from touching each
70 other and the tube *e*, they are conducted through a cylinder, *d*, and a plug, *d'*, made of wood or other insulating material. Instead of this cylinder *d*, a number of insulating disks such as
shown in Fig. 6, together with a short plug
75 similar to the plug *d'*, may, however, be applied. The outer end of the wires *a a* is connected by means of other wires with an electric battery and an electro-magnet, which may
80 be used for operating an alarm-bell or other signaling device, or an arrangement for extinguishing the fire or dropping the grate-bars, &c.

Into the metal rings *k*, forming the rims of
the cups or disks *b* and *b'*, are placed the rings
85 *c* and *c'*, respectively, made of an easily-fusible metal or alloy. The point of fusion of the lower ring, *c*, should be slightly higher than the temperature which the water in the boiler
90 has at the maximum degree of steam-pressure allowed, whereas the upper ring, *c'*, must melt by the heat of the steam when at its lowest pressure. These rings are made to fit closely
to the rim *k* in order to prevent their outer
95 surface from being oxidized. On the inside they may be similarly protected by the end of the cylinder *d* and of the plug *d'*. It is, however, not absolutely necessary that the rings

c and *c'* be constructed exactly as described. Their form and arrangement may be modified, and even a fusible metallic body, not being of annular shape, may be employed. Also, the wires *a a* may be insulated in a different manner.

The action of the apparatus is as follows: While the water-level in the boiler is higher than the lower edge of the tube *f* water will be pressed by the steam into the annular space between the two tubes as far up as the air contained in this space permits. The part of the apparatus outside of the boiler being sufficiently long, the surrounding air will keep the temperature of its top end considerably below the temperature of the steam when at its lowest degree of pressure. Under normal circumstances the upper ring, *c'*, whose point of fusion may be, for instance, at 90° centigrade, (194° Fahrenheit,) will therefore not melt; but when the water-level sinks below the lower edge of the tube *f* steam will enter into the annular space between *e* and *f*, and by its heat melt the ring. The molten metal flows into the cavity *h* of the cup and produces contact between the two wires *a a*, whereby the electric apparatus is put into operation. When, on the other hand, the steam-pressure, and consequently the temperature of the water, become excessive, the lower ring, *c*, will melt and cause the electric contact between the wires *a a* in a similar manner as in the first case. The same effect is produced by an excess of temperature caused by retarded ebullition.

In order to prevent bubbles of steam from entering into the annular space between the two tubes during the regular working of the boiler, the projecting part of the tube *e* may be provided with a collar, *m*, which directs these bubbles sidewise.

If the apparatus is to be used for controlling the height of water-level only, the cup *b* and the ring *c* are left away; but the tube *e* should not be made shorter, as otherwise the water would fill out the whole area of the tube *f*, which might cause a prejudicial heating of the upper part of the apparatus. When a fusion of either of the rings *c* or *c'* has taken place the wires, together with the cups, &c., are withdrawn from the tube *e*, the metal which had been melted is removed from the cup, and a new fusible ring is introduced.

The conducting wires or rods *a a* may be made in sections jointed or screwed together, as shown in Fig. 2, whereby their insertion into and withdrawal from the apparatus are facilitated when there is but little room above the boiler.

When a maximum degree of temperature only is to be indicated the upper part of the apparatus, with ring *c'*, cup *b'*, &c., and also the tube *f*, may be left away, or the apparatus represented by Fig. 3 may be used. In this modification the tube *e* is inverted, the cup *b* is placed on top of the insulating-cylinder *d*, or the upper end of this cylinder forms the cup,

while the fusible metallic body *c* is made in the shape of a disk pressed by the top edges of the cylinder *d* (or of the cup *b*) against the top of the tube *e*. The apparatus arranged in this form is introduced from below or obliquely from the side into the vessel, the contents of which are to be controlled with regard to their temperature. If this temperature is to be maintained below the degree of heat at which easily-fusible alloys melt, the arrangement shown by Fig. 4 will be found available. The electric contact between the two wires *a a* is in this case obtained by a metallic plug, *c''*, which is kept suspended above the ends of the wires by means of tallow, wax, paraffine, stearine, or any other easily-fusible substance, such substance being poured in melted state or pressed into the cavity *h* of the cup *b* and into the groove with which the plug *c''* is provided. When the tallow, &c., in *h* becomes sufficiently soft from an excess of temperature above the degree desired the plug *c''* descends and causes contact between the conducting-wires.

In the arrangement of apparatus represented by Figs. 5 and 6 the tube *f* is divided into two parts, the upper one of which is hermetically attached to the tube *e* at the top as well as at the bottom, whereas the lower part is thus fixed at the top only. The two parts of *f* are put in communication with each other by a comparatively narrow pipe, *l*, which is bent spirally or in other suitable manner, so as to allow a certain length to be condensed into a small space. This pipe, presenting a considerable cooling-surface for the water which enters into the same, admits a reduction of the total length of the apparatus outside of the boiler.

When in any works two or more boilers are provided with the controlling apparatus all these apparatuses may be put in relation with the same alarm-bell, provided that a small electro-magnet be inserted into each circuit previous to its connection with the other conducting-wires, the power of this electro-magnet being utilized for indicating the number or other designation of the controlling apparatus by which the current has been established. As in other arrangements of this kind, the electro-magnet may, for instance, be employed for opening a hinged plate which covers the number, &c., arranged together with the other numbers on a register-board.

The described apparatus presents the advantage that it is not subject to such inconveniences as often occur with the safety apparatuses at present applied to steam-boilers. It is not liable to become inoperative or to stick, as is often the case with steam-gages, floats, and safety-valves. Its fusible rings are not exposed to incrustation, as the ordinary fusible plugs, and its action does not give rise to any escape of steam. It is, on the contrary, always in a state to indicate with certainty and in due time all causes of danger of an explosion, including the retarded ebullition, for the

indication of which no appropriate instrument has heretofore been in existence.

I claim as of my invention—

1. The combination, within a tube, *e*, of an
5 insulating-cup, *b*, of two insulated conducting-
wires, *a a*, connected with an electric alarm-bell
or other electric receiver and passing into the
said cup, and of a metallic body so arranged
with regard to the wires *a a* that it will cause
10 contact between them either by its own fusion
or by the fusion of tallow, wax, paraffine,
stearine, or any other easily-fusible substance
by which the said metallic body is kept sus-
pended, substantially as and for the purpose
15 described.

2. The combination, with the tube *e*, con-
taining in its upper part the insulating-cup *b'*,
the two insulated conducting-wires *a a*, con-
20 nected with an electric alarm-bell or other re-
ceiver and passing into the said cup, and the
easily-fusible metallic ring or body *c'*, arranged
as described, of the tube *f*, surrounding the
tube *e* and hermetically attached to the same
at the top, as hereinbefore described, and for
25 the purpose specified.

3. The combination, with the tubes *e* and *f*
and the two conducting-wires *a a*, of the two
insulating-cups *b* and *b'* and the two easily-
fusible metallic rings or bodies *c* and *c'*, the
wires *a a*, passing into or through the cup *b'* 30
and into the cup *b*, substantially as described,
and for the purpose stated.

4. The combination, with the tube *e*, con-
taining the cups *b* and *b'*, the conducting-wires
a a and the fusible metallic rings or bodies *c* 35
and *c'*, and with the tube *f*, made of two parts,
of the pipe *l*, as hereinbefore described, and
for the purpose specified.

5. The combination, with the tube *e*, sur-
rounded by the tube *f* and containing the de- 40
scribed parts *a a*, *b b'*, *c*, and *c'*, of the collar *m*,
as and for the purpose stated.

In testimony whereof I have signed my name
to this specification in the presence of two sub-
scribing witnesses.

RICHARD SCHWARTZKOPFF.

Witnesses:

BERTHOLD ROI,
CARL NEUER.