(No Model.) 2 Sheets—Sheet 1

W. JONES.

BALANCED SLIDE VALVE.

No. 270,809. Patented Jan. 16, 1883.

Fig. 3.

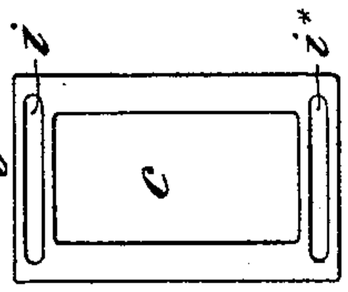

Fig. 9.

Fig. 10.

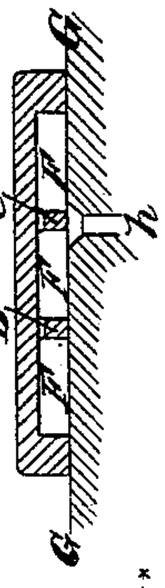

Fig. 1.

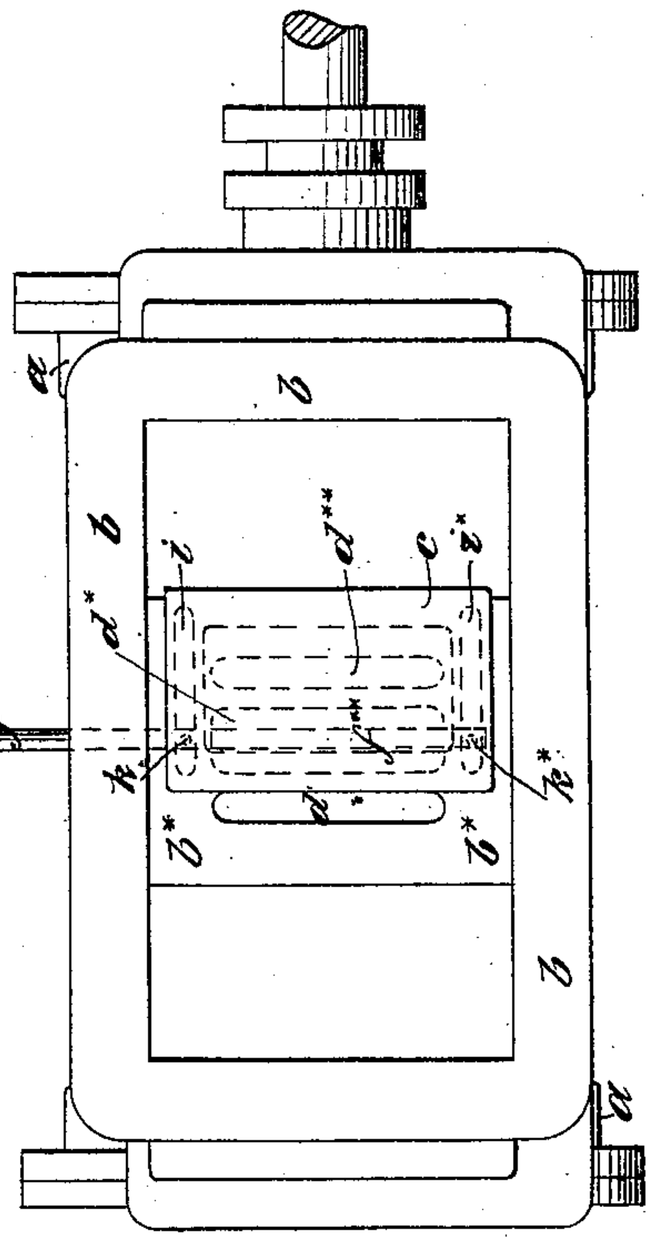

Fig. 2.

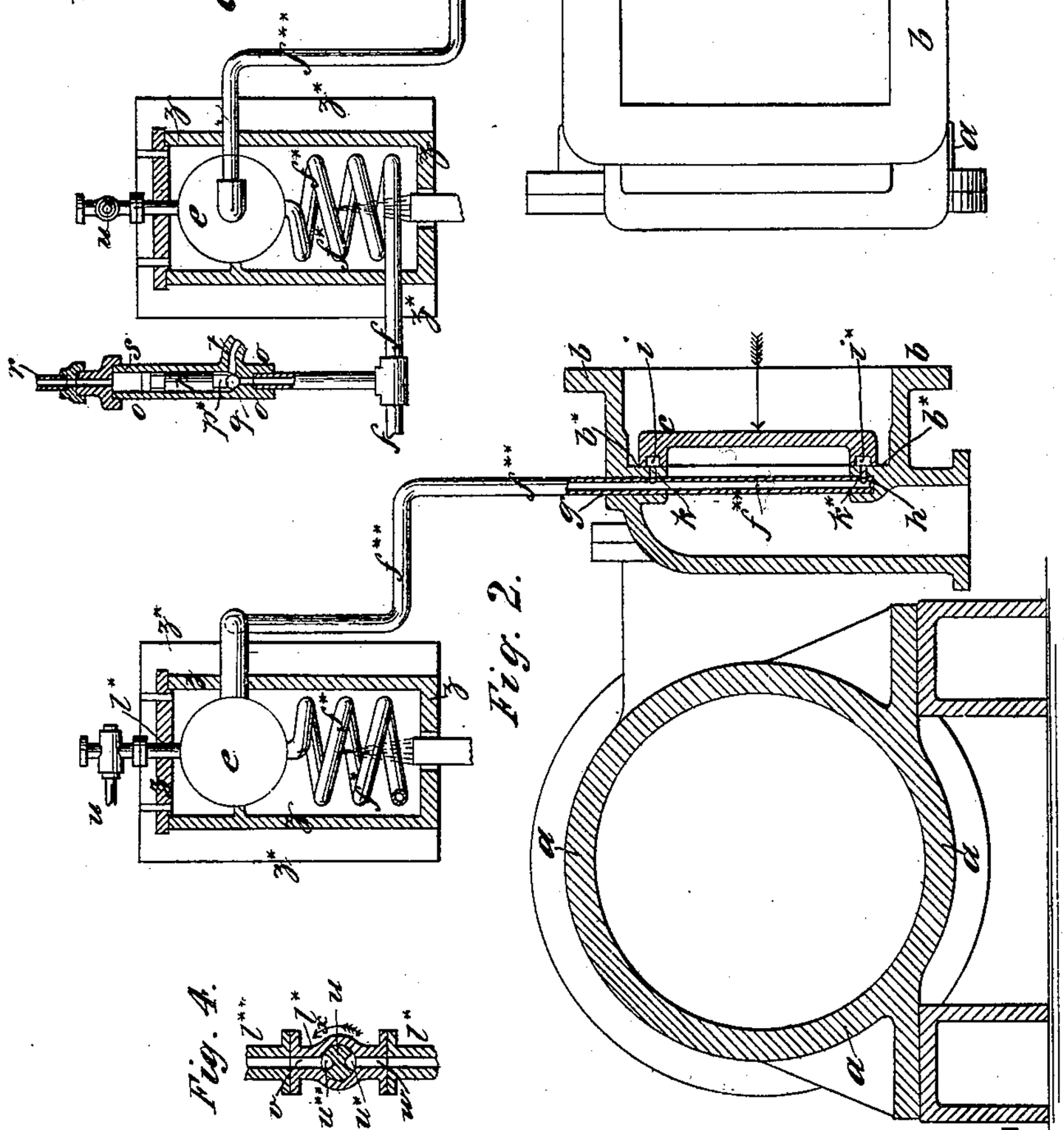

Fig. 4.

Witnesses-
Fred't Haynes
Ed. L. Moran

Inventor
Wright Jones
by his Attorneys
Brown & Brown

(No Model.) 2 Sheets—Sheet 2.

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Fig. 6.

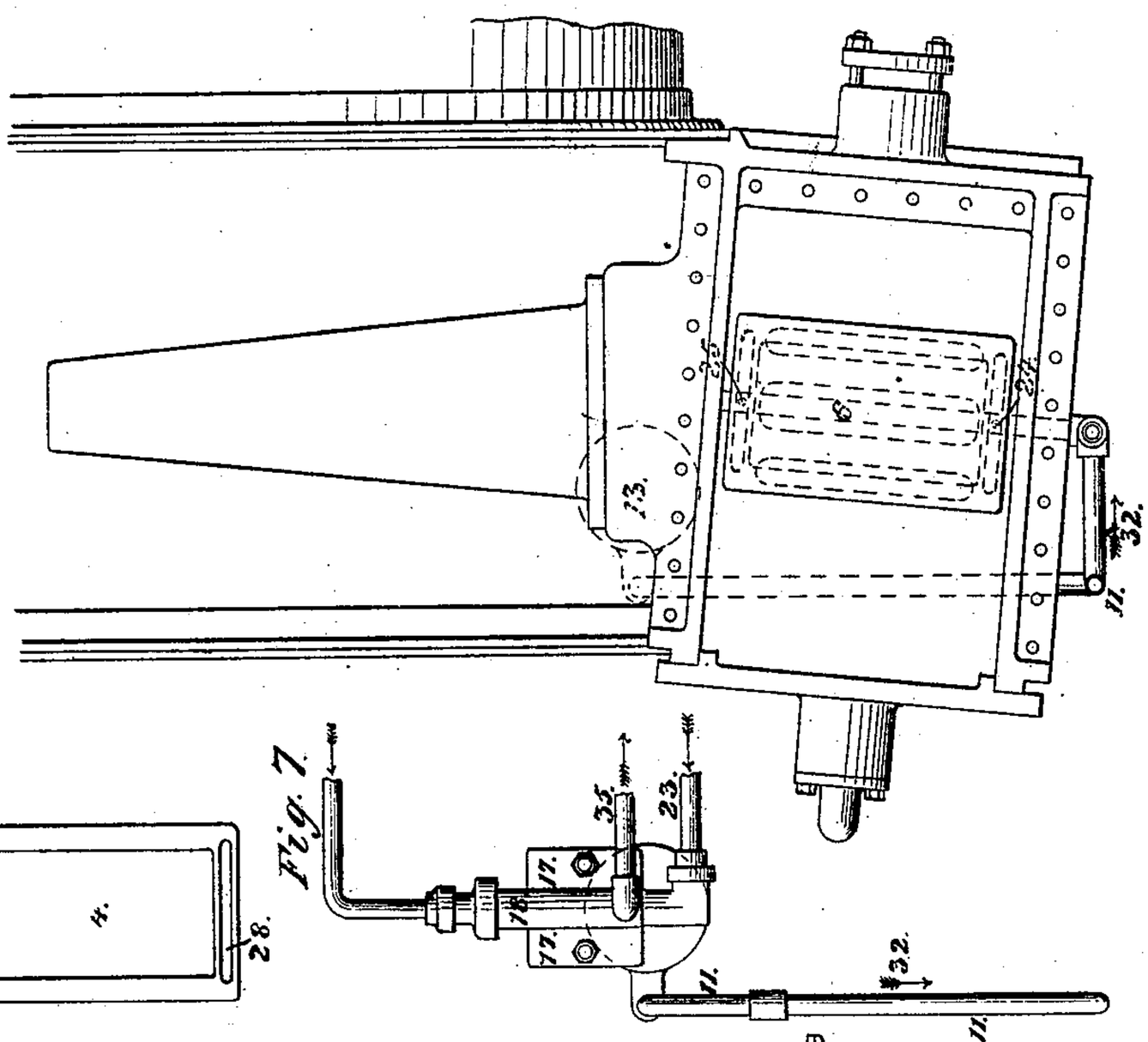
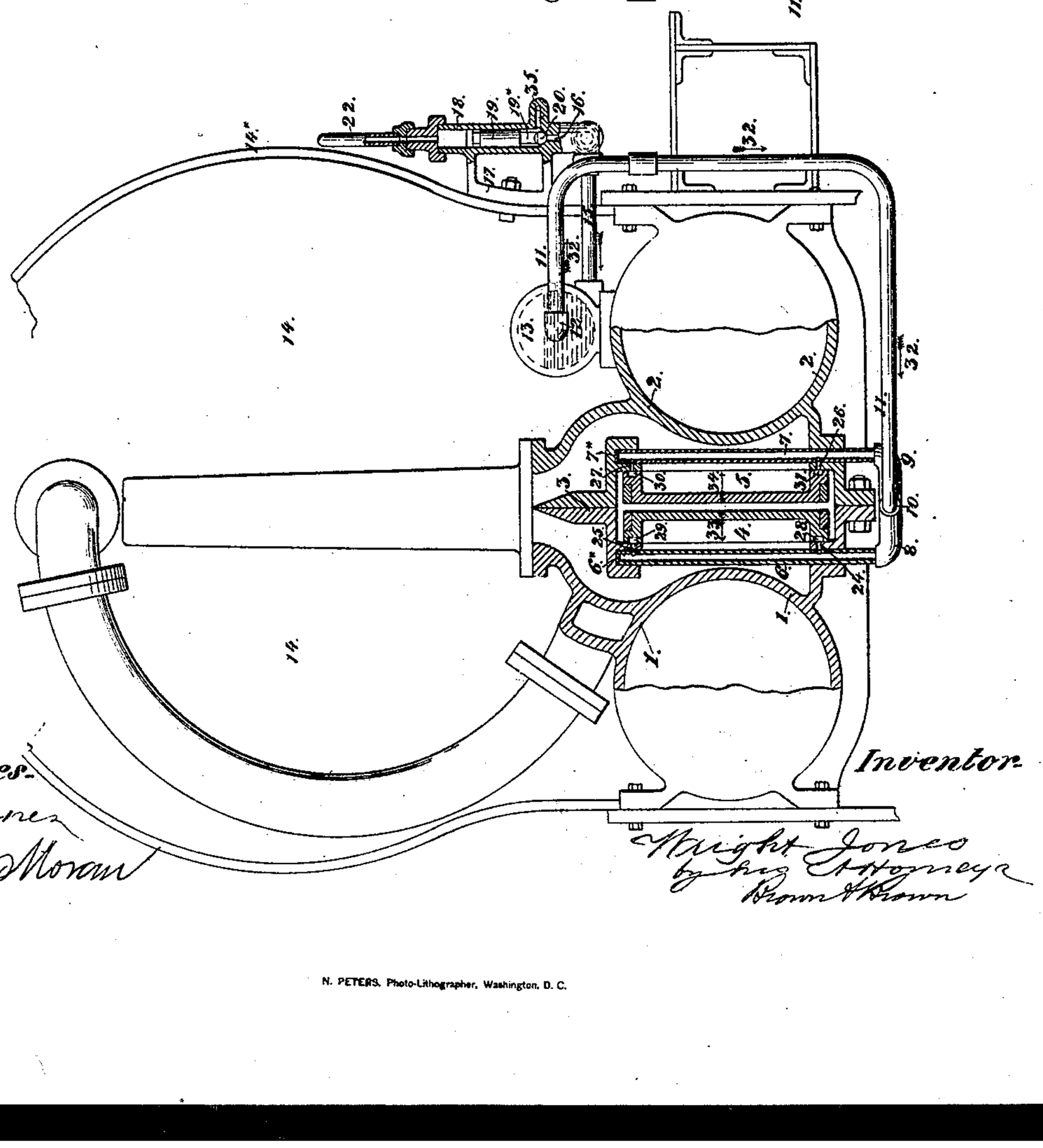


Fig. 8.

Fig. 7.

Fig. 5.



Witnesses.
J. Haynes
Ed L. Moran

Inventor.
Wright Jones
by his Attorneys
Brown & Brown

UNITED STATES PATENT OFFICE.

WRIGHT JONES, OF MANCHESTER, COUNTY OF LANCASTER, ENGLAND.

BALANCED SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 270,809, dated January 16, 1883.

Application filed June 7, 1882. (No model.) Patented in England March 11, 1882, No. 1,187; in Germany May 4, 1882, No. 19,054; in France May 4, 1882, No. 136,661, and in Belgium May 5, 1882, No. 41,899.

To all whom it may concern:

Be it known that I, WRIGHT JONES, of Manchester, in the county of Lancaster, England, engineer, have invented certain new and useful improvements applicable to the balanced slide-valves of steam and other motive-power engines, of which the following is a specification.

My invention relates to the method of counterbalancing more or less of the pressure exerted upon the backs of slide-valves by the pressure of water, steam, or other fluid against the faces of the slide-valves. This method has been carried into effect by forming one or more cavities in a valve-seat and maintaining fluid under pressure in said cavities to act upon the face of the valve; but such a construction is objectionable for several reasons, which are hereinafter stated, and the object of my invention is to overcome these and other objections. It has also been proposed to admit the steam or motive fluid to cavities in the valve-face, and to construct the valve seat and face so that said cavities, by the movement of the valve, are brought into coincidence with the supply-ports of the cylinder. In this construction the steam or other live motive agent is not admitted to the valve-chest and does not act upon the back of the valve, but the valve is held to its seat by steam or other fluid of greatly-reduced pressure, with which the valve-chest is filled and which has no escape therefrom.

My invention consists in the combination, in a steam or other motive-power engine, of a cylinder provided with the ordinary valve-chest, and with a valve-seat containing supply and exhaust ports, a slide-valve within said chest for controlling the passage of the motive agent directly from said chest to the supply-ports, and provided with one or more cavities in its face, a pipe or passage for conducting fluid to the cavity or cavities in the valve-face, and means for producing a pressure of fluid in said cavity or cavities to more or less counterbalance the pressure of the live motive agent on the back of the valve.

The invention also consists in novel details of construction and combinations of parts hereinafter particularly described and claimed.

In order that my invention may be better understood and more readily carried into effect, I will now proceed to describe the same, reference being made to the drawings hereunto annexed.

Figures 1 and 2 illustrate my invention as applied to the slide-valve of a horizontal stationary engine; but such parts only are shown as are necessary to illustrate the application of my invention. Fig. 1 is a side elevation, and Fig. 2 a vertical cross-section taken at right angles to Fig. 1. Fig. 3 is a face view of the slide-valve. Fig. 4 is a vertical sectional view, on a larger scale, of part of the details of Fig. 1, similar letters of reference being placed upon corresponding parts in each of the figures.

At *a* is the cylinder, provided with a valve-chest, *b*, within which is the slide-valve *c*, capable of being slid upon the valve-face *b**, and admitting steam to or allowing the steam to escape from the cylinder *a* by means of the ports *d d* d*** in the ordinary manner.

At *e* is a hollow globe or chamber, capable of containing fluid. Communicating with the interior of this globe or chamber *e* is a pipe, *f*, formed into a spiral or coil at *f**. Communicating with the interior of the globe or chamber *e* is a pipe, *f***, which passes to the valve-chest *b*, passing through the side thereof, and being made steam-tight at the point *g*, the extremity *h* of the pipe being closed.

Within the face of the slide-valve *c*, and at each side thereof, I form cavities, grooves, or slots *i i**, such grooves or slots not extending throughout the entire width of the valve *c*. (More clearly shown in the detached face view of the valve, Fig. 3.) The grooves or slots *i i** communicate with the pipe *f*** through the openings *k k**, formed in the valve-chest *b*.

To the interior of the globe or chamber *e*, I supply, through the pipe *f*, water or other fluid by means of a pump or other suitable apparatus, actuated in any convenient manner or by any apparatus, to which I shall subsequently refer. The water or other fluid I supply to the interior of the globe or chamber *e* at such pressure that the force it exerts within the grooves *i i** shall nearly but not quite counterbalance the pressure exerted upon the valve

c in the direction of the arrow *n*, Fig. 2, by the steam or other fluid from which the motive power is obtained.

In cases where the pressure of the steam or other fluid within the valve-chest *b* is not uniform, it is desirable to prevent the valve *c* from being forced from the seat *b**, upon which it is slid when a reduction of pressure occurs, and also to counterbalance an increased steam-pressure, which would tend to force the valve *c* in the direction of the arrow *n* against the surface upon which it is slid, and for these purposes I make use of the following apparatus, (shown in Fig. 2:)

To the pipe *f*, I connect a cylinder, *o*, provided with a piston, *p*, capable of being slid therein. Within the lower portion of the barrel or cylinder *o*, I form a seating for a ball-valve, *q*, upon which a portion, *p**, of the piston *p*, having a reduced diameter, rests.

Secured to the upper part of the barrel or cylinder *o* by means of a union or other joint is a pipe, *r*, which is to be in communication with the interior of the valve-chest *b*, or with the boiler supplying steam to the aforesaid valve-chest. The steam from the valve-chest passing along the pipe *r* acts upon the piston *p* so as to force it in the direction of the arrow *s*, and thereby presses the ball or valve *q* against its seating. When the pressure of the water or other fluid contained in the chamber *e*, caused by the pump or the heat applied thereto, is sufficient to counterbalance, or nearly so, the steam-pressure upon the slide-valve *c*, the valve *q* will allow the water or other fluid to escape from the pipe *f* into the waste-pipe *t*, the areas of the piston *p* and valve *q* being so proportioned that the valve *q* shall be forced by the steam pressing the piston *p* in the direction of the arrow *s*, so that the pressure within the slots or grooves *i i** shall be maintained at a pressure which shall nearly counterbalance the force of the steam pressing the slide-valve *c* in the direction of the arrow *n*.

Instead of supplying the hollow sphere or chamber *e* with water or other fluid by means of a pump or equivalent apparatus, as previously described, I may make use of the following apparatus: Upon the upper part of the hollow sphere or chamber *e*, I attach a pipe or tube, *l**, (shown upon an enlarged scale in Fig. 4,) within which is a cylindrical cavity provided with a plug, *u*, capable of being rotated therein. Within this plug I form two cavities or recesses, *u* u***. As the plug *u* is rotated the cavities or recesses will be consecutively presented to the parts *v w* of the tube *l**. The plug I cause to rotate by any convenient means. In the position shown the cavity or recess *u*** is in communication with the portion *v* of the pipe *l**, from which it will become filled with water or other liquid supplied by the pipe *l***. As the plug *u* is rotated in the direction of the arrow *x* the cavity *u*** will be brought into communication with the opening *w*, leading into the globe or chamber *e*. So long as the upper part of the globe or chamber *e* contains vapor, to be hereinafter referred to, the water or other liquid will fall from the cavity *u*** into the interior of the globe or chamber *e*. The cavity *u** in the plug *u* having arrived in communication with the part *v* of the pipe *b**, it will receive a quantity of water or other liquid, to be afterward passed into the globe or chamber *e*. Beneath the globe or chamber *e*, and within the coiled pipe *f**, I place a gas or other flame, *y*. Such flame, heating the coiled pipe *f** and globe or chamber *e*, generates steam or vapor within the said globe or chamber, thereby producing an elastic pressure in the water or other liquid for counterbalancing the steam-pressure upon the slide-valve *c* in the direction of the arrow *n*, as previously described. I inclose the globe or vessel *e* and coiled pipe *f** within a casing, *z*, formed of metal or other suitable material, which supports the globe or vessel *e* by means of projecting lugs formed on the casing *z*, such casing also preventing currents of air acting upon the flame *y;* and to prevent loss of heat by radiation, I surround the casing *z* by an outer casing, *z**, and the space or cavity between the two casings I fill with some non-conductor of heat, such as asbestus. Through the upper part of the casings *z z**, I form openings for the escape of the products of combustion of the flame *y*.

The manner in which I apply my invention to the slide-valves of locomotive-engines is illustrated by Figs. 5, 6, 7, and 8 of Sheet 2 of the accompanying drawings, Fig. 5 being a vertical cross-section taken at right angles to Fig. 6, which is a side view. Fig. 7 is a view taken at right angles to Fig. 5 of some of the details of that figure. Fig. 8 is a face view of one of the slide-valves. At 1 2 in these figures are the cylinders, between which is the valve-chest 3, within which are the slide-valves 4 5, by which the admission and exit of the steam to and from the cylinders 1 2 is controlled. Passing through the side of the valve-chest 3 are two pipes, 6 7, their extremities $6^{\times}$ $7^{\times}$ being closed, their other ends being screwed or otherwise fastened into elbows 8 9, screwed or otherwise attached to a T-piece, 10, from which extends a pipe, 11, screwed or otherwise fastened into a projecting part, 12, formed upon the hollow globe or chamber 13, placed within the smoke-box 14 of the locomotive-engine aforesaid. From the hollow globe or chamber 13 extends a pipe, 15, communicating with an aperture, 16, formed in the lower part of a bracket, 17, secured to the side 14* of the smoke-box 14 in any convenient manner. Within the upper part of the bracket 17 is formed a cylinder, 18, within which, and capable of being slid therein, is a piston, 19. An extension, 19*, of the piston 19 is formed of a reduced diameter, and is in contact with a ball, 20, resting upon a seating, so as to constitute a valve closing the opening 16, communicating with the pipe 15, before referred

to. Extending from the upper part of the cylinder 18, and communicating therewith, is a pipe, 22, in communication either with the steam contained within the boiler of the locomotive or with the steam within the valve-chest 3.

At 23 is a pipe communicating with a pump, by which water or other fluid may be forced into the globe or chamber 13, from which it will pass through the pipe 11, T-piece 10, and elbows 8 9 to the pipes 6 7, from which it passes through openings 24 25 26 27, communicating with the slots or grooves 28 29 30 31, formed within the faces of the slide-valves 4 5, such grooves or slots extending lengthwise of the said valves parallel with the direction in which they are slid when working, the said grooves formed in the face of the aforesaid valves being more clearly shown in the detached view, Fig. 8, which is a view of the valve 4, the valve 5 being similarly constructed. The water or other fluid forced through the pipe 11 in the direction of the arrows 32 will pass into the pipes 6 7, then through the openings 24 25 26 27 into the grooves or slots 28 29 30 31, so as to partially counterbalance the steam-pressure, such steam-pressure tending to force the slide-valves 4 5 in the direction of the arrows 33 34, respectively. A portion of the water or other fluid forced into the globe or chamber 13 by means of the pump before referred to becomes expanded and partially vaporized by the heat in the smoke-box 14, thereby becoming elastic, such elasticity tending to prevent any shock upon the valves 4 5, arising from the action of the pump aforesaid. The steam-pressure upon the slide-valves 4 5, acting in the direction of the arrows 33 34, respectively, is partially counterbalanced, as previously described in reference to stationary engines, and the piston 19 and valve 20 act as before described when referring to similar parts in reference to stationary engines. The water or other fluid allowed to escape by the valve 20 passes along the pipe 35 into any suitable receptacle, and may be again passed along the pipe 23 by the pump previously named. Any water or other fluid that may escape between the faces of the slide-valves 4 5 and the surfaces upon which they are slid will be carried away by the exhaust-steam from the cylinders 12.

In some cases I form the slots or grooves into which the water or other fluid is forced for counterbalancing the steam-pressure on the slide-valve with cross-bars, as shown by Figs. 9 and 10, Fig. 9 showing a portion of a slide-valve with a groove, F, formed therein, Fig. 10 being a longitudinal section of Fig. 9 on the line A B. At intervals across the slot or groove F, I form cross-bars C D, the surfaces of which, being in contact with the valve-face G, prevent a ridge from arising upon the face G from the sliding of the valve thereon. Through the backs of the cross-bars C D, I form openings, so that the water or other fluid may pass into the entire length of the slot or groove F, and the opening *h*, supplying water or other fluid to the slot or groove F, I form of such width that it is never entirely covered or closed by the cross-bars C D when being slid over the said opening *h*.

I have hitherto referred to the slide-valves of stationary and locomotive steam-engines only; but it will be readily understood that my invention is also applicable to the slide-valves of marine engines, and also to hydraulic or other motive-power engines in which slide-valves are employed.

I am aware that cavities have been formed in the valve-seat of an engine and fluid introduced therein for counterbalancing more or less of the pressure on the back of the valve, and I do not claim such a construction as included in my invention. My construction, in which the cavities are formed in the valve-face, is more desirable for several reasons. In my construction I can make the cavity or cavities nearly as long as the valve itself, the difference in length being only the thickness of metal at the ends of the cavity or cavities, while if the cavities are formed in the seat they must be at least the length of movement or travel of the valve shorter than the valve, else the cavities would be uncovered and the fluid escape at each end of the valve's travel. Hence I can use a less pressure of fluid in the cavities than where the cavities are formed in the seat. When the cavities are formed in the seat the valve travels considerably beyond the cavities at each end of its movement, and hence the pressure of fluid in the cavities acts on the valve at varying points in its length, nearer each end alternately, and has a tendency to raise the ends of the valve alternately and to cause it to wear rounding instead of flat. When the cavities are formed in the face of the valve the pressure of the fluid therein always acts on the valve at the same points in its length, and there is no tendency to raise the valve at either end. Another advantage of my construction is that the improvement can be readily applied to any engine-cylinder by simply changing the valve, while it would be far more expensive to change the cylinder.

I am aware that a slide-valve has been provided with spaces or cavities to which a live motive agent is admitted from passages in the valve-seat, and from which the motive agent passes to the supply-ports in the valve-seat. In such a construction the live motive agent in the spaces or cavities in the valve tends to force it away from its seat; but it is held to its seat by filling the valve-chest with fluid of a greatly-reduced pressure, which has no escape therefrom, and which acts on the back of the valve to hold it to the seat. I do not claim this construction as included in this invention.

Having thus described the nature of my said invention and the manner of carrying the same into effect, I desire it to be understood that I claim as my invention—

1. The combination, in a steam or other mo-

tive-power engine, of a cylinder provided with the ordinary valve-chest, and with a valve-seat containing supply and exhaust ports, a slide-valve within said chest for controlling the passage of the motive agent directly from said chest to the supply-ports, and provided with one or more cavities in its face, a pipe or passage for conducting fluid to the cavity or cavities in the valve-face, and means for producing a pressure of fluid in said cavity or cavities to more or less counterbalance the pressure of the live motive agent on the back of the valve, substantially as herein described.

2. In a steam or other motive-power engine, the combination of a cylinder provided with the ordinary valve-chest, a slide-valve in said chest for controlling the passage of the motive agent directly therefrom to the supply-ports of the engine, and provided in its face with one or more cavities, a valve-seat provided with holes or openings which are always in communication with said cavity or cavities as the valve travels, and a pipe which communicates with said holes or openings in the valve-seat, and through which fluid is delivered to said cavity or cavities under pressure to more or less counterbalance the pressure of the live motive agent on the back of the valve, substantially as herein described.

3. The combination, with an engine-cylinder and a slide-valve constructed with a cavity or cavities in its face, of the pipe *f*, means for supplying fluid under pressure through said pipe to the cavity or cavities in the valve, the cylinder *o*, piston *p*, valve *q*, and pipe *r*, all arranged and adapted to operate substantially as and for the purpose herein described.

WRIGHT JONES.

Witnesses:
W. T. CHEETHAM,
Patent Agent, 18 *Saint Ann's Street, Manchester.*
EDWIN JNO. REYNOLDS,
49 *King Street, Manchester.*