

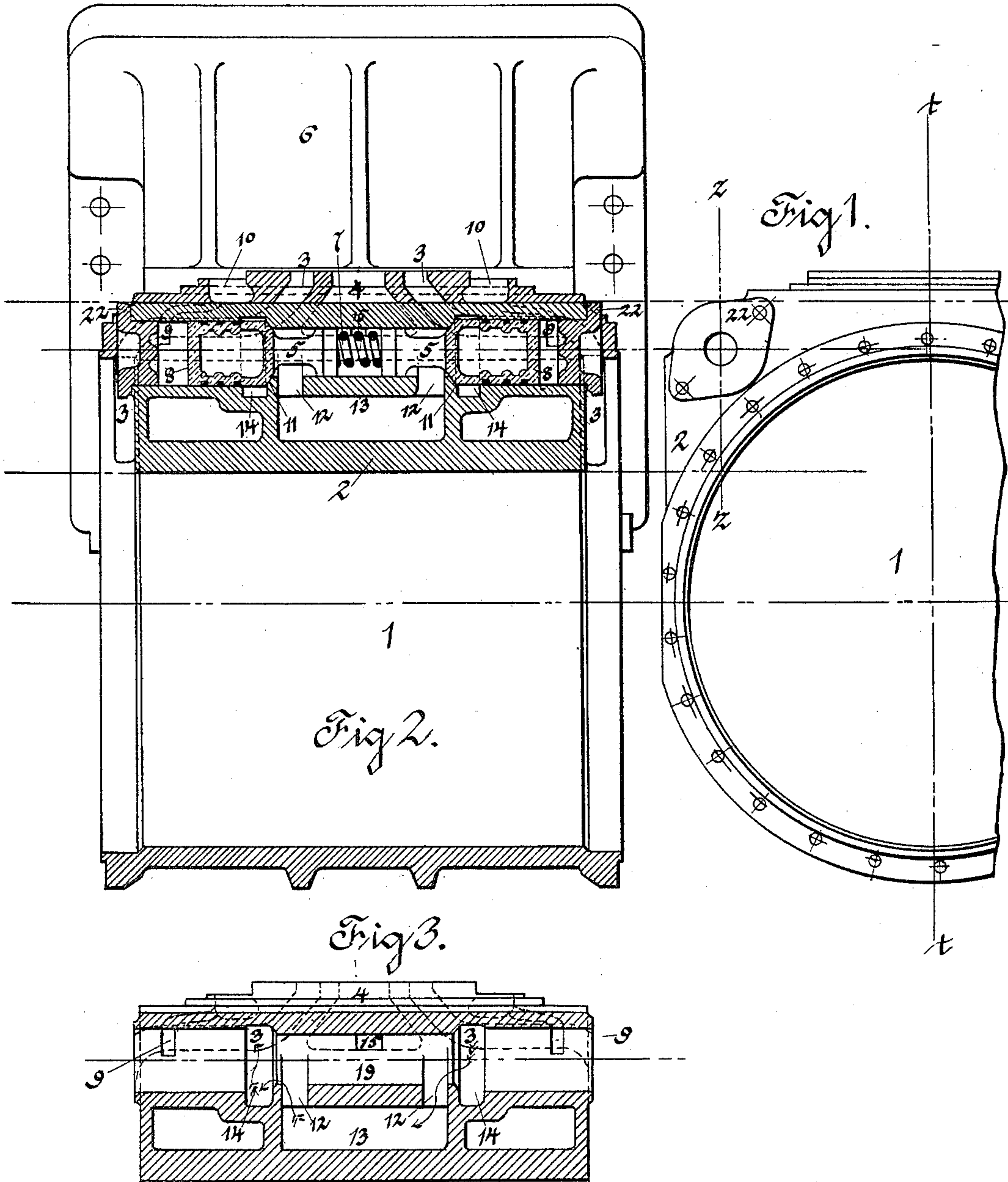
(No Model.)

2 Sheets—Sheet 1.

T. H. SYMINGTON.  
CYLINDER RELIEF VALVE.

No. 581,788.

Patented May 4, 1897.



Thomas H. Symington  
INVENTOR

WITNESSES:  
Wm. H. Handy,  
M. L. Stewart

BY  
Stewart Stewart  
ATTORNEYS

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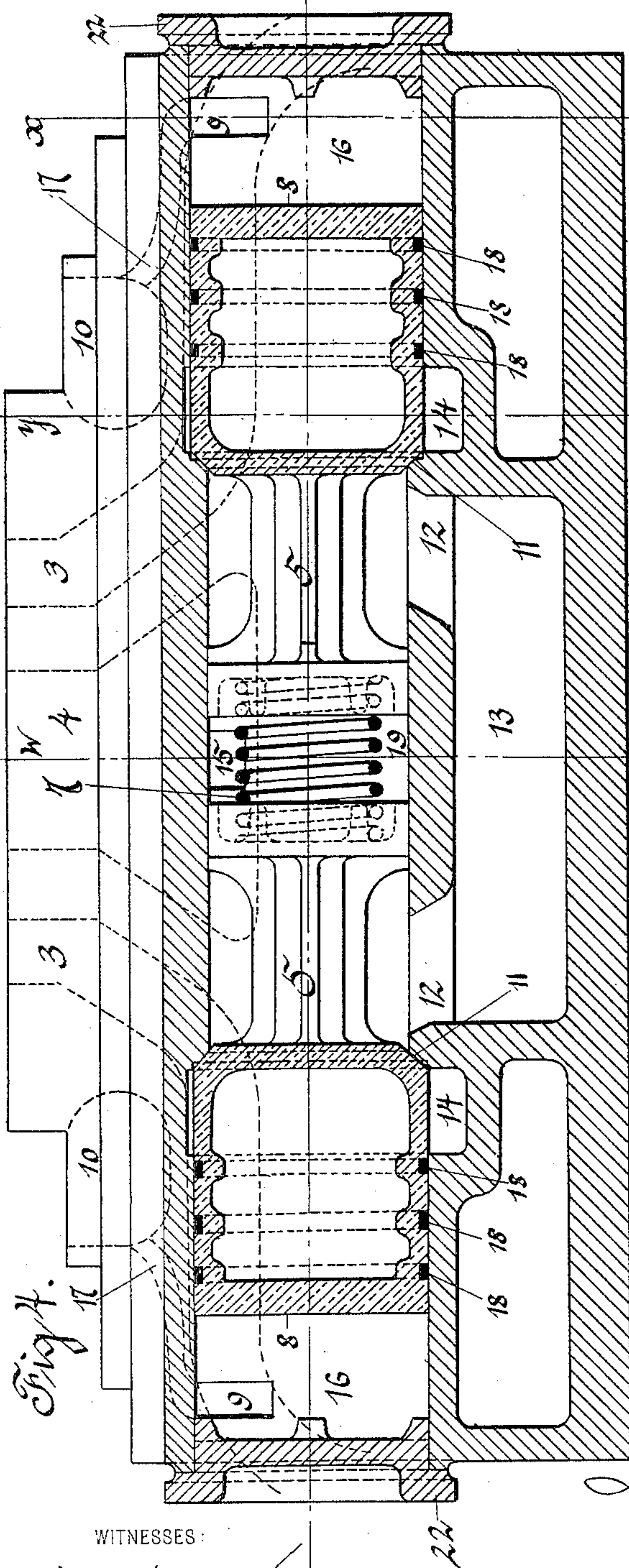


Fig. 4.

WITNESSES:

*Wm. H. Handy,*  
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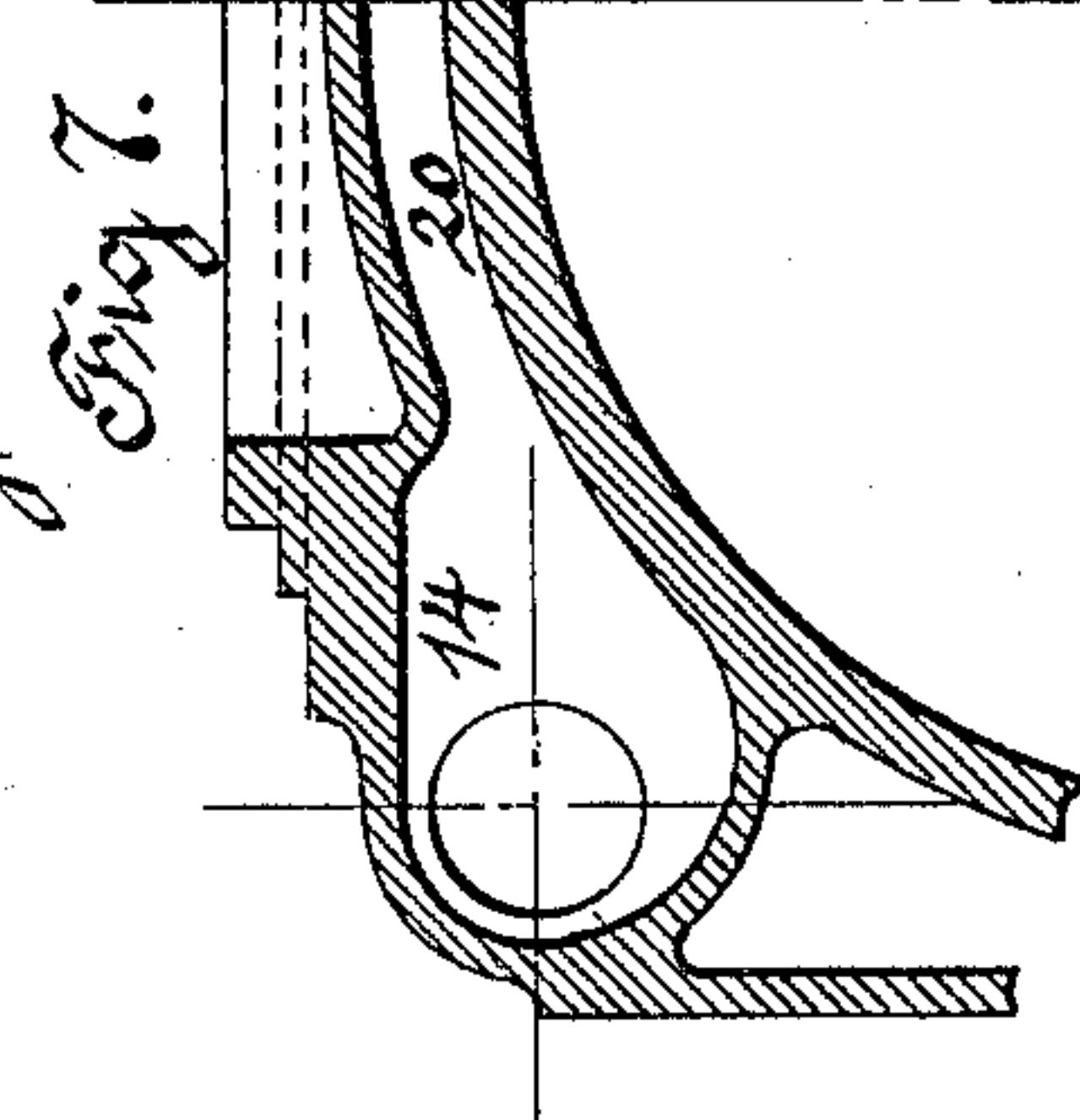


Fig. 7.

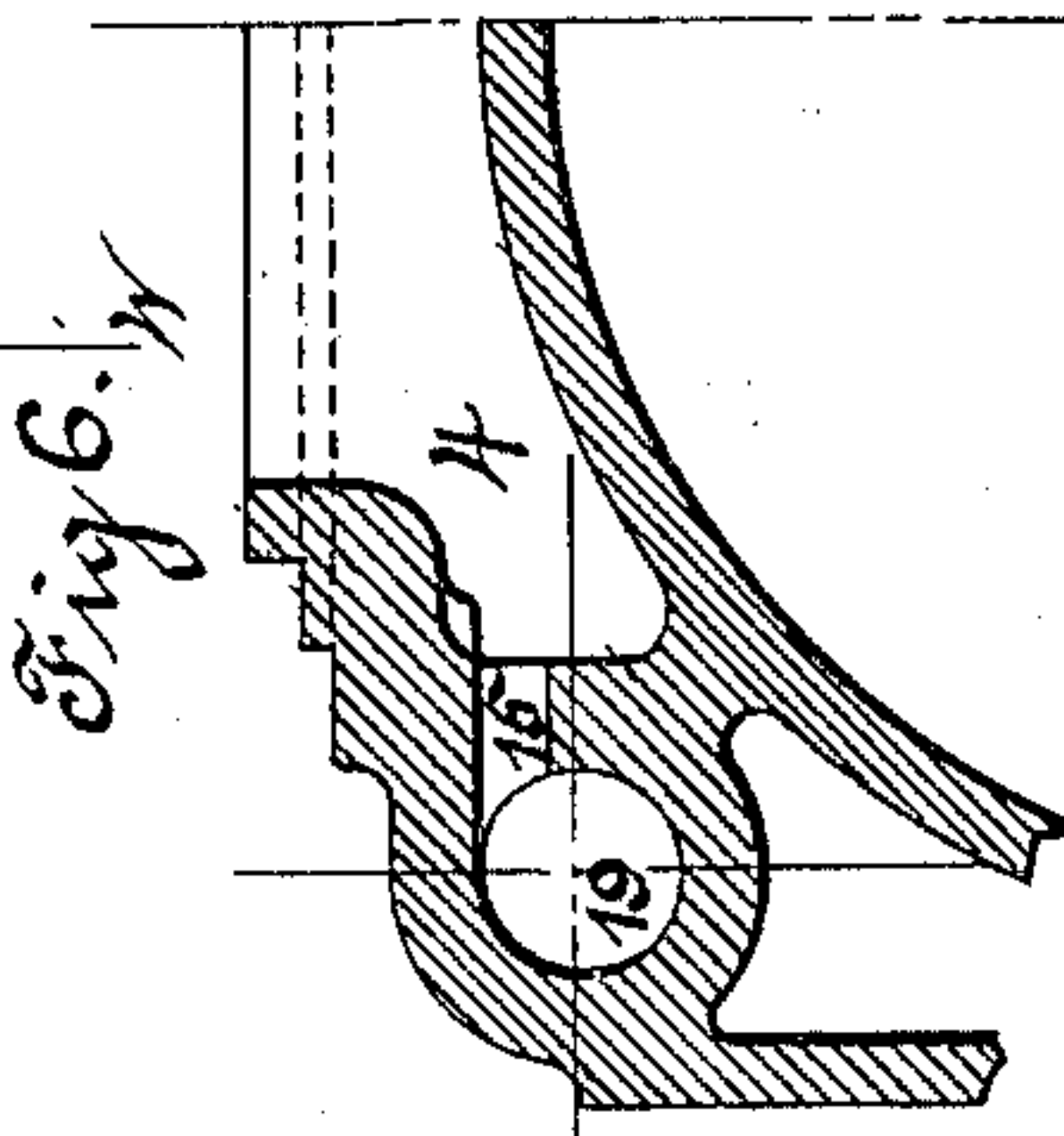


Fig. 6.

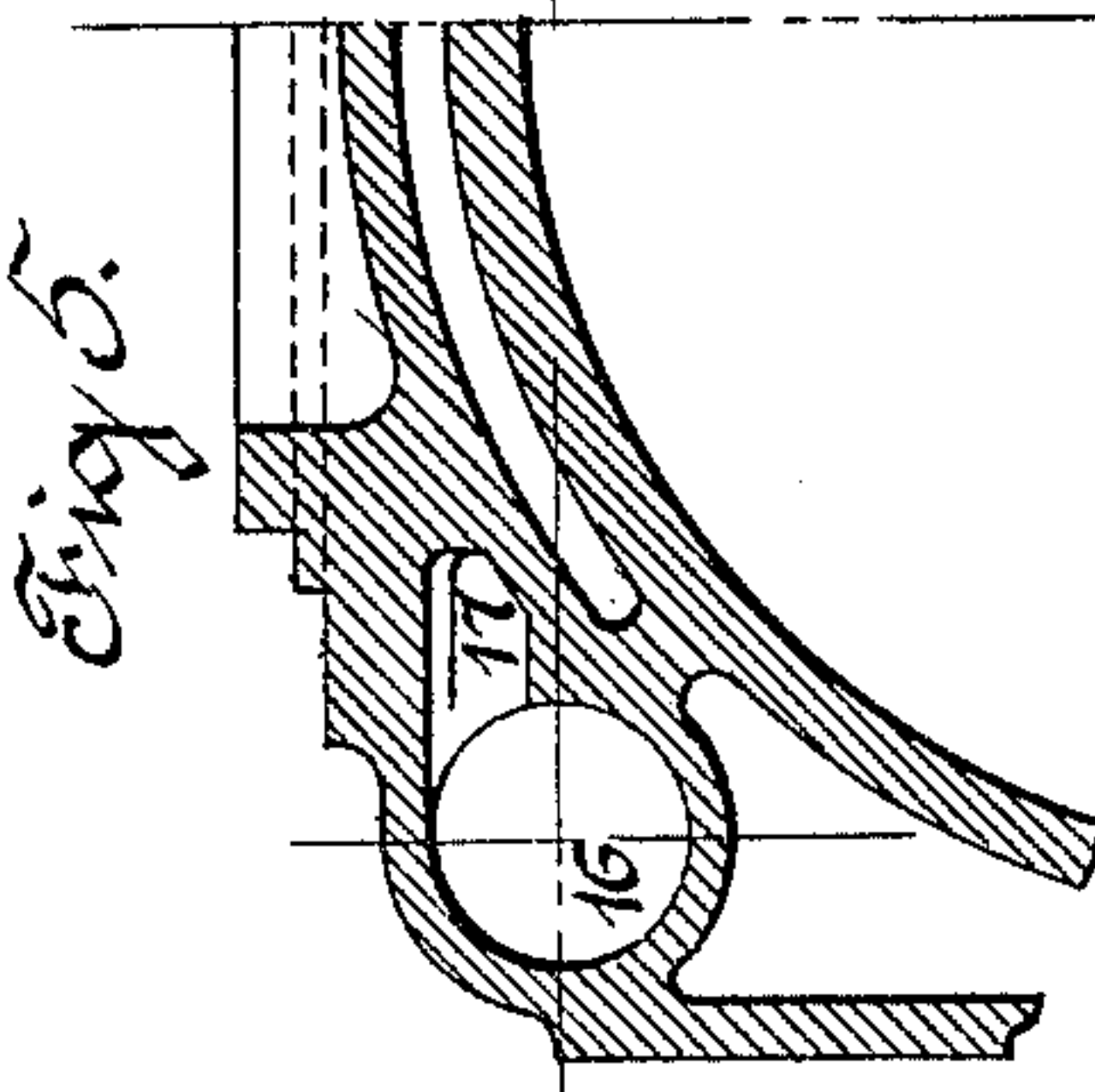


Fig. 5.

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# UNITED STATES PATENT OFFICE.

THOMAS HARRISON SYMINGTON, OF RICHMOND, VIRGINIA.

## CYLINDER RELIEF-VALVE.

SPECIFICATION forming part of Letters Patent No. 581,788, dated May 4, 1897.

Application filed September 2, 1896. Serial No. 604,627. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS HARRISON SYMINGTON, a citizen of the United States, and a resident of Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Cylinder Relief-Valves, of which the following is a specification.

The primary object of my invention is to provide means for preventing compression in a locomotive-cylinder when running without steam. This compression, as is well known, causes excessive pounding and, together with suction, acts as a brake. In the ordinary compound locomotive when the throttle is closed the draft caused by the large low-pressure piston pumping air through the stack is sufficient to cause the engine to burn nearly as much fuel when running on no load as when running on full load, also; under ordinary conditions a considerable amount of smoke-box gases are sucked into the cylinder. By the use of my invention pounding is prevented, the engine is allowed to run freely downhill, and the two last-mentioned defects are minimized.

My invention consists in a relief-valve which when the throttle is closed automatically connects together both ends of the cylinder of a locomotive and at the same time puts both in communication with the atmosphere through the exhaust, the said valve keeping the two ends of the cylinder connected while the engine is running under these conditions and yet disconnecting them and keeping them disconnected as soon as the throttle is opened.

The construction and operation of this valve are fully explained in the following specification, reference being had to the accompanying drawings.

Figure 1 shows an end view of the cylinder. Fig. 2 is a longitudinal sectional view taken on the two lines  $z z$  and  $t t$  of Fig. 1, the section on line  $z z$  being through the automatic relief-valve and that back of it on line  $t t$  being through the center of the cylinder and the steam and exhaust ports. Fig. 3 is a longitudinal section on line  $z z$  of Fig. 1 with the auxiliary relief-valve removed, showing the connecting ports. Fig. 4 is an enlarged

longitudinal section taken on line  $z z$  of Fig. 1. Figs. 5, 6, and 7 are sectional views on lines  $x x$ ,  $w w$ , and  $y y$  of Fig. 4.

Referring to Fig. 1, the part 2 above the cylinder 1 contains the ordinary arrangement of exhaust and steam ports and in addition to these the auxiliary ports connecting with the automatic relief-valve which is directly back of the head-plate 22, a passage being cored out for it.

In the double sectional view shown in Fig. 2 the front section on line  $z z$  of Fig. 1 shows the construction and also position of the relief-valve with respect to the steam-ports 3 and exhaust-port 4. This valve is in two similar parts 5 5. 7 is a spring normally held compressed by steam-pressure on the ends 8 of the valves. The openings 9 are in direct connection with the steam-chest. The chamber 13, ports 12, and recesses 14 constitute a part of the connection between the ends of the cylinder. This connection is opened when the valves are pressed away from their seats 11.

The connecting-ports are more clearly shown in Fig. 3, in which the valves 5 are not shown. The recesses 14 are here shown in direct connection with the steam-ports 3, the course of the steam and air from one end of the cylinder to the other being shown by the arrows. These arrows would be reversed with the piston moving in the opposite direction.

15 is a port connecting the middle valve-chamber 19 with the exhaust-port 4, Fig. 6, and is provided for the purpose of affording free access to the atmosphere for any steam which may leak past the valves 5 into the said chamber 19.

In Fig. 2 the section on line  $t t$  of Fig. 1 shows in dotted lines the course of the ports 3 to the cylinder 1. The part 6 is the supporting structure for the locomotive-boiler, and is illustrated in the drawings merely to show the disposition of the various parts with respect to each other.

In Fig. 4, 17 are the connecting-ports between the chambers 16 and the recesses 10 in the steam-chest. Most of the parts shown in this figure are shown in Fig. 2.

Fig. 5, the section taken on line  $x x$  of Fig. 4, shows the connecting-port 17.



Fig. 6, the section taken on line *ww* of Fig. 4, shows the connection between the chamber 19 and exhaust 4 by means of the port 15.

Fig. 7, the section on line *yy* of Fig. 4, shows the connection-port 20 between the recess 14 and the steam-port 3.

In operation the valve works in the following manner: Under normal conditions with the throttle open the two valves 5 5 are held against their seats 11 11 by steam-pressure on their ends 8 8, the steam having free access from the steam-chest into the chambers 16 16 by means of ports 17 17. As soon, however, as the throttle is closed steam-pressure is removed from the chambers 16 16 and ends 8 8, and the spring 7 presses the valves 5 5 apart and away from their seats 11 11. This opens a passage between the ends of the cylinder by way of ports 3 3, ports 20 20, which enter ports 3 3, (shown in Fig. 7,) recesses 14 14, ports 12 12, and chamber 13, and the steam and air contained in the cylinder will circulate freely back and forth through these openings during the whole piston-stroke. Of course during that part of the return stroke before compression takes place the cylinder has free access to the atmosphere through the exhaust, and it is only during the last or compression part of the stroke when the exhaust is cut off that this free passage for steam and air between the ends of the cylinder is of use in preventing pounding. With the engine running under these conditions there can be neither a vacuum on one side nor compression on the other side of the piston. Hence there can be no brake action on the engine. The amount of air pumped out through the stack is minimized, since a considerable amount returns to the other end of the cylinder to prevent the formation of a vacuum, and since there is no vacuum there is no tendency for smoke-box gases to enter the cylinder. When the throttle is again opened and steam admitted against the ends 8, the valves are pushed back to their seats and connection between the ends of the cylinder closed.

Having now fully described my invention, what I desire to claim and secure by Letters Patent is—

1. In a relief-valve for steam-engine cylinders, the combination of a chamber provided with four ports, two at each end, one of said ports at each end of the chamber connected

to a source of steam-supply and one of said ports at each end of the chamber connected to opposite ends of the steam-engine cylinder, with a pair of valves seated within the chamber which when closed cut off the communication between the ends of the steam-engine cylinder and when open establish it.

2. In a relief-valve for steam-engine cylinders, the combination of a chamber provided with four ports, two at each end, one of those at each end of the chamber being connected to a source of steam-supply and the other at each end of the chamber being connected to the end of the cylinder, with a pair of valves seated in said chamber, which when closed cut off the communication between the ends of the cylinder, but when open permit it, said valves being normally pressed open by a spring located between them.

3. In a relief-valve for steam-engine cylinders, the combination in a cylindrical chamber of a pair of piston-valves located and seated therein, so as to open and close communication between the ends of said chamber, with four ports, one of which is located in each end of said chamber and behind the valves, and is in communication with the steam-chest of the engine, and the other two in front of the valves when open and communicate with the opposite ends of the cylinder, whereby when the valves are open the two ends of the cylinder are maintained in constant communication with one another.

4. In a relief-valve for steam-engine cylinders, the combination in a cylindrical chamber of a pair of piston-valves located and seated therein so as to open and close communication between the ends of said chamber, with four ports, one of which is located in each end of said chamber and behind the valves, and is in communication with the steam-chest of the engine, and the other two steam-ports communicating with opposite ends of the engine-cylinder and arranged to be opened and closed by the valves when seated or unseated.

Signed at Baltimore, in the State of Maryland, this 20th day of May, A. D. 1896.

THOMAS HARRISON SYMINGTON.

Witnesses:

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M. G. STEUART.