(No Model.)

7 Sheets—Sheet 1.

E. L. PEASE.

GAS HOLDER.

No. 432,434. Patented July 15, 1890.

Fig. 1.

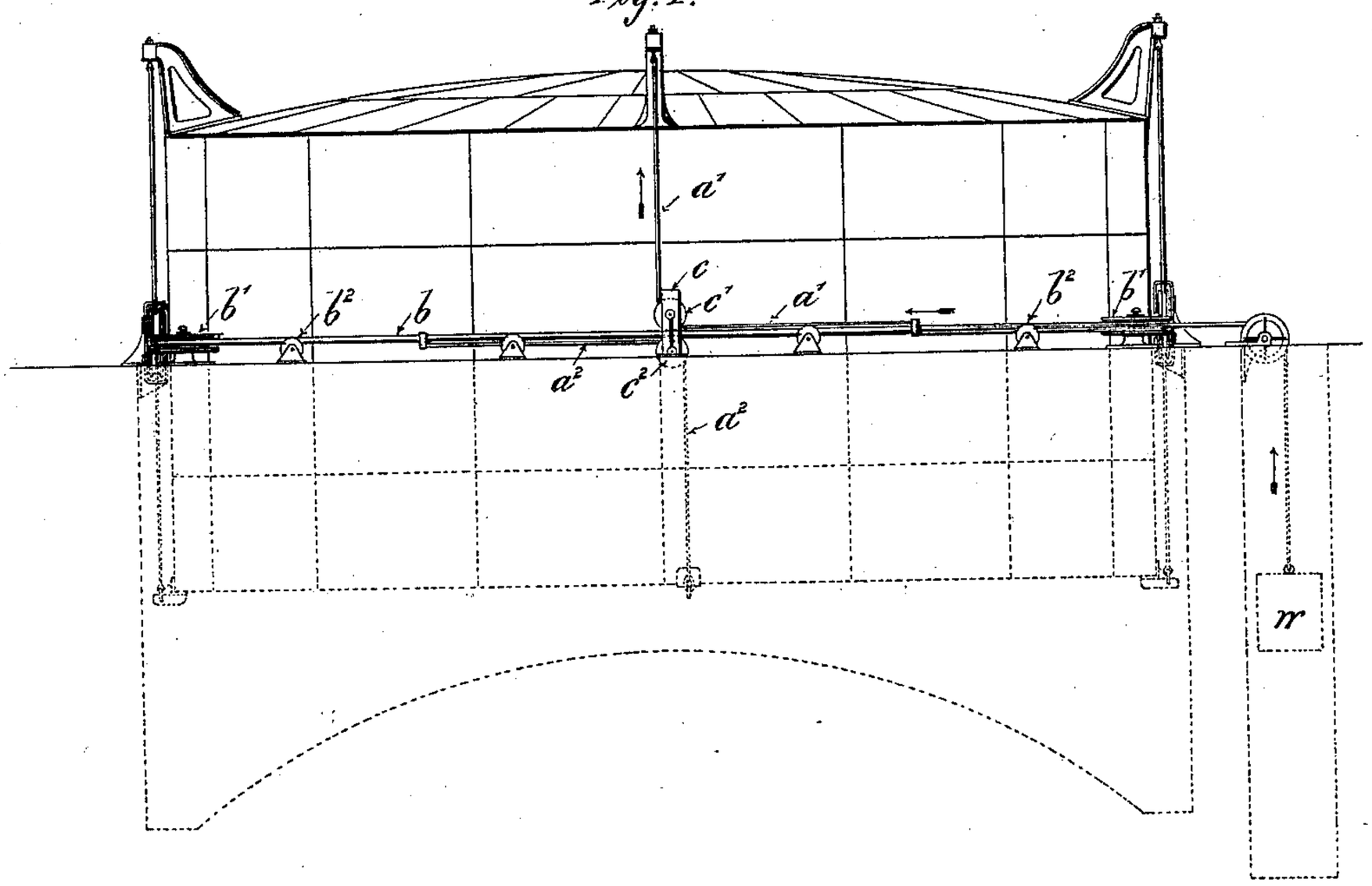
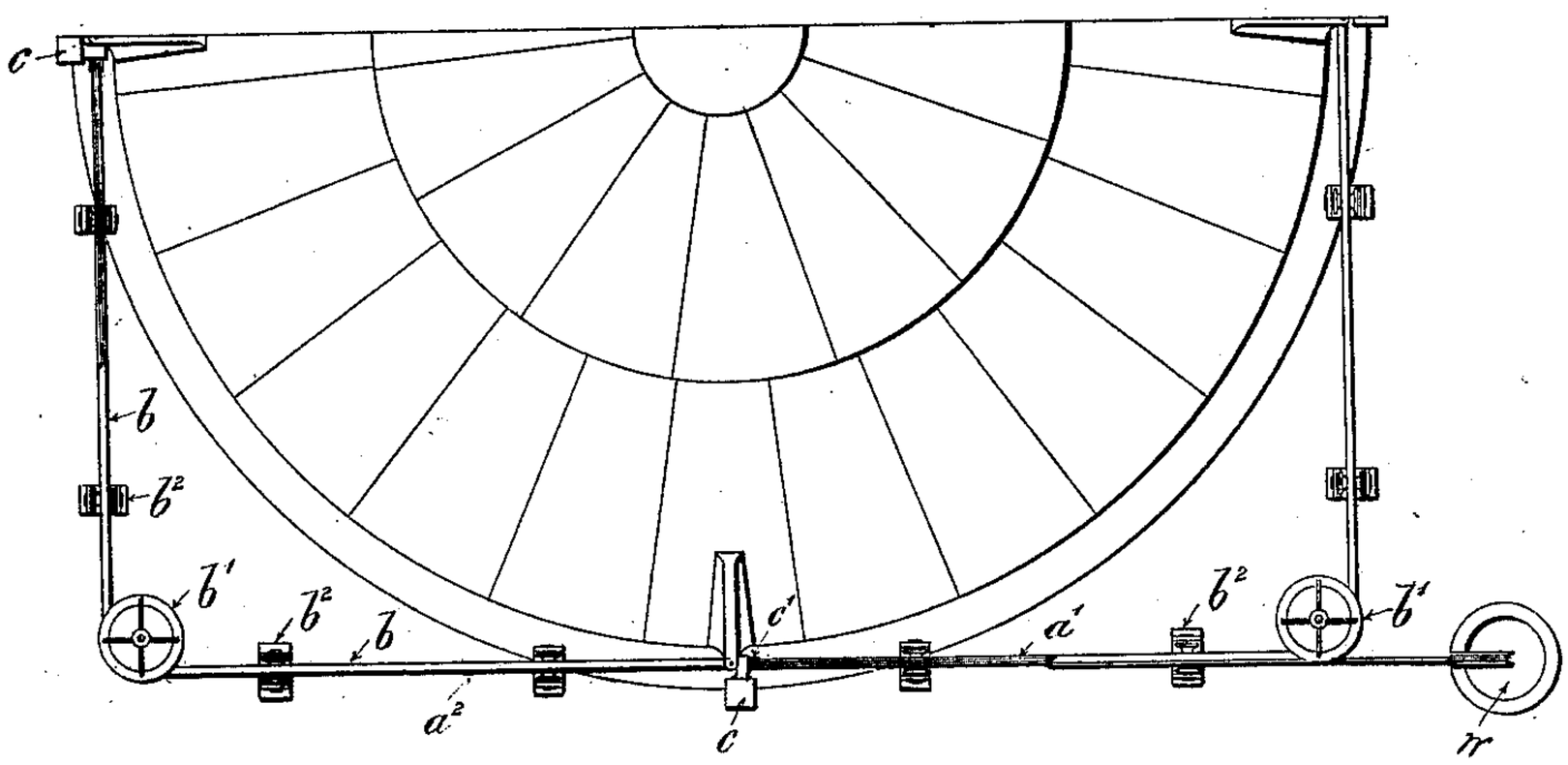


Fig. 2.



Witnesses;
D. J. Keller.
Vernon W. Dorsey

Inventor:
Edward L. Pease.
By. C. S. Whitman —
Attorney

(No Model.) 7 Sheets—Sheet 2.

E. L. PEASE.

GAS HOLDER.

No. 432,434. Patented July 15, 1890.

Fig. 3.

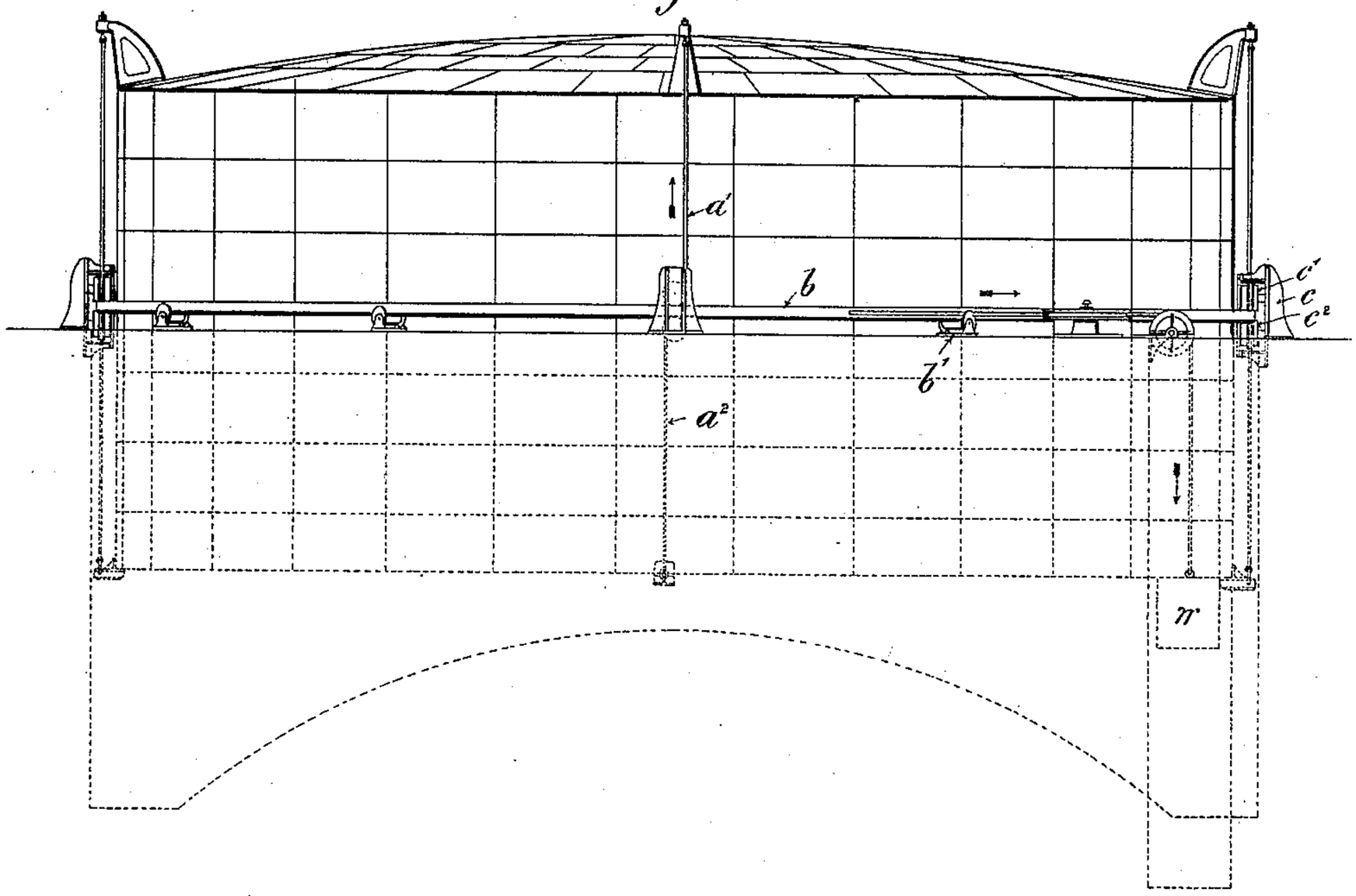
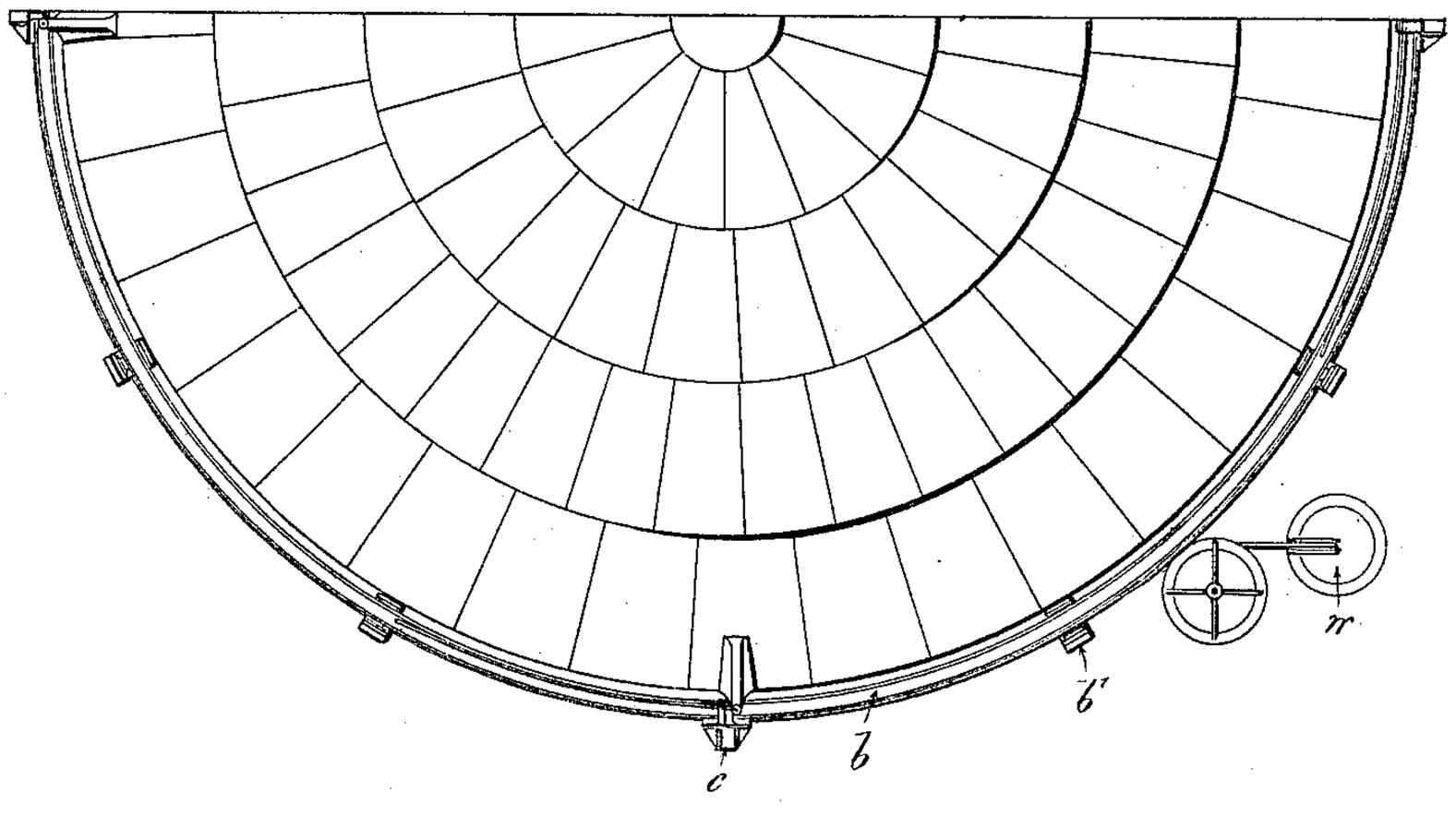


Fig. 4.



Witnesses;
C. F. Keller.
Vernon W. Dorsey

Inventor:
Edward L. Pease.
By: C. S. Whitman
Attorney.

(No Model.)

7 Sheets—Sheet 3.

E. L. PEASE.

GAS HOLDER.

No. 432,434.

Patented July 15, 1890.

Fig. 8.

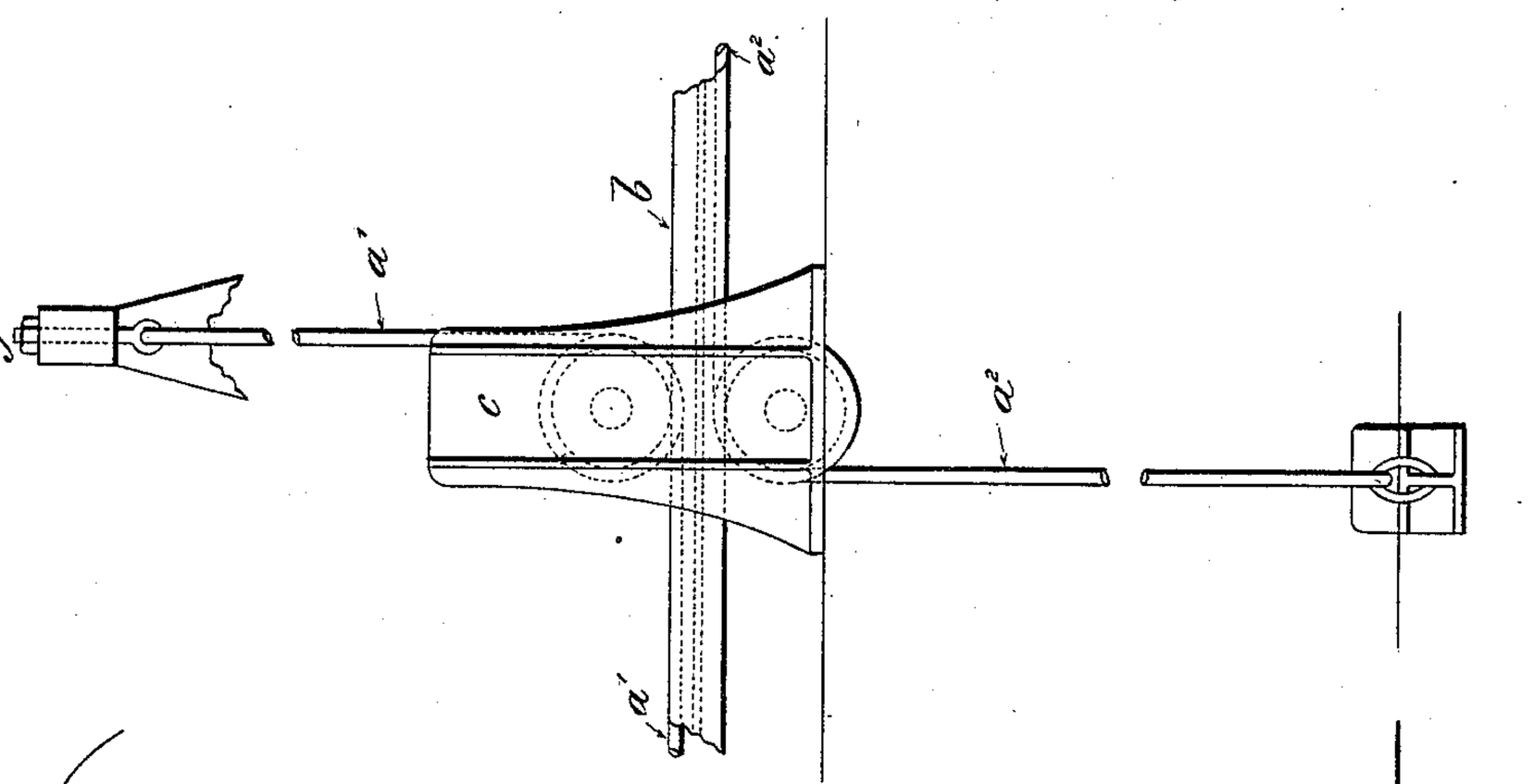


Fig. 7.

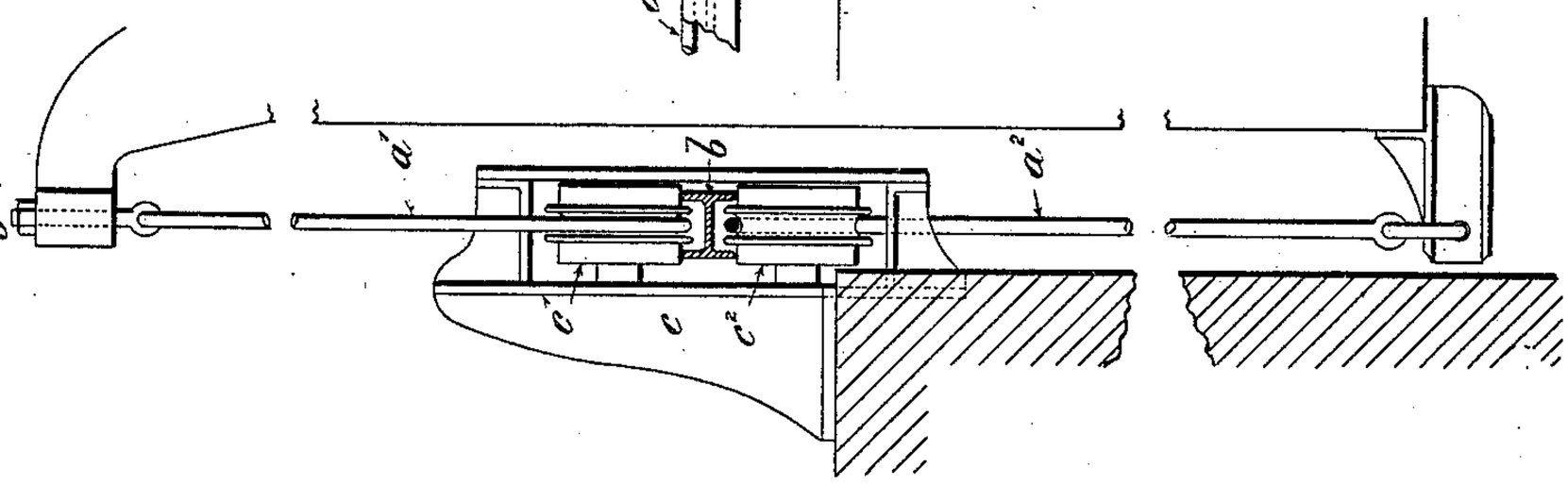


Fig. 6.

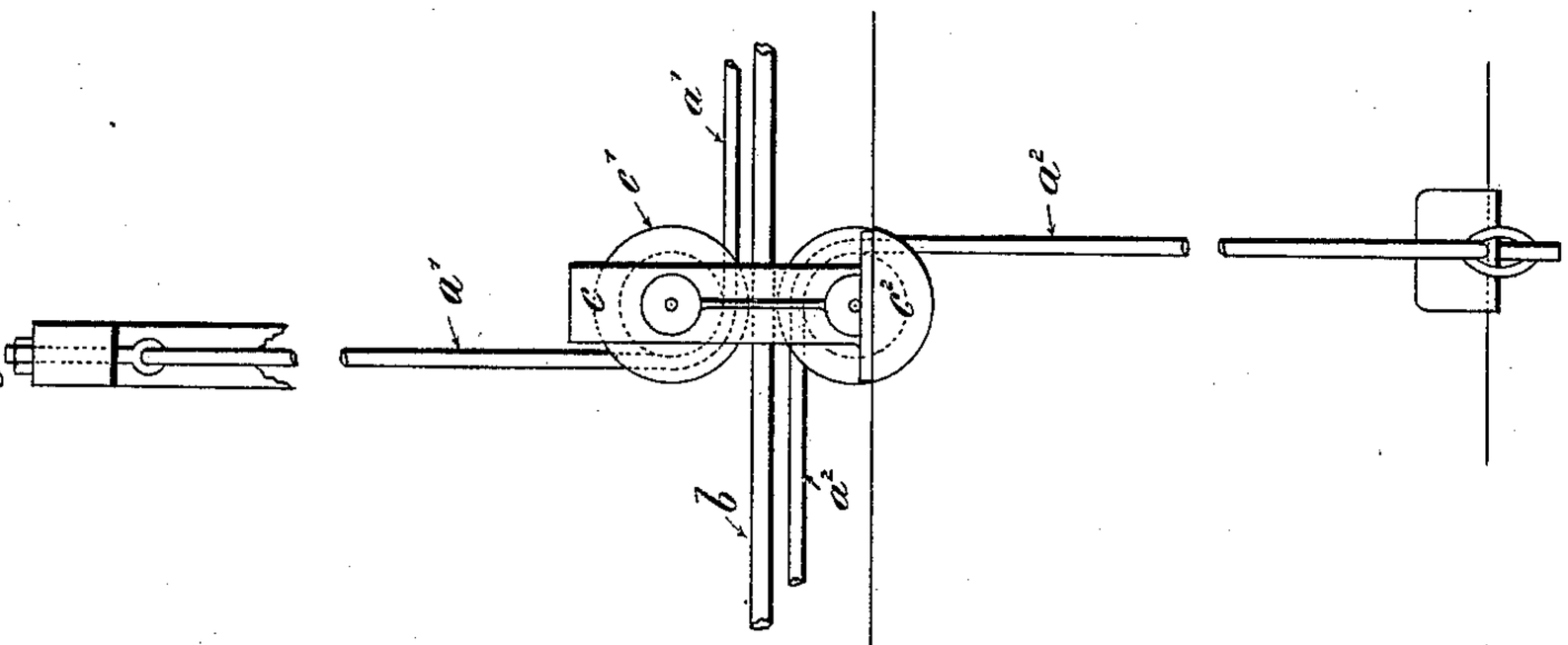
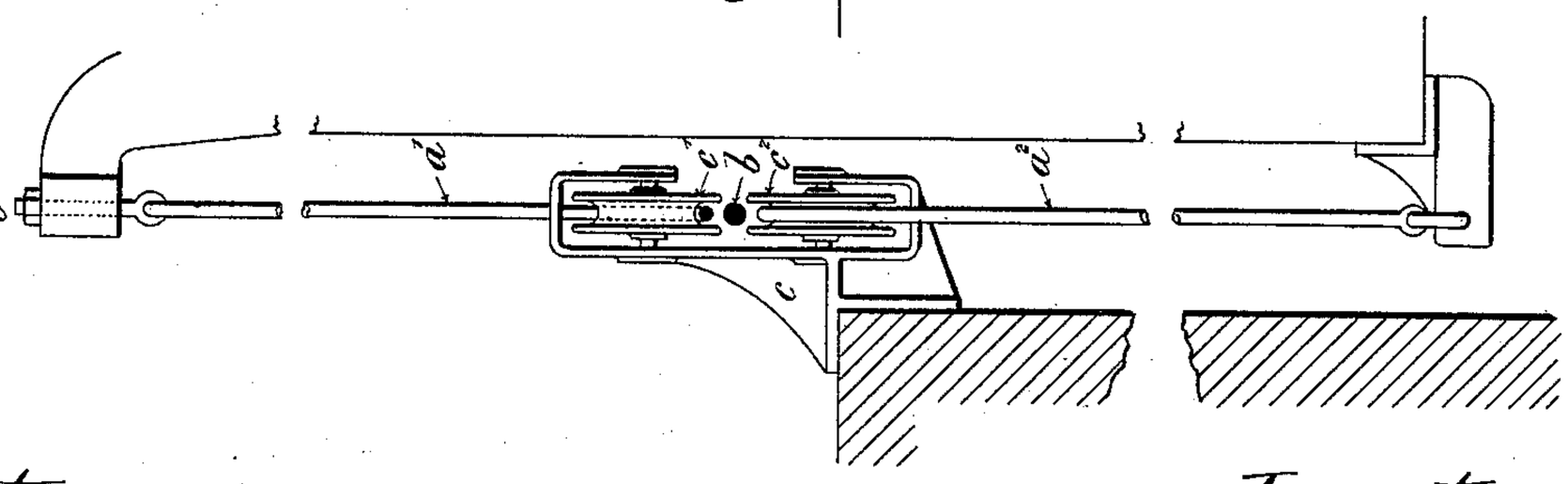


Fig. 5.



Witnesses:
C. J. Keller.
Vernon M. Dorsey

Inventor:
Edward L. Pease.
By C. S. Whitman
Attorney.

(No Model.) 7 Sheets—Sheet 4.

E. L. PEASE.

GAS HOLDER.

No. 432,434. Patented July 15, 1890.

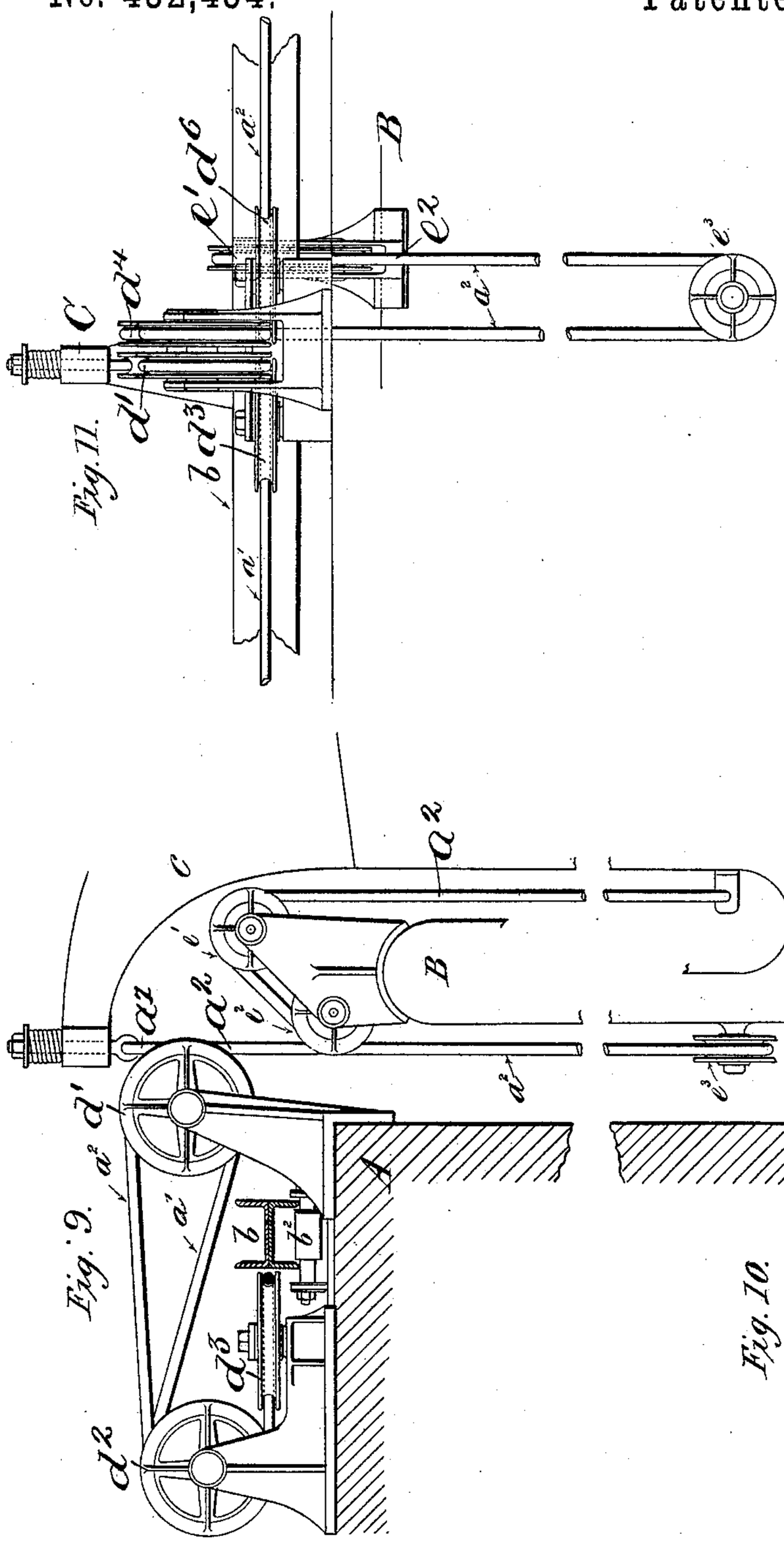


Fig. 11.

Fig. 9.

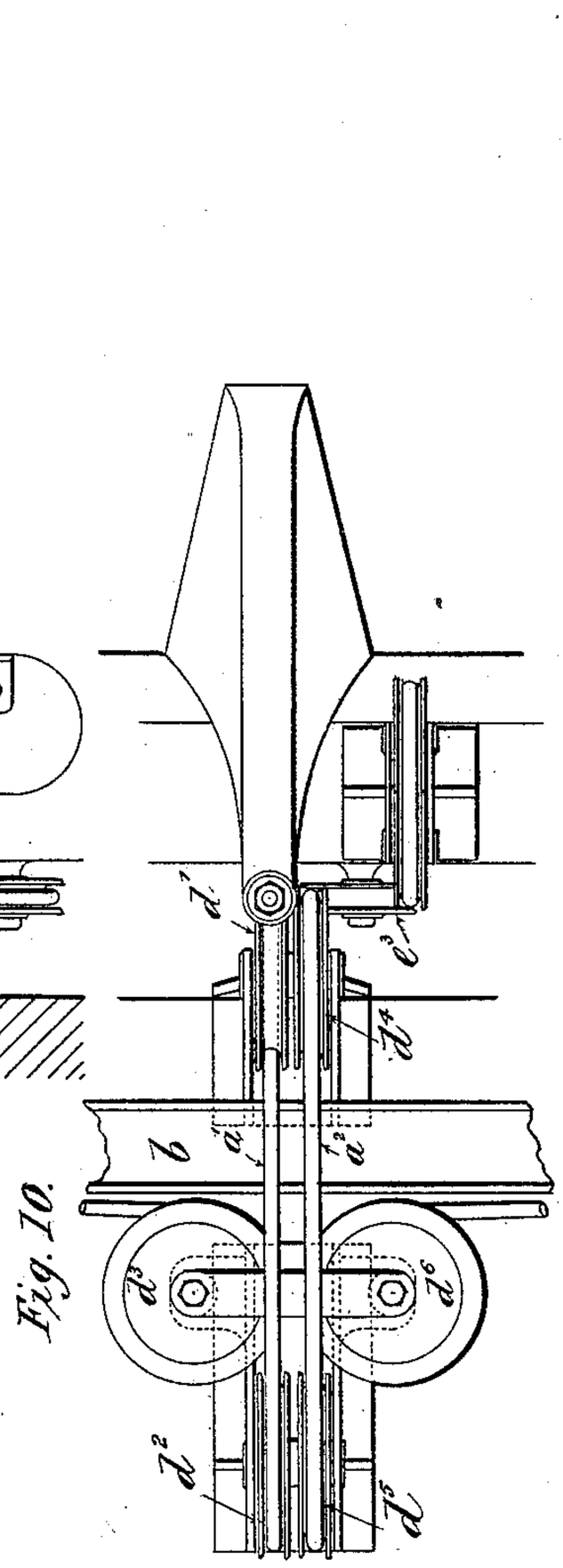


Fig. 10.

Witnesses;
C. O. Miller.
Vernon W. Dorsey.

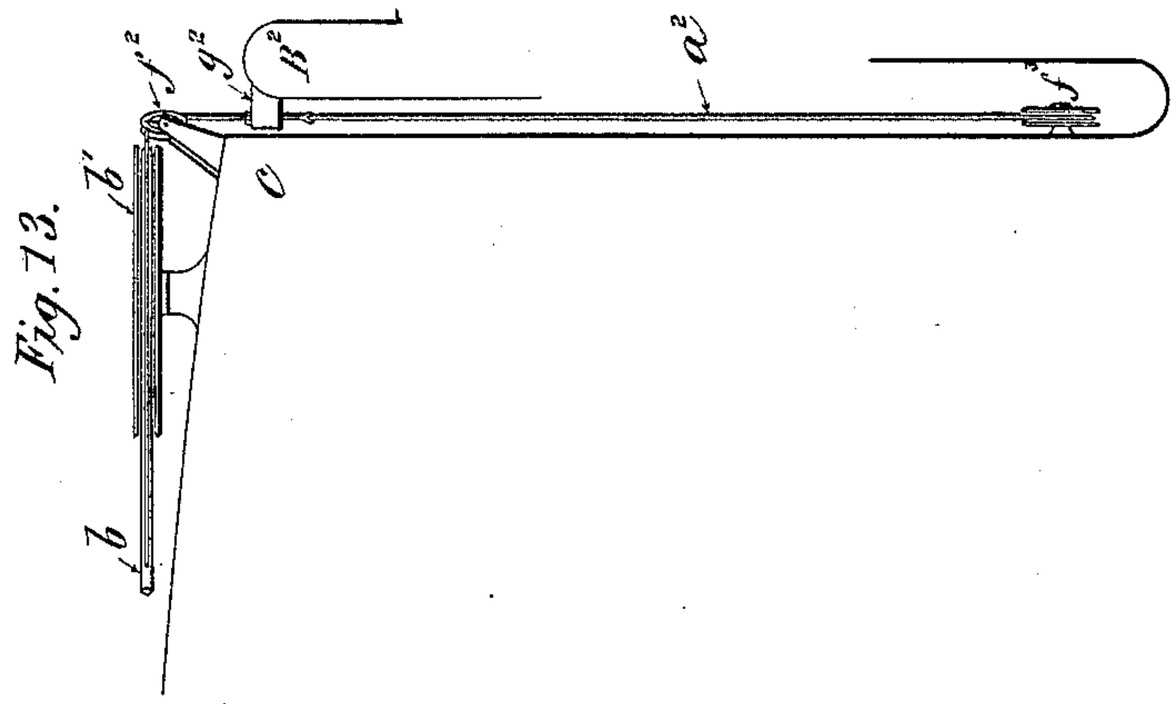
Inventor:
Edward L. Pease.
By C. S. Whitman
Attorney.

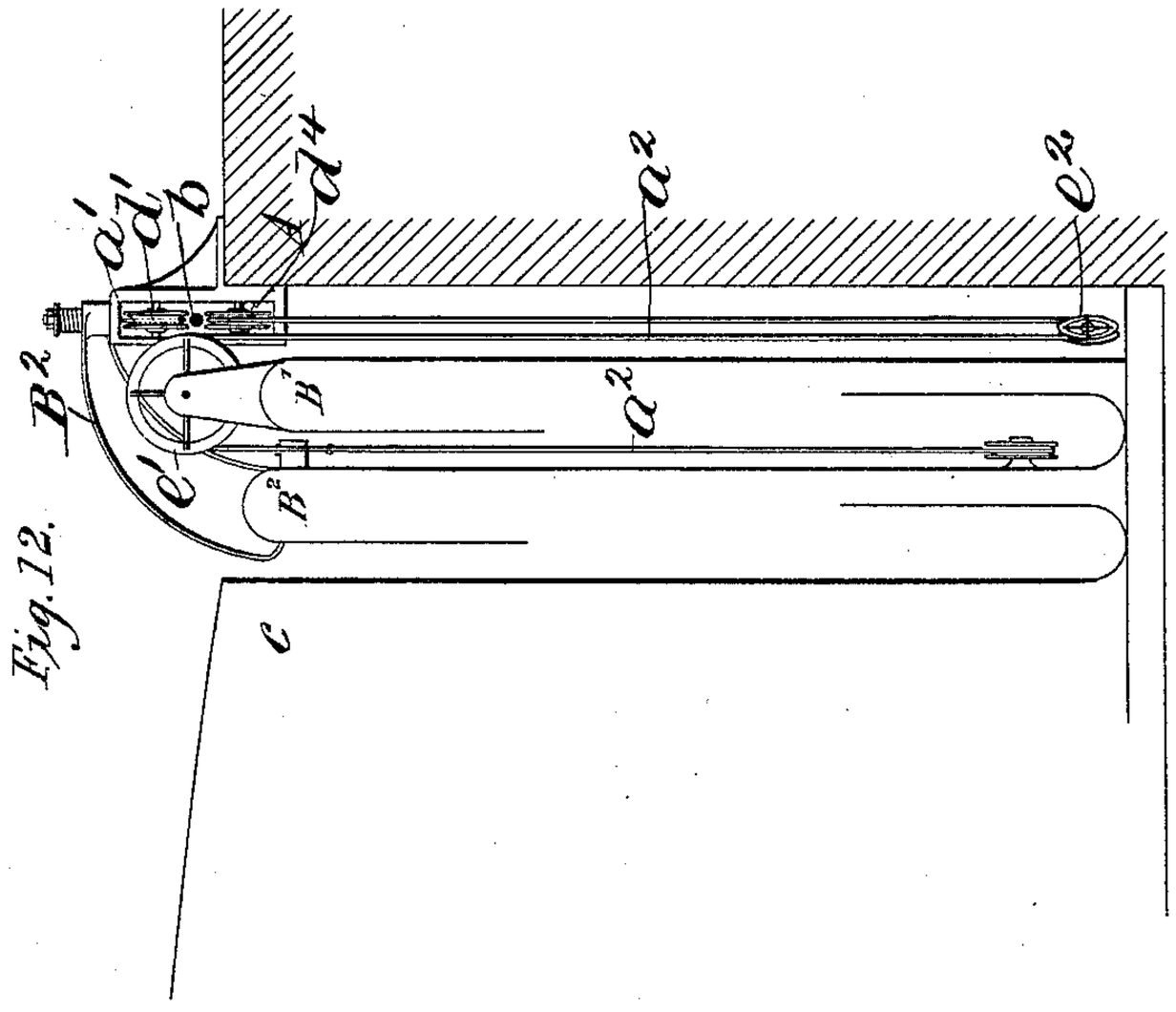
(No Model.) 7 Sheets—Sheet 5.

E. L. PEASE.

GAS HOLDER.

No. 432,434. Patented July 15, 1890.





Witnesses;
D. J. Keller.
Vernon W. Dorsey

Inventor:
Edward L. Pease.
By C. S. Whitman
Attorney.

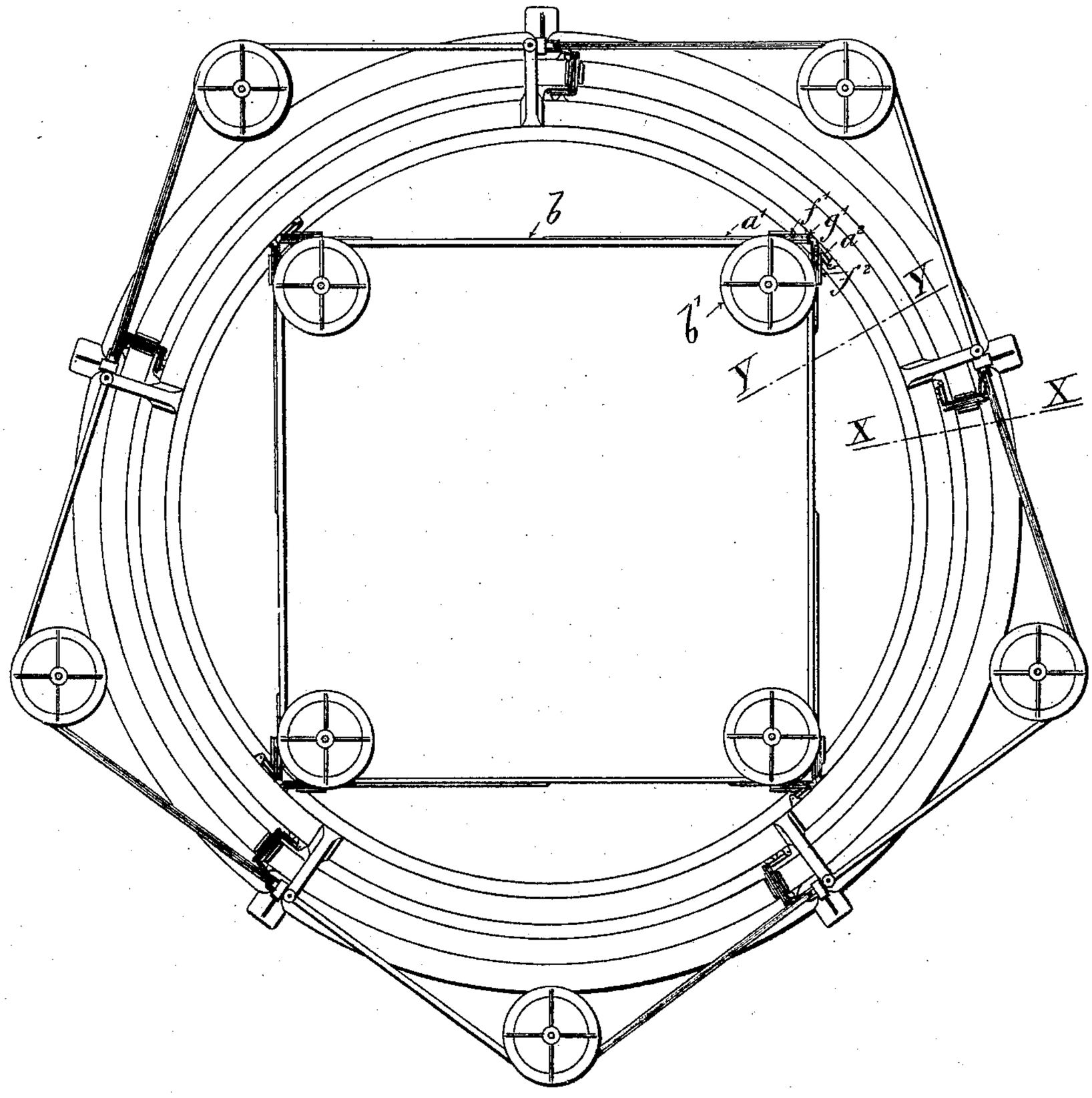
(No Model.) 7 Sheets—Sheet 6.

E. L. PEASE.

GAS HOLDER.

No. 432,434. Patented July 15, 1890.

Fig. 14.



Witnesses:
C. F. Keller.
Vernon W. Dorsey.

Inventor:
Edward L. Pease.
By C. S. Whitman
Attorney.

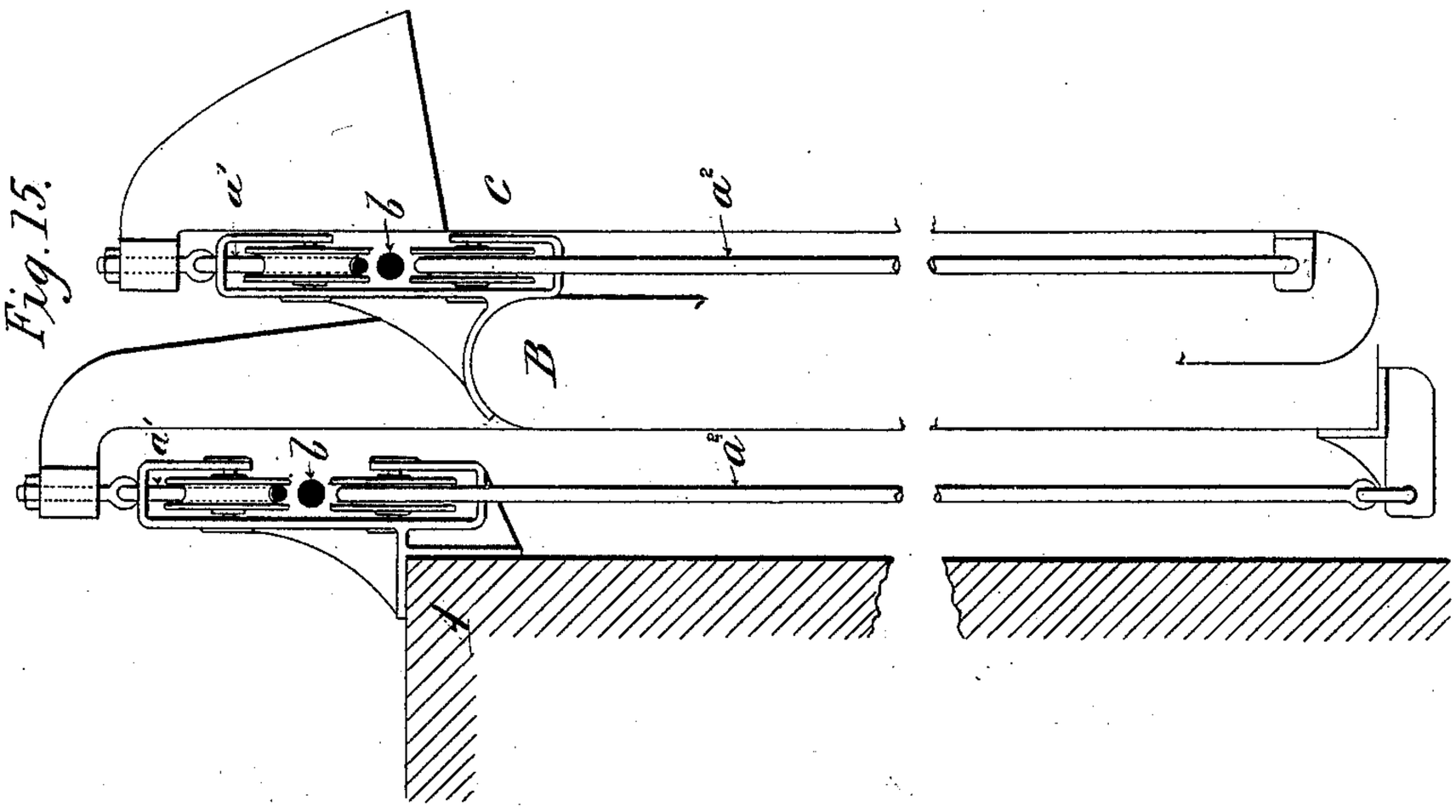
(No Model.) 7 Sheets—Sheet 7.

E. L. PEASE.

GAS HOLDER.

No. 432,434. Patented July 15, 1890.

Fig. 15.



Witnesses;
E. J. Keller.
Vernon W. Dorsey

Inventor
Edward L. Pease.
By. C. S. Whitman
Attorney.

UNITED STATES PATENT OFFICE.

EDWARD LLOYD PEASE, OF DARLINGTON, COUNTY OF DURHAM, ENGLAND.

GAS-HOLDER.

SPECIFICATION forming part of Letters Patent No. 432,434, dated July 15, 1890.

Application filed July 31, 1889. Serial No. 319,361. (No model.)

To all whom it may concern:

Be it known that I, EDWARD LLOYD PEASE, a subject of the Queen of Great Britain, residing at Darlington, in the county of Durham, England, have invented certain new and useful Improvements in Gas-Holders; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to means or appliances for guiding and controlling gas-holders, so as to support them in the working or level position with the requisite stability, which said means or appliances can also be used for regulating and adjusting the pressure exerted by the gas-holder upon the gas within.

The means generally employed to guide a gas-holder up and down and to keep it in the vertical position without sideward movement are well known to consist of columns or standards fixed at suitable distances apart in a ring round the gas-holder, each of which columns or standards is fixed rigidly in position, and is provided on the side toward the gas-holder with a runner, upon the face of which a pulley supported in brackets extending from the gas-holder travels up and down the column or standard as the gas-holder rises and falls, the pressure to be exerted by the gas-holder on the gas inside being adjusted and regulated when necessary by balance-weights suspended from chains connected to the holder and carried over the tops of the columns or standards.

The essential feature of my invention consists in the employment of ropes, (preferably of wire,) chains, or the like, applied to keep the gas-holder in the working position with the requisite stability and serving, also, when required, to regulate and adjust the pressure exerted by the gas-holder upon the gas within. I will, for the sake of simplicity of description, refer to ropes; but it is to be understood that I include in that expression chains or the equivalents thereof, which operate for the purposes of my invention, as herein explained.

It will be obvious from the following description that the arrangements according to my invention may be considerably varied without departing from its nature. The arrangement may consist of upper check-ropes secured at their upper ends to the top curb of the gas-holder and of lower check-ropes with their lower ends secured to the lower part of the lift or of one of the lifts, which check-ropes are controlled in working by means of any suitably-constructed mechanism or appliances to serve as a substitute for fixed columns or standards, or, if preferred, to be used in combination with them. For instance, where a gas-holder provided with the usual guide-framing is telescoped for enlargement my improved system can be applied to the additional lifts without removing the guide-framing erected for the original lifts. In applying ropes for this purpose in accordance with my invention, I usually connect the said ropes which I term "check-ropes," to the gas-holder, and so train them over pulleys or guides and connect them to other appliances that the rise and fall of the holder automatically draws the said check-ropes into position to apply such a check to any tendency of the holder to get out of the level that any variation from the level position becomes impossible, and the points of attachment of the check-ropes to the holder all rise and fall together, the effect being that any external influences tending to raise or depress the holder at some particular part are resisted by check-ropes on the other side of the holder, which meet a tilting force on one side of the holder by a lifting force on the other side, or a depressing force on one side by a restraining force on the other side, so that no movement but a vertical one can take place. In order that the check-ropes may be always at a suitable tension whatever be the position of the gas-holder or any lift thereof, it is necessary that the check-ropes should be capable of extending their length in the vertical direction to an extent equal to at least the full travel of the gas-holder, the upper check-ropes being drawn out from some position below the lowest level ever reached by the parts to which they are connected and the lower check-ropes being similarly drawn out from some position above the highest level ever reached by the parts at which they are secured to the bottom lift or brought round the pulleys pivotally attached thereto. Pulleys provided at these positions can be employed to divert the check-ropes from the vertical direction to be connected to and con-

trolled by any suitably-constructed mechanism or appliances by which they are given out or taken up as their upwardly and downwardly extending portions are lengthened or shortened with the rise or fall of the gas-holder. It is preferable that the check-ropes so employed be applied in equal numbers as upper and lower check-ropes, and the combination or arrangement of mechanical parts or appliances by which they are kept in tension and otherwise controlled and brought into action will generally be simplified by arranging the said check-ropes in pairs or couples, an upper and lower check-rope together forming a pair or couple. These pairs or couples are preferably connected to the gas-holder at points equidistant from each other, the number of such pairs or couples required to prevent the gas-holder from getting out of the level position being obviously not less than three; but they may be any greater number desired.

In the drawings hereunto annexed, in which the same letters of reference indicate corresponding parts, wherever they occur, in all the figures, the arrangement or construction of parts similar in principle but modified in detail in the various figures to suit the requirements of differently-constructed or different-sized gas-holders illustrate what I believe to be the most advantageous manner of carrying my invention into effect.

In Figs. 1 and 2 an elevation and corresponding half-plan illustrate a single-lift gas-holder supported in a position midway between its highest level and the tank-bottom by four upper and four lower check-ropes a' a^2, arranged in couples at equal distances round the lift, and connected to the endless wire rope b, which I term the "coupling-rope," the rope a' being connected to the top of the lift and the rope a^2 being connected to the bottom of the lift.

Corresponding to Figs. 1 and 2, Figs. 5 and 6 illustrate in detail and on an enlarged scale the relative position of the check-ropes a' a^2 when worked in couples, and the manner in which they are diverted from the vertical direction to connect them to the coupling-rope b. The coupling-rope b is an endless rope following a track round the lift, and is free to move a certain distance in a direction either to the right or left round the pulleys b' and upon the rollers b^2. In this case, in which there are four couples of check-ropes a' a^2 applied at equal distances apart, by setting out the coupling-rope b in the form of a square of the proper dimensions, the track of the coupling-rope b is brought so as to pass in a right line between the pulleys c' c^2 in each of the twin brackets c, by which arrangement the upper check-ropes a' are brought round the pulleys c' in one direction and the lower check-ropes a^2 round the pulleys c^2 in the opposite direction to their points of connection with the coupling-rope b, so that whichever way the coupling-rope b is drawn in giving out one set of check-ropes it takes up corresponding lengths of the other set of check-ropes. In this manner by properly connecting the check-ropes to the coupling-rope—that is, with right-hand connections for the upper check-ropes and left-hand connections for the lower ones, or the reverse of this, as the case may be—when the gas-holder rises the check-ropes a' all draw the coupling-rope b in the direction required to take up the check-ropes a^2, and when the gas-holder falls the ropes a^2 similarly draw the coupling-rope b in the opposite direction, in which it takes up the check-ropes a'. The points of connection of the check-ropes a' a^2 with the coupling-rope b should be at such parts of the coupling-rope that the said points of connection will clear the pulleys c' c^2 in any position of the gas-holder the full distance they are drawn in either direction with the coupling-rope, being of course the same as the distance between the highest and lowest positions of the highest lift under control.

The pressure exerted by the gas-holder upon the gas within is adjusted and regulated by the strain required to draw up the upper check-ropes a' as the lift is rising, the tension on which is sustained by the coupling-rope b. Consequently the strain can be increased by retarding the motion of the coupling-rope b, or be reduced by accelerating its motion, either of which results can be effected in various ways—such, for instance, as the means illustrated by way of example in Figs. 1, 2, 3, and 4, in which a system of weights suspended from the coupling-rope b travel up and down with the gas-holder. In Figs. 1 and 2 the weight w acts as a retarding force to the rise of the gas-holder and as an accelerating force to its fall, thus causing the gas-holder to exert a correspondingly-increased pressure upon the gas within, the weight being so suspended from its connection with the coupling-rope b as to be an ascending weight with the rise of the gas-holder and a descending weight with its fall. In Figs. 3 and 4 the weight w acts as an accelerating force to the rise of the gas-holder and as a retarding force to its fall, thus diminishing the pressure upon the gas within, the weight being so suspended from its connection with the coupling-bar b as to be a descending weight with the rise of the gas-holder and an ascending weight with its fall.

Where a flexible coupling-rope is not desirable, I substitute therefor a suitable section of iron or steel bar, such as a channel or H bar.

Referring to Figs. 3, 4, 7, and 8, which illustrate the application of my invention to a single-lift gas-holder when an H-bar is employed as a coupling-bar, Fig. 3 is an elevation, and Fig. 4 a half-plan, of a gas-holder with the lift partially raised, Figs. 7 and 8 again illustrating in detail and on an enlarged scale the relative positions of the check-ropes a' a^2 when worked in couples, and the man-

ner in which they are connected to the coupling-bar b. This coupling-bar, which forms a circular girder of larger diameter than and concentric with the gas-holder, is supported on rollers b^2, upon which it can move a certain distance in either direction concentrically round the holder. The pulleys b', which are indispensable in the case of a flexible coupling-rope, are dispensed with in the case of a rigid coupling-bar. In all other respects the description of the mechanical details and the mode of operating them with reference to Figs. 1, 2, 5, and 6 is equally applicable in the case of the rigid coupling-bar illustrated in Figs. 3, 4, 7, and 8.

The above-described modes of applying my invention to a single-lift gas-holder, whether by the employment of a flexible coupling-rope or a rigid iron or steel coupling-bar, is equally applicable to the bottom or outside lift of multiple-lift gas-holders.

I will now proceed to describe how I prefer to apply my invention to the inner lifts of multiple-lift gas-holders by referring to Figs. 9, 10, and 11, which illustrate in detail the means or arrangement of mechanical parts employed in controlling the second lift with the check-ropes connected to a coupling-bar provided at the tank side, as already described with reference to the first or outside lift. In Fig. 9, which illustrates the mechanism in question in transverse part sectional view, A is the tank side; B is the "dip" of the bottom or outside lift, and C the "goose-neck" of the next inner lift. Fig. 10 is a plan view, and Fig. 11 a view in front elevation, corresponding to the transverse part sectional view in Fig. 9. In this case the coupling-bar b is not brought into line with the check-ropes a' a^2, but moves upon rollers b^2, placed to one side of the tank edge. This involves the employment of additional pulleys for each check-rope, which I provide as follows: For the upper check-rope a' the pulleys d' d^2, rotating in line in a vertical plane, and pulley d^3, rotating horizontally in the plane of the coupling-bar, are so placed relatively to the vertical line of motion of the check-rope a' and to position of the coupling-bar b that the connection with the coupling-bar b is effected by passing the said check-rope a' under pulley d', over pulley d^2, and round pulley d^3 in the manner clearly shown more particularly in Fig. 10. In the case of the lower check-rope a^2, which has to be carried over the dip B of the outer lift to serve the inner lift, pulleys e' e^2 are mounted on the dip B, as illustrated more particularly in Fig. 9, in any suitable manner. A pulley e^3 is also pivotally attached to the lower part of the bottom or outside lift in a line with the pulleys e' e^2 on the dip, and three other pulleys d^4 d^5 d^6 are provided to form a twin set with the pulleys d' d^2 d^3, as already described, for transmitting the upper check-rope a'. By this system of pulleys the lower check-rope a^2 is carried from its point of connection with the inside lift over the dip B on pulleys e' e^2, and is then led down under pulley e^3, and again up to the pulleys d^4 d^5 d^6 on the tank side, passing over pulleys d^4 d^5 and round pulley d^6 to its connection with the coupling-bar b, as already described with reference to the upper check-rope a'. If the coupling-rope is brought into line with the check-ropes, as illustrated in Fig. 15, the pulleys d', d^2, d^3, d^4, d^5, and d^6 are not required. The connection of the upper check-ropes a' with the coupling-bar b, and their action, is the same as already described for a single-lift gas-holder, except that a greater length is required in the check-ropes, and a correspondingly greater distance is traveled by the coupling-rope in giving out and taking them in. The action of the lower check-ropes a^2 is as follows: As the gas-holder rises the ropes a^2 are drawn up over pulleys e' e^2 and under pulley e^3 to the coupling bar or rope until the two lifts are "cupped," when both rise together, and the coupling bar or rope draws up the lower check-rope a^2 from pulleys e^3 only as it rises with the outer lift, the rope behind pulley e^3 remaining stationary. When the gas-holder falls again, the reverse operation takes place.

The above-described part of my invention for controlling an inside lift of a multiple-lift gas-holder by leading the lower check-ropes therefrom over the dips of the next lower or outer lift involves the employment of additional pulleys and corresponding sharp bends in the check-ropes, which check-ropes are also increased in length for every additional dip over which the same system of check-ropes is trained. The distance to be traveled in either direction by the coupling bar or rope is also correspondingly increased. I therefore prefer to employ this mode of applying my invention for controlling the bottom and intermediate lifts of multiple gas-holders and to substitute therefor an independent system of check-ropes and their operating mechanism for the top lift supported on and worked from the crown thereof, as illustrated in Figs. 12, 13, and 14, in which Figs. 12 and 13 are part sectional views taken on lines X X and Y Y, respectively, of Figs. 14, which is the corresponding view in plan. In these figures, A is the tank side, B' B^2 the dips of the first and second lifts, and C the upper part or curb of the top lift.

The arrangement of parts or appliances employed for operating the check-ropes of the outer and intermediate lifts is precisely similar in principle and mode of working to what has already been described with reference to Figs. 9, 10, and 11, and is only different therefrom by the substitution of a flexible coupling-rope drawn into line with the check-ropes for a rigid coupling-bar, which lies outside of the vertical line of motion of the check-ropes.

The arrangement of parts or appliances for controlling the top lift by check-ropes worked from the crown of the lift is as follows: The

coupling-rope b is carried round horizontally-grooved pulleys b', which are placed near enough to the side of the lift to enable the check-ropes a' a^2 to be connected to the coupling-rope by being led over pulleys f' f^2 in the manner shown. These check-ropes are worked in couples in the manner hereinbefore described. The lugs g' g^2 are provided on the dip of the lift below, the upper check-ropes a' being secured direct to lugs g', and the lower check-ropes a^2 to the lugs g^2 after passing down under pulley f^3, which is pivotally attached to the lower part of the top lift, and up again in the manner shown, so that the same motion of the coupling-rope which takes up one set of the check-ropes gives out corresponding lengths of the other set of check-ropes, in the manner hereinbefore described.

Fig. 15 illustrates how the check-ropes of each inner lift can be worked independently by providing the same arrangement of parts or appliances on each dip for the lift above as are provided at the tank side for the bottom lift.

As before stated, I do not restrict myself to the precise details or arrangements which I have described with reference to the accompanying drawings, which are merely intended to illustrate suitable means by which the essential features of my invention can be applied to gas-holders of the kind in ordinary use, as the arrangement or combination of parts by which wire ropes, chains, or the like can be employed as check-ropes to be automatically given out and taken up with the rise and fall of the gas-holder and kept in a suitable state of tension, so as to operate to resist the tendency of the movable part or parts of the gas-holder to get out of position, and also, if desired to control the pressure put on the gas, may be varied in many ways without departing from the essential feature of my invention; but

What I claim is—

1. The combination of a gas-holder, ropes attached to a plurality of points at the top and bottom thereof, and a coupling device adapted to oscillate around the said holder, the said ropes being attached thereto, as and for the purposes described.

2. The combination of a gas-holder, a ring adapted to oscillate therearound, and ropes attached to the said ring and to the top and bottom of the said holder at a plurality of points, the said ropes being branched off from the ring in directions dependent upon their connection with the top or bottom of the holder, as and for the purposes described.

3. The combination of a gas-holder, a ring adapted to move around the said holder, pulleys arranged near the path of the said ring, and ropes attached to the said ring, passing over the said pulleys and attached to the top and bottom of the said holder, as and for the purposes described.

4. In a controlling device for gas-holders having a plurality of lifts, the combination of a ring adapted to move concentrically around the said holder, a rope attached to the said ring and to the top of one of the inner lifts, a pulley on the base of the outer lift, and a rope secured to the said ring, passing around the said pulley and attached to the base of the said inner lift, as and for the purposes described.

5. In a controlling device for gas-holders having a plurality of lifts, the combination of a ring adapted to move around the said holder, a rope attached to the said ring and to the top of one of the inner lifts, a pulley on the base of the outer lift, a rope secured to the said ring, passing around the said pulley and attached to the base of the said inner lift, and pulleys to secure the proper alignment of the ropes and the rings before their junction, as and for the purposes described.

6. In a controlling device for gas-holders having a plurality of lifts, the combination of a ring adapted to move around the said holder, a rope attached to the said ring and to the top of the lift intermediate between the outer and top or inner lift, a pulley on the base of the outer lift, a second rope also secured to the said ring, passing around the said pulley and attached to the base of the said intermediate lift, a coupling-rope, pulleys upon the base of the top lift, pulleys upon the top of the top lift carrying the said coupling-rope, a rope attached to the said coupling-rope and to the intermediate lift, and ropes attached to the said coupling-rope, passing around the said pulleys upon the base of the top lift and attached to the intermediate lift, as and for the purposes described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD LLOYD PEASE.

Witnesses:
GEORGE JAMES CLARKSON,
HENRY PROCTOR.