

N° 6820



A.D. 1904

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Complete Specification Left, 14th Oct., 1904—Accepted, 17th Nov., 1904

PROVISIONAL SPECIFICATION.

“Improvements in Safety Valves”.

I, HENRY ALBERT HOY of Springfield, Bromley Cross, Bolton le Moors, in the County of Lancaster, Engineer, do hereby declare the nature of this invention to be as follows:—

My invention relates to safety valves and consists in a construction of duplex safety valve which is especially adapted for use on locomotives, but may be applied to any type of steam generator.

In carrying my invention into effect in one convenient form, I provide a valve casing which is constructed in three parts. The lower part is adapted to be riveted to the shell of the boiler. The top of this lower part is machined to receive the second part which carries the safety valve seats. This second part is preferably constructed of cast iron and so also is the top part. This second portion is of the nature of a cover for a chamber, of which the lower portion of the valve casing forms the cylindrical sides. This second portion of the casing is provided with two holes, one for each valve. Valve seats which may conveniently be constructed of brass are placed in these holes. The inside diameter of each hole is however of larger diameter except for a small portion at the bottom of the hole than the exterior diameter of the valve seat, so that the valve seat except at its lower portion can expand to a greater extent than the valve casing. Each seat is provided with a flange, and a recess is cut in the valve casing to receive this flange. This recess is however of greater diameter than the external diameter of the flange so as to allow for expansion. The lower surface of the flange forms a seat however on the lower surface of this recess in the valve casing. To secure the valve seat in place within the valve casing I may countersink the hole in the casing through which the valve seat passes at its lower end and edge over the valve seat at this place. The valve I employ is of the conical lift type and is provided with webs which work within the interior of the seat so as to guide the valve in a vertical path. The webs are clear of that portion of the seat which makes contact with the surrounding cylindrical surface of the valve casing. The webs are cut away at their tops so as to give a free passage for the escape of steam all round the valve when this is off its seat. Stops of any convenient nature may be provided to prevent the valve moving too far from its seat. I provide each valve with an adjustable lip which is of the nature of a ring, internally threaded so as to screw on to the exterior of a cylindrical portion on the valve which is externally threaded to receive the ring. The ring has an annular downwardly projecting part with a very fine lower edge. This is arranged so as to almost touch the top of the flange of the seat when the valve is on its seat. Holes are bored through the flange of the seat so as to be inside the adjustable lip. These holes establish communication between the annular chamber enclosed by the valve, its adjustable lip and the valve seat flange and a second annular chamber which surrounds the valve seat below the flange. This second chamber of the one valve seat is put in communication with a corresponding chamber around the other valve seat, by means of a passage. This passage is provided with an adjustable valve which I call a pop regulator for reasons which will be evident when this specification has been read through.

Each safety valve is loaded with a coil spring situated between two plates, of

[Price 8d.]



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which the lower one has a conical projection which engages in a hollow in the top of the valve, while the upper one has a hollow into which passes a conically pointed screwed pin. This screwed pin is internally threaded and works through a bush fitted in a hole cut in the top part of the valve casing. This top part of the valve casing has a lower portion which is secured by studs to the second 5 portion before mentioned of the valve casing. This upper portion of the valve casing is provided with a chimney which is furnished at its top with a muffler. This chimney and muffler are common to the two valves. The screwed pin before mentioned which acts on the plate before mentioned at the top of the spring which controls each valve is provided with a square portion or other 10 means for screwing it in or out and is provided with a lock nut for locking it in position. A cap is provided over the end of this pin which projects outside the valve casing. This cap is provided at its upper end with a cup shaped hollow, through a hole at the bottom of which passes an extension of the screwed pin, this extension having an annular groove cut in it. After the 15 valves have been adjusted, these caps are placed over the ends of the screwed pins and lead is poured into the cup shaped hollow in each cap so as to cover the top of the projection on the pin. An impressed stamp or seal can be placed on the lead and provision is thus made against any unwarranted adjustment of the springs. Although I find this method of sealing the spring adjusting pin 20 a convenient one, I do not confine myself to it but may in any case when thought desirable use any other suitable sealing arrangement.

The action of this duplex safety valve is as follows;—When the steam pressure below either of the valves exceeds the spring pressure on the valve plus friction, the valve will lift. At first the valve lifts a very small extent from 25 its seat and the steam escapes past the adjustable lip as fast as it can pass the main seating surface of the valve. When however the valve rises further from its seat there is a definite appreciable pressure within the annular chamber between the valve, its adjustable lip and the flange on the valve seat. This pressure tends to lift the valve further off its seat and a pop action is produced. 30 At the same time the steam flows from this annular chamber through the holes in the valve seat to the annular chamber surrounding the valve seat and then by the passage before mentioned to the corresponding chamber around the second valve seat. The steam can then pass through the holes in the flange in this second valve seat and so cause a pressure in the annular chamber between 35 the second valve, its adjustable lip and the flange on its seat. This valve, being just on the point of lifting, will be caused to rise from its seat owing to this additional pressure. This device therefore ensures that both valves shall normally come into use—a matter of considerable practical importance. To get this action to take place exactly as desired it is necessary to adjust the lips on 40 the two valves and to adjust the pop regulator. The pop regulator can be adjusted by simply screwing its valve into any desired position and locking it by a lock nut. The lips on the safety valves can also be adjusted by a screwing action and can be locked by a set screw or other convenient means; but, to allow of convenient adjustment of these lips, I provide the top of the valve with 45 a number of holes which serve not only for gripping the valve with a suitable key for turning it but also serve as an indication of the position of the lip with regard to the valve and seat and of the amount of movement given to it in adjusting it.

Dated this 21st day of March, 1904.

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30, Cross Street, Manchester.
Agents.

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COMPLETE SPECIFICATION.

"Improvements in Safety Valves".

I, HENRY ALBERT HOY of Springfield, Bromley Cross, Bolton le Moors, in the County of Lancaster, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

5 My invention relates to safety valves and consists in a construction of duplex safety valve which is especially adapted for use on locomotives, but may be applied to any type of steam generator.

Referring now to the accompanying drawings which illustrate my invention;—

10 Figure 1 is a sectional elevation of a duplex safety valve constructed in one convenient form according to my invention and fitted on a boiler of the locomotive type.

Figure 2 is a sectional plan of the same, the section being taken on the line A A of Figure 1.

15 Figure 3 is a sectional elevation, the section being taken on the lines B B of Figures 1 and 2, and the lower part of the valve casing being omitted.

Figure 4 is a plan view of one of the valves drawn to an enlarged scale.

In the drawings, *a* represents the boiler shell. The valve casing is constructed in three parts *b*, *c* and *d*. The lower part *b* is riveted to the shell of the boiler by the rivets *f*. The top of this lower part *b* is provided with a 20 machined flange *g* which receives a machined flange *h* provided on the second part *c* which carries the safety valve seats. The two flanges are held together by studs *l*. This second part is preferably constructed of cast iron and so also is the top part *d*. This second portion is of the nature of a cover for the chamber *k*, of which the lower portion *b* of the valve casing forms the cylindrical 25 sides. Two holes *n*, *n* are provided in this second portion of the casing, one for each valve. Valve seats *m*, *m* which may conveniently be constructed of brass are placed in these holes. The inside diameter of each hole is, however as shown of larger diameter, except for a small portion *o* at the bottom of the hole, than the exterior diameter of the valve seat, so that 30 the valve seat except at its lower portion can expand to a greater extent than the valve casing. Each seat is provided with a flange *p*; and a recess *q* is cut in the valve casing to receive this flange. This recess *q* is however of greater diameter than the external diameter of the flange *p* so as to allow for expansion. The lower surface of the flange 35 forms a seat however on the lower surface of the recess. To secure the valve seat in place within the valve casing, I may countersink the hole *n* at the bottom end and edge over the valve seat at this place as shown at *r*. I employ a valve *s* of the conical lift type which is provided with webs *t* which work 40 within the interior of the seat so as to guide the valve in a vertical path. The webs *t* are clear of that portion of the seat which makes contact with the surrounding cylindrical surface of the valve casing. The webs *t* are cut away at their tops so as to give a free passage for the escape of steam all round the valve when this is off its seat. I provide each valve with an adjustable ring *v* which is internally threaded so as to screw on to the exterior of a cylindrical 45 portion on the valve which is externally threaded to receive it. The ring has an annular downwardly projecting lip *w* with a very fine lower edge. This is arranged so as to almost touch the top of the flange *p* of the seat when the valve is seated. Holes *w* are bored through the flange of the seat so as to be inside the adjustable lip. These holes establish communication between the

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annular chamber *x* enclosed by the valve, its adjustable lip and the valve seat flange and a second annular chamber *y* which surrounds the valve seat below the flange. This second chamber *y* of the one valve seat is put in communication with a corresponding chamber *y* around the other valve seat, by means of a passage *z*. This passage *z* is provided with an adjustable valve or regulator 2 which I call a pop regulator for reasons which will be evident when this specification has been read through. 5

Each safety valve is loaded with a coil spring 3 situated between two plates 4 and 5, of which the lower plate 4 has a conical projection 6 which engages in a hollow 7 in the top of the valve, while the upper plate 5 has a hollow 8 into which passes a conically pointed screwed pin 9. This screwed pin 9 is externally threaded and works through a bush 11 fitted in a hole cut in the top part of the portion *d* of the valve casing. This top part *d* of the valve casing has an annular machined surface 12 which seats upon the top of the part *c* and is secured thereto by studs 33 (Figure 3). This upper portion *d* of the valve casing is provided with a chimney 14 which is furnished at its top with a muffler which consists of a curved plate 15 containing a large number of perforations 16. This chimney and muffler are common to the two valves. The screwed pin 9 of each valve is provided with a square portion 10 or other means for screwing it in or out and is provided with a lock nut 17 for locking it in position. A cap 18 is provided over the end of the pin 9 which projects outside the valve casing. This cap 18 is provided at its upper end with a cup shaped hollow 19, through a hole at the bottom of which passes an extension 21 of the screwed pin 9, this extension having an annular groove 22 cut in it. After the valves have been adjusted, this cap 18 is placed over the end of the screwed pin and lead is poured into the cup shaped hollow 19 so as to cover the top of the projection on the pin. An impressed stamp or seal can be placed on the lead and provision is thus made against any unwarranted adjustment of the spring 3. Although I find this method of sealing the spring adjusting pin a convenient one, I do not confine myself to it but may in any case when thought desirable use any other suitable sealing arrangement. 10 15 20 25 30

The action of this duplex safety valve is as follows;—When the steam pressure below either of the valves exceeds the spring pressure on the valve plus friction, the valve will lift. At first the valve lifts a very small extent from its seat and the steam escapes past the adjustable lip *w* as fast as it can pass the main seating surface of the valve. When however the valve rises further from its seat, there is a definite appreciable pressure within the annular chamber *x*. This pressure tends to lift the valve further off its seat and a pop action is produced. At the same time the steam flows from this annular chamber *x* through the holes *w* in the valve seat flange to the annular chamber *y* surrounding the valve seat, and then by the passage *w* to the corresponding chamber around the second valve seat. The steam can then pass through the holes *w* in the flange of the second valve seat and so cause a pressure in the annular chamber *x* of the second valve. This valve being just on the point of lifting will be caused to rise from its seat owing to this additional pressure. This device therefore insures that both valves shall normally come into use—a matter of considerable practical importance. To get this action to take place exactly as desired, it is necessary to adjust the lips on the two valves and to adjust the pop regulator. The pop regulator can be adjusted by simply screwing the valve into any desired position and locking it there. 35 40 45 50

The pop valve is conveniently constructed as a screwed cylinder 2 with a conical lower end 31 which engages with a shoulder 32 formed on a nipple 29, the lower end of which is screwed into the part *c* of the valve casing. The interior 28 of this nipple below the valve is in communication with the passage *z*. A chamber 27 is provided in the nipple above the valve seat and this chamber communicates with the exterior of the nipple by means of holes 26. The valve 2 can be screwed down within the nipple so that its conical end is 55

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any required distance from the shoulder 32 on the nipple. The valve can then be locked in place by means of the lock nut 25.

The lips *u* on the safety valves can be adjusted by a screwing action of the rings *v* and can be locked by a set screw 24 or other convenient means. To allow of convenient adjustment of these lips *u*, I provide the top of the valve with a number of slots 23 which serve not only for gripping the valve with a suitable key for turning it, but also serve as an indication of the position of the lip with regard to the valve and seat and of the amount of movement given to it in adjusting it.

If the pop regulating valve is screwed down on to its seat, then the pressure in the annular chamber *x* of any valve cannot be relieved by way of the holes *w*, the passage *z* and the pop regulator. Therefore when once the valves have lifted from their seats under a pressure of a given amount, the pressure will need to fall considerably below this amount before they will again close, that is to say, there is a considerable difference between the opening and closing pressures of the valves. When the pop regulating valve is lifted well clear of its seat, steam in the annular chamber *x* of either valve can escape readily and therefore the pressure in this annular chamber can never be much above atmospheric pressure, and therefore the closing pressure of the valve will be very nearly the same as the opening pressure. The position of the pop regulating valve with relation to its seat can be minutely adjusted and therefore the difference between the opening and closing pressures of the safety valve can be adjusted to the desired amount.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. The duplex safety valve combined with pop regulator, substantially as described.
2. The combination with a duplex safety valve of a pop regulating valve which controls the outlet of a passage which communicates with an annular chamber surrounding each valve and enclosed by an annular lip carried by said valve, substantially as and for the purpose described.
3. In combination, a valve casing formed of three parts such as *b*, *c* and *d*, valves controlling openings in said part *b*, rings such as *v* adjustably attached to said valves, and each enclosing an annular chamber such as *x*, a passage such as *z* which communicates with said chambers *x* by means of holes in the valve seat, and an adjustable regulating valve controlling the outlet from said passage *z*, substantially as and for the purpose described.
4. In combination, a valve such as *s* provided with a ring of slots such as 23, a ring such as *v* having a sharp acting edge such as *u* and adapted to be adjustably secured by screwing on the exterior of the said valve *s*, and a valve seat such as *m* having a flange such as *p* which is provided with holes such as *w*, substantially as and for the purpose described.
5. In combination, a valve such as *s* provided with a ring of slots such as 23, a ring such as *v* having a sharp acting edge such as *u* and adapted to be adjustably secured by screwing on the exterior of the said valve *s*, a valve seat such as *m* having a flange such as *p* which is provided with holes such as *w*, a coil spring adapted to press the said valve on its seat, a screwed pin such as 9 adapted to regulate the compression of said spring and a cap such as 18 provided with a hollow such as 19 into which passes the end of the pin 9, substantially as and for the purpose described.
6. In combination, a valve such as *s* provided with a ring of slots such as 23, an adjustable ring such as *v* having a sharp acting edge such as *u* adapted to enclose an annular chamber such as *x*, a valve seat such as *m* having a flange such as *p* which is provided with holes such as *w* which establish communication between said chamber *x* and a chamber such as *y*, a passage such as *z*

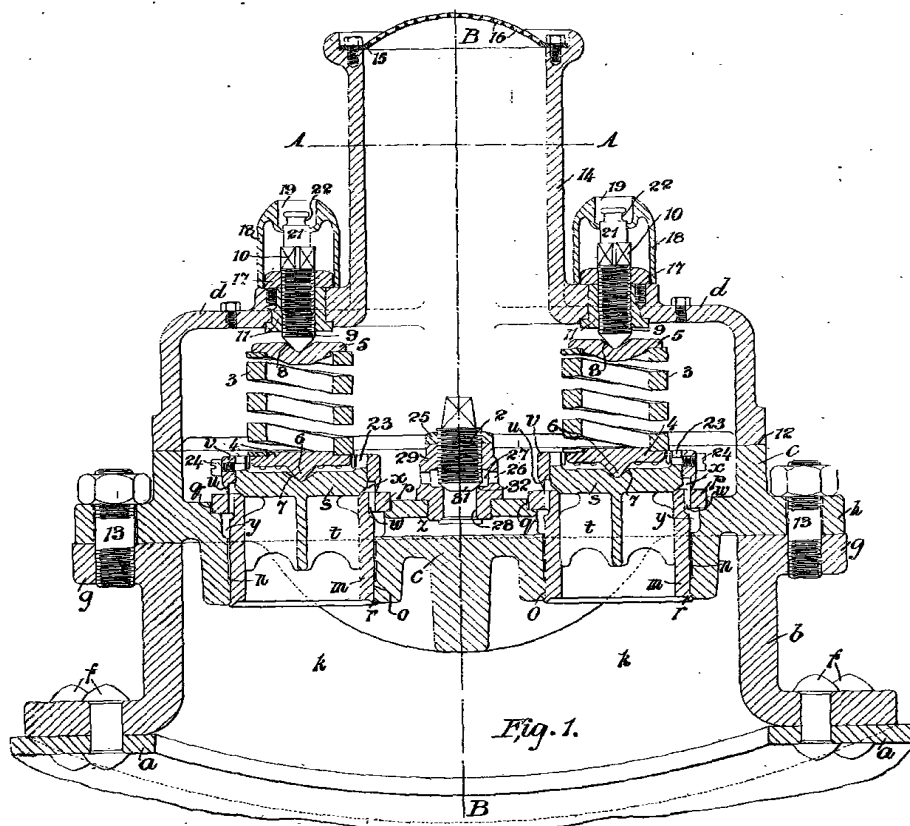
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connecting said chamber *y* with the interior of a nipple such as 29 and an adjustable valve or regulator such as 2 adapted to control the exit from the said nipple, substantially as and for the purpose described.

Dated this 14th day of October, 1904.

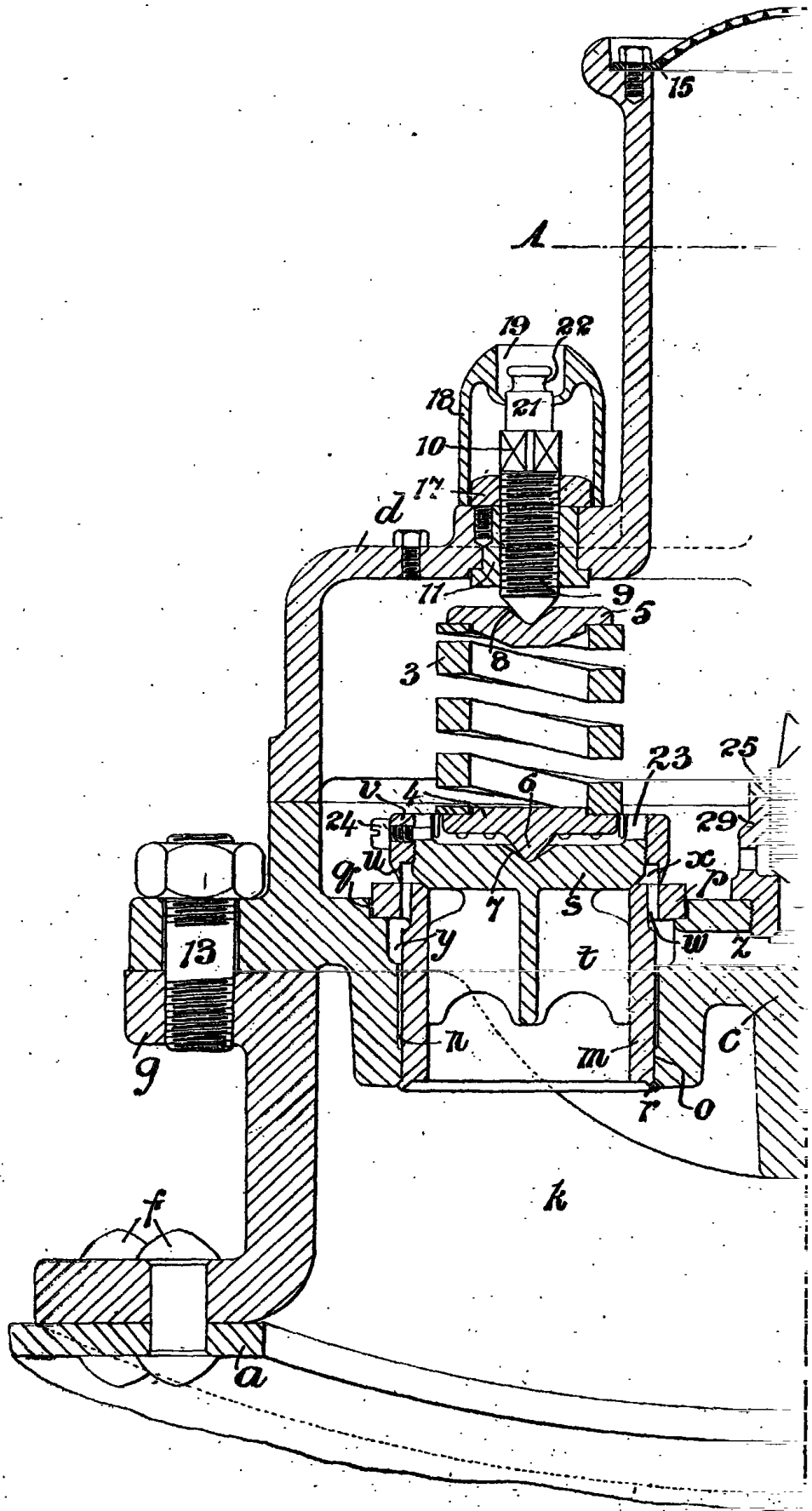
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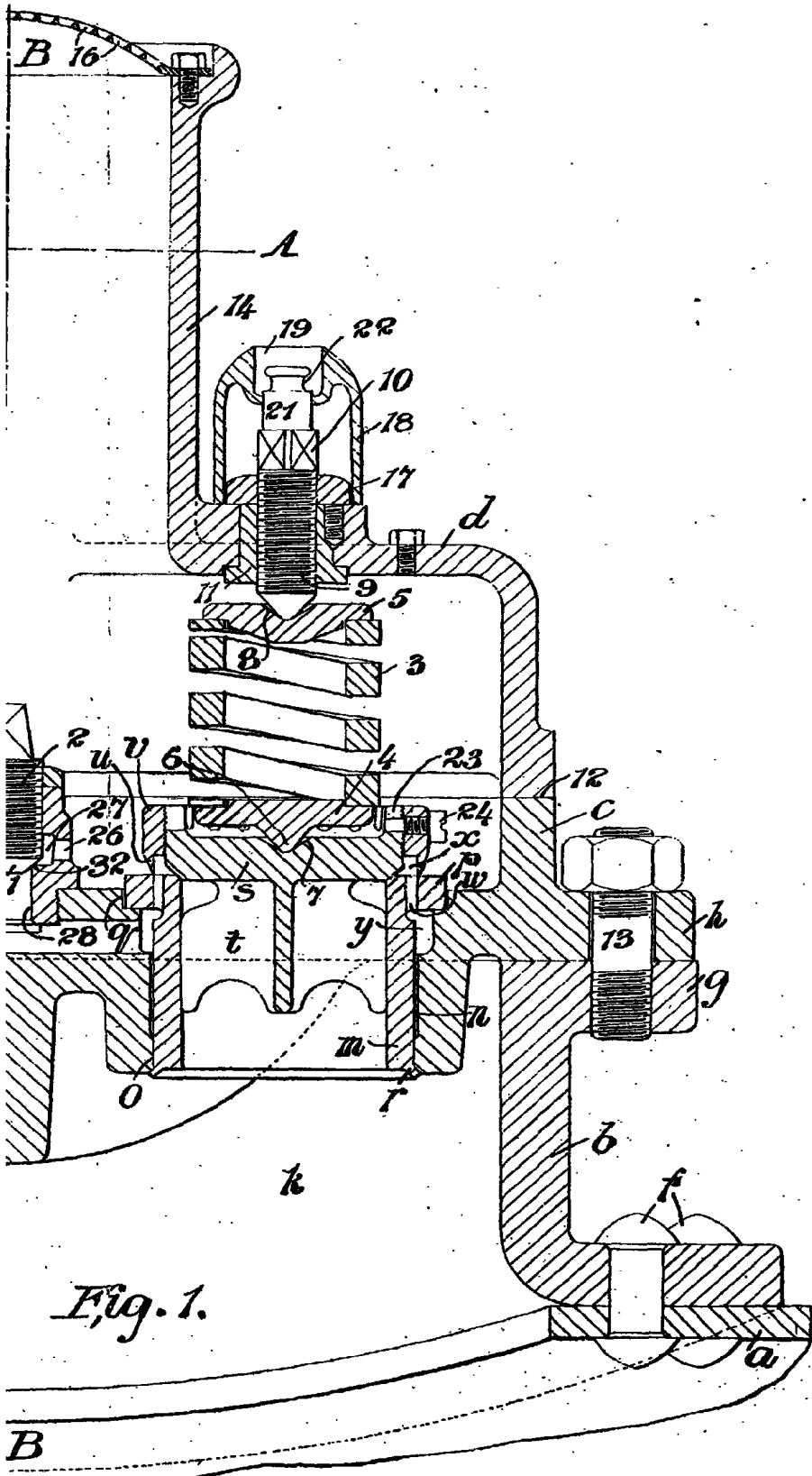
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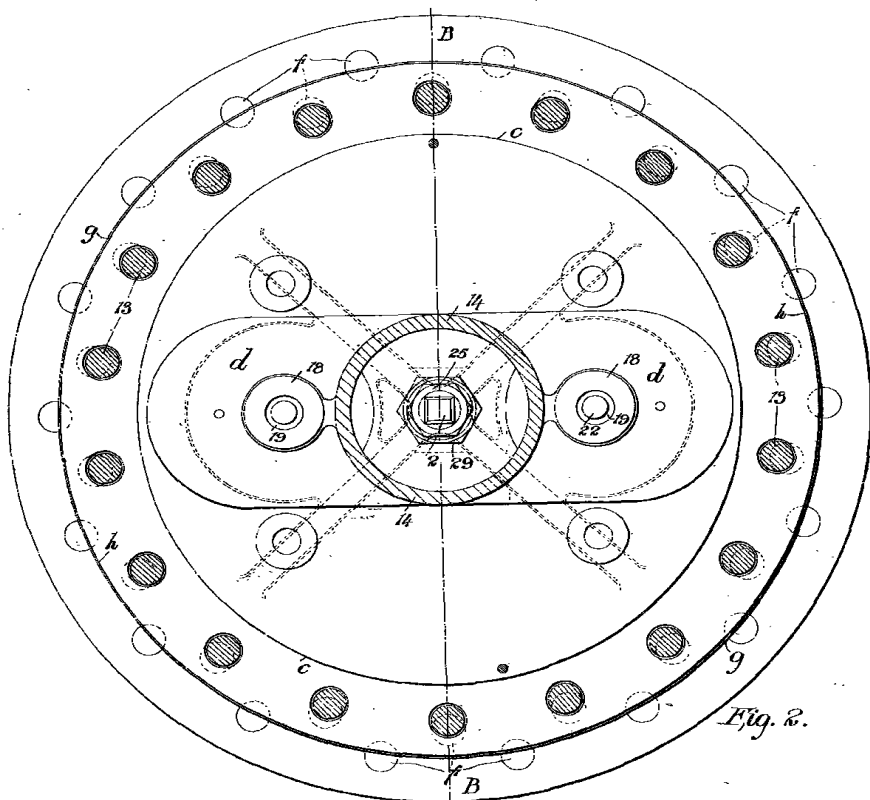
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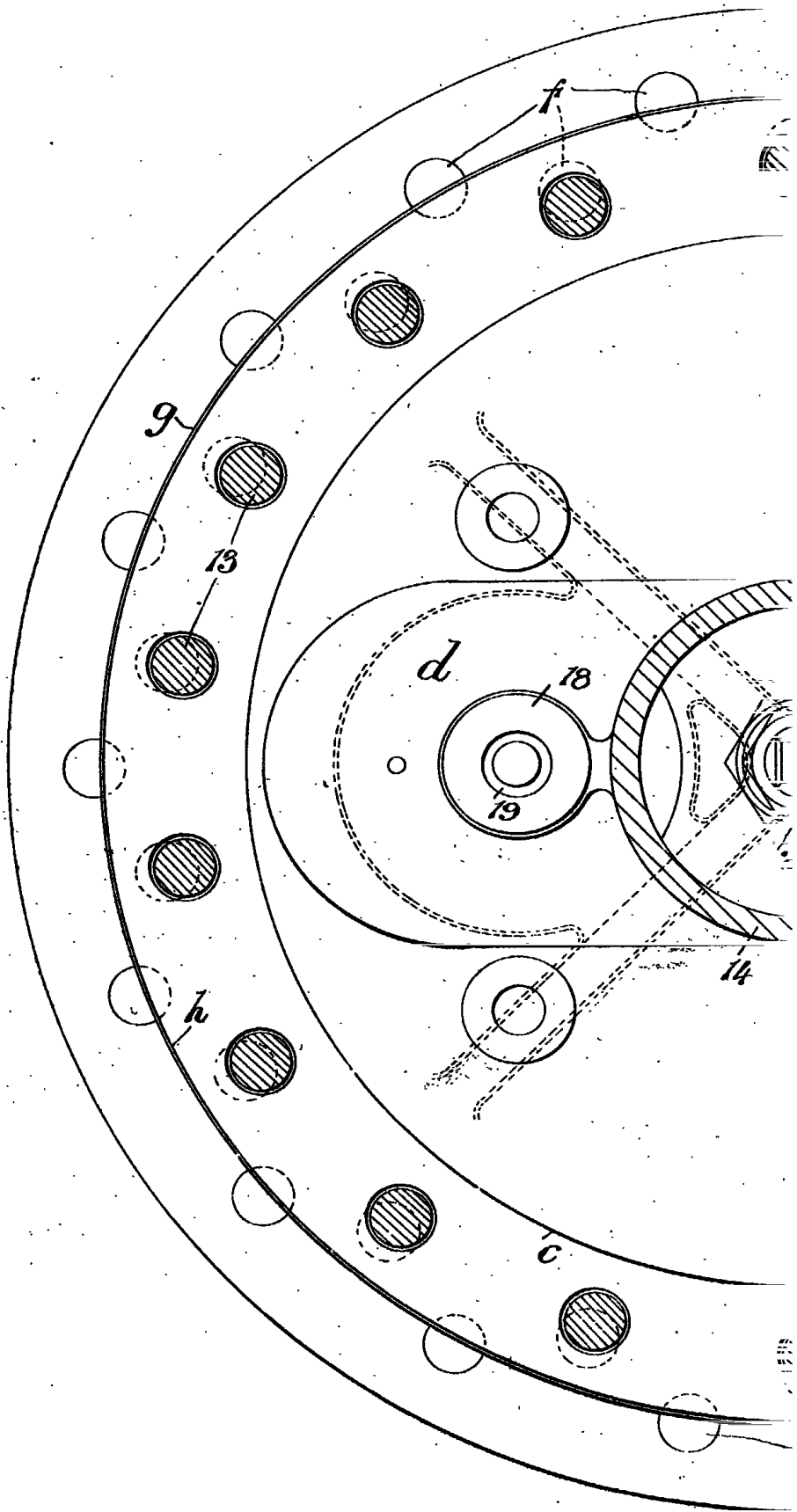
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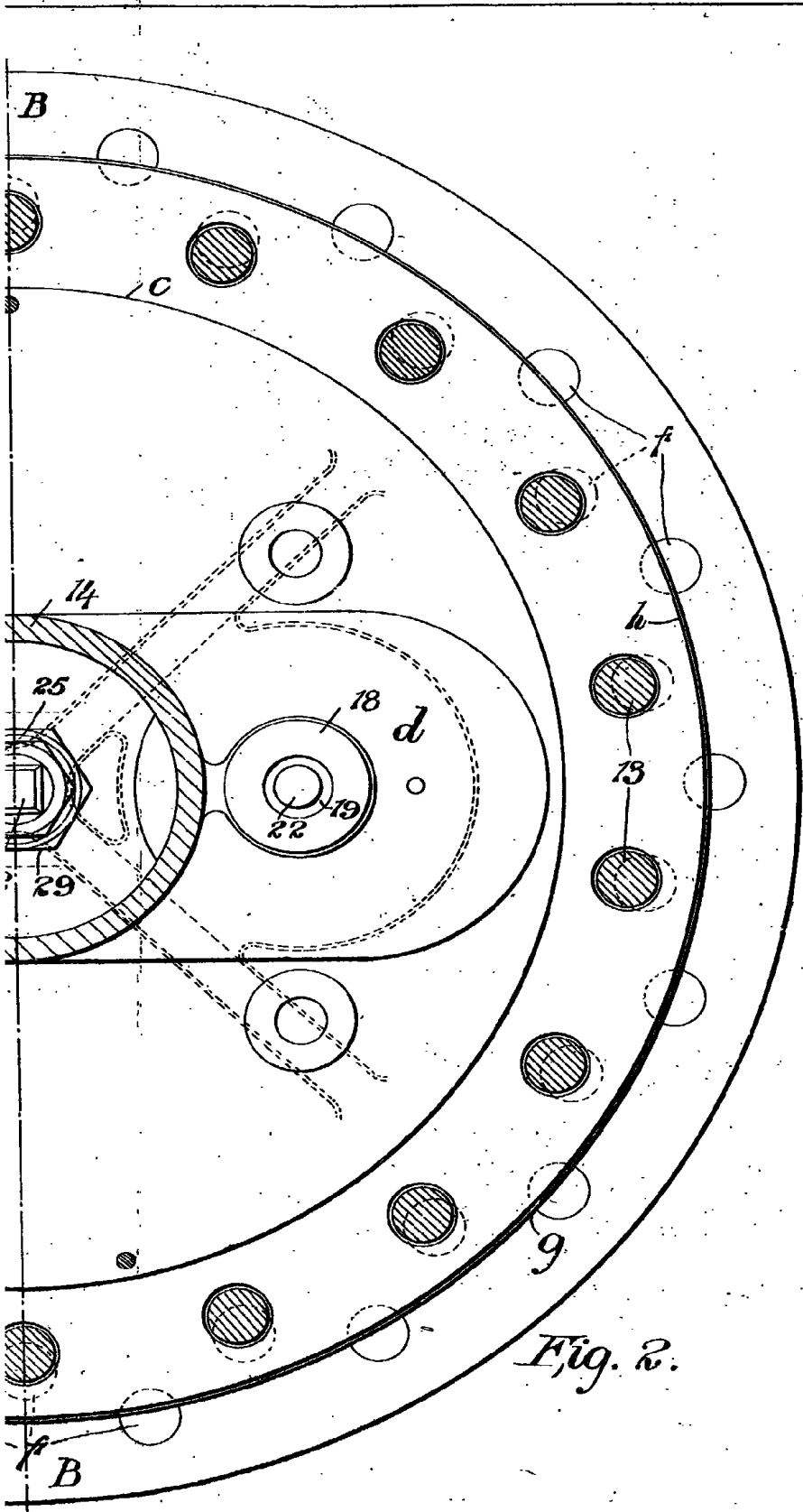


Fig. 2.

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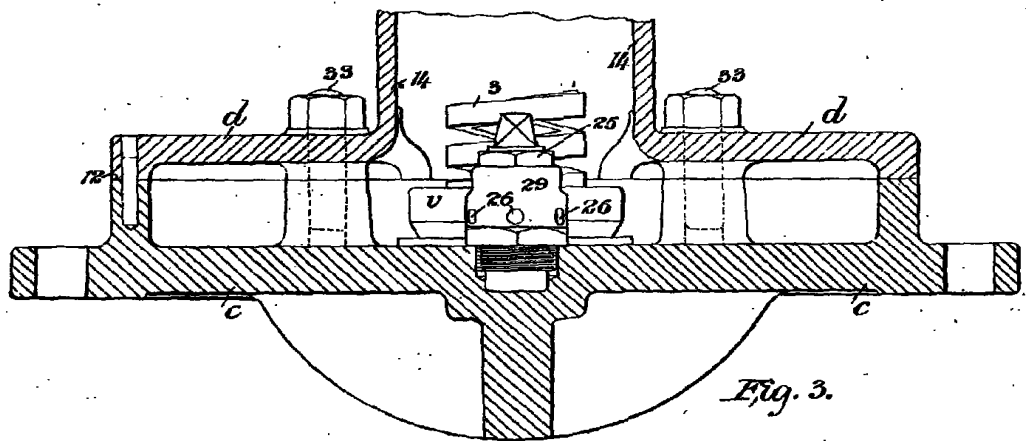


Fig. 3.

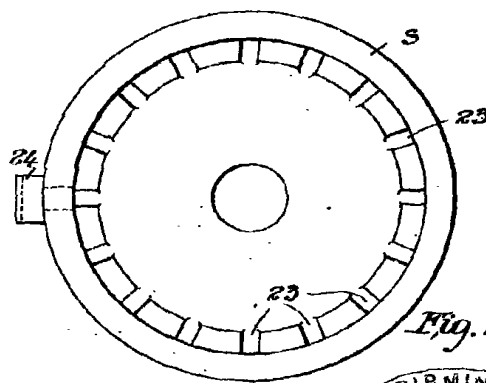


Fig. 4.

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