

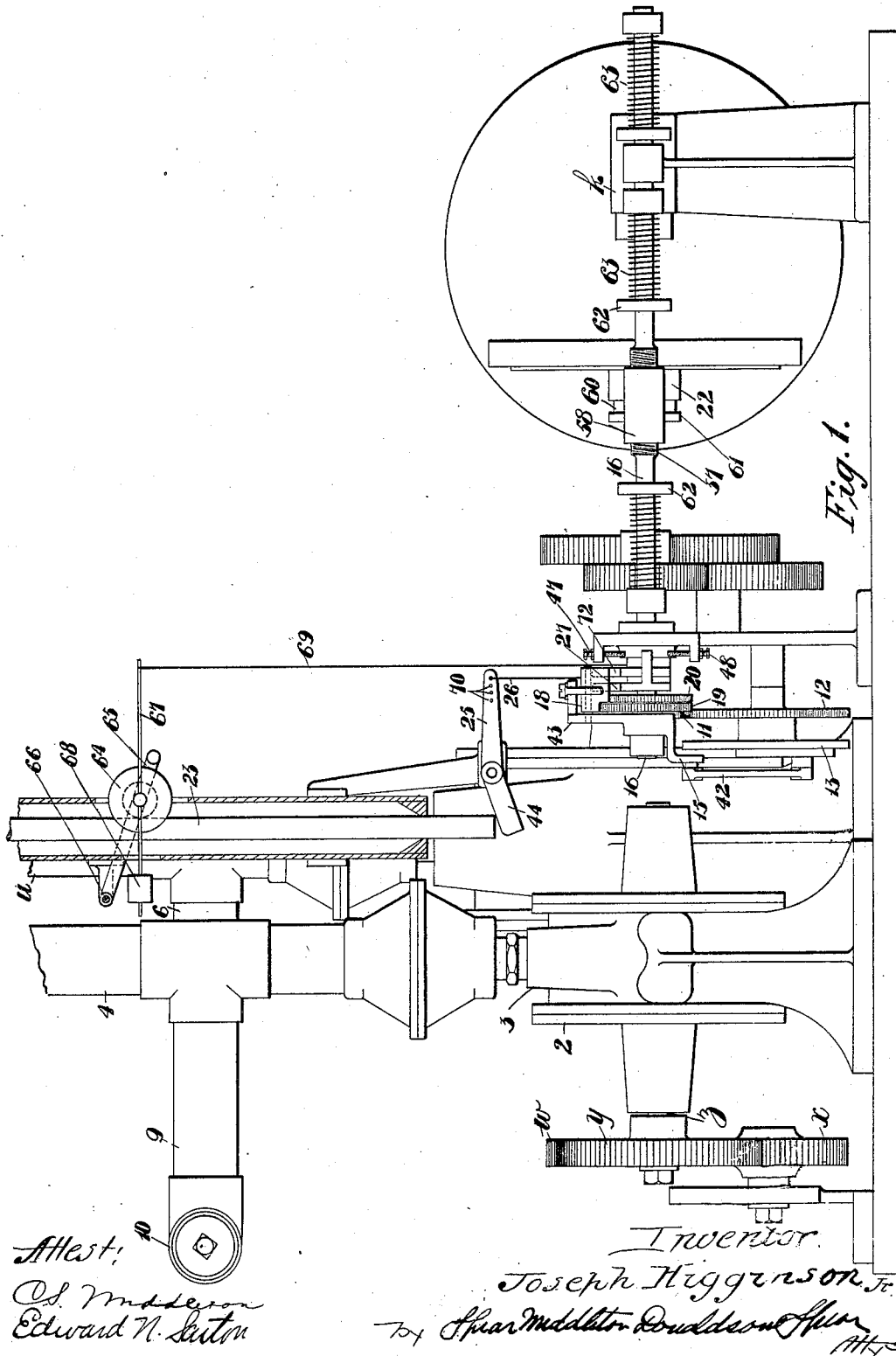
No. 828,313.

PATENTED AUG. 14, 1906.

J. HIGGINSON, JR.
GAS CONTROLLING APPARATUS.

APPLICATION FILED FEB. 7, 1905.

6 SHEETS—SHEET 1.



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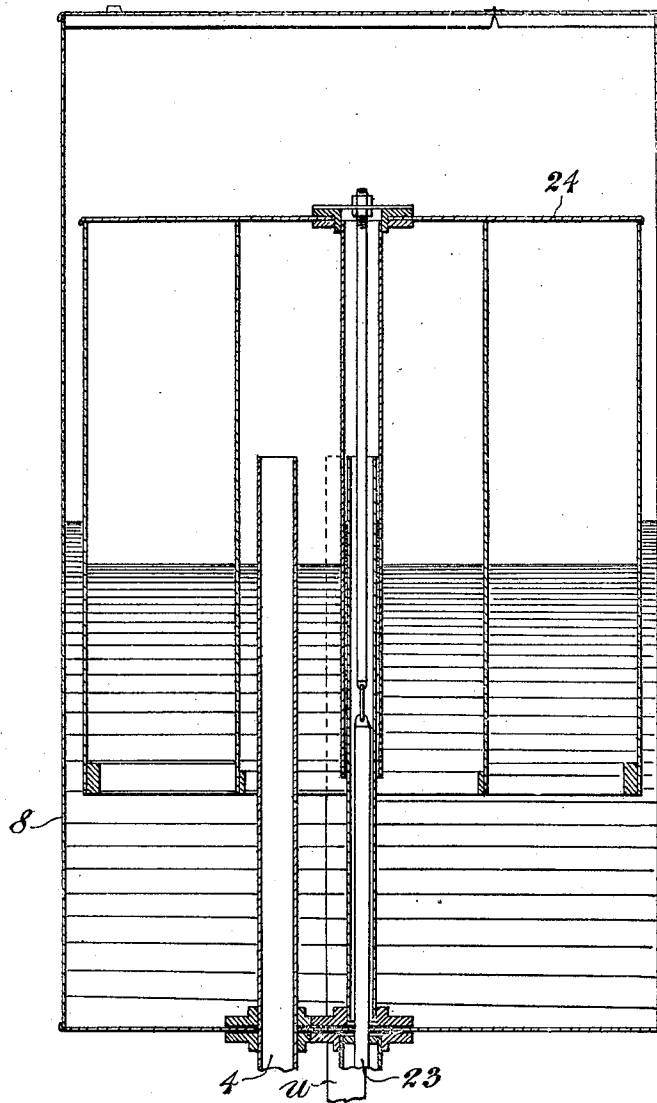


Fig. 7a

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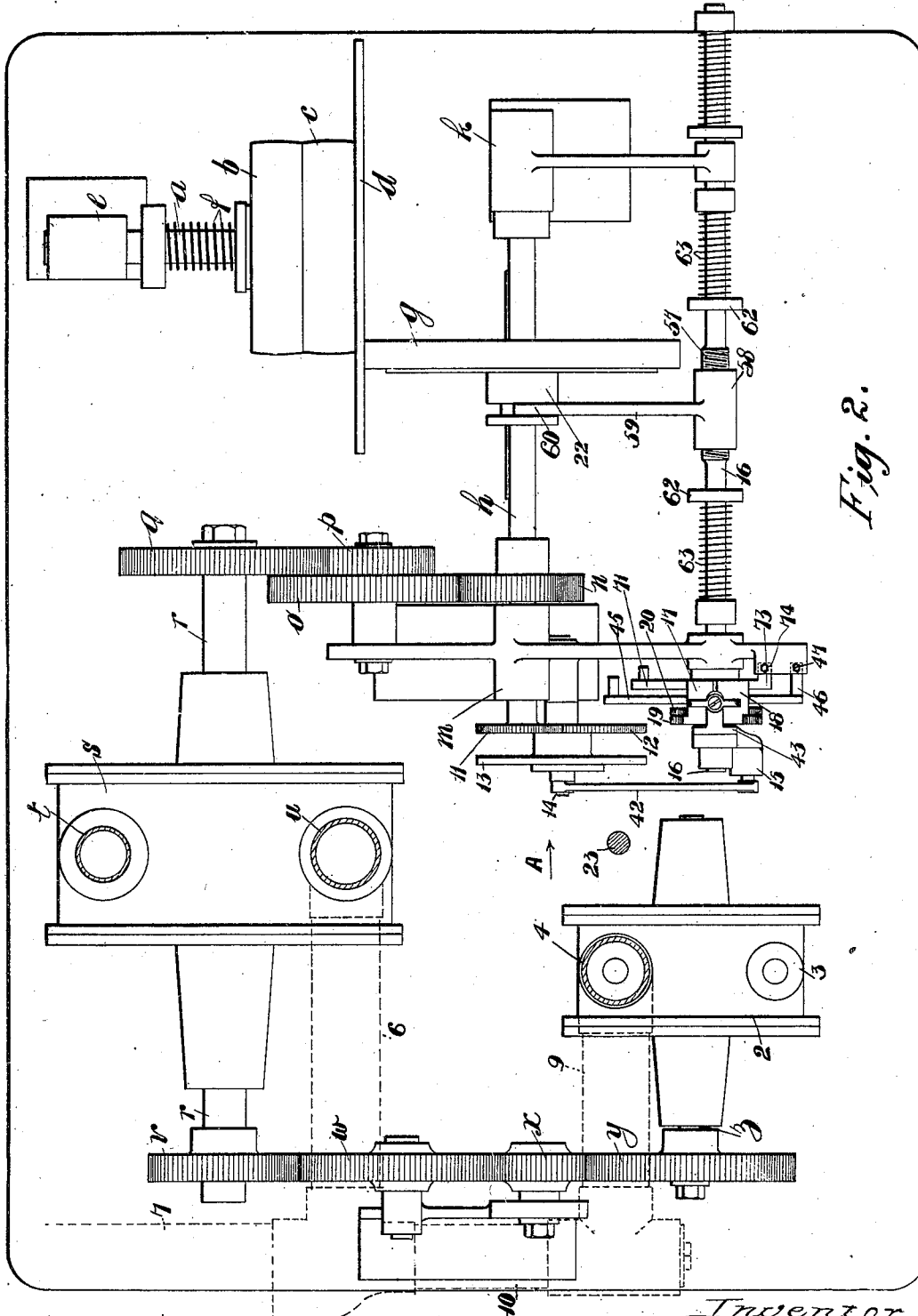


Fig. 2.

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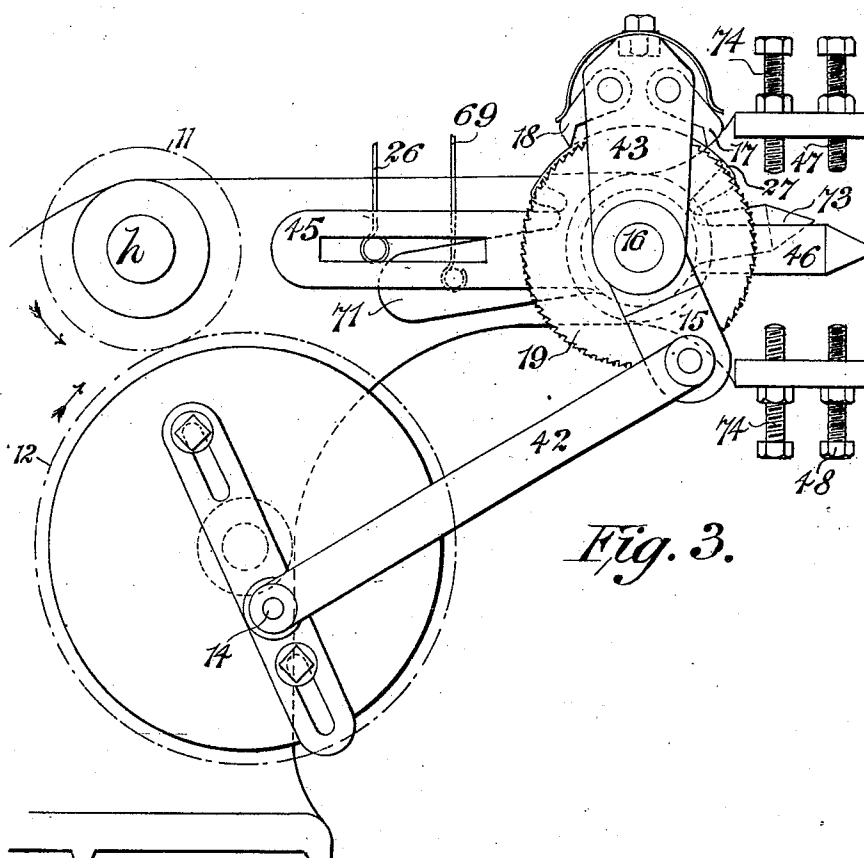


Fig. 3.

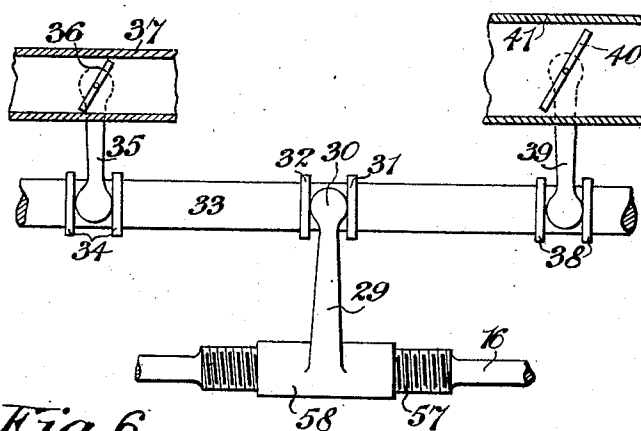


Fig. 6.

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6 SHEETS—SHEET 5.

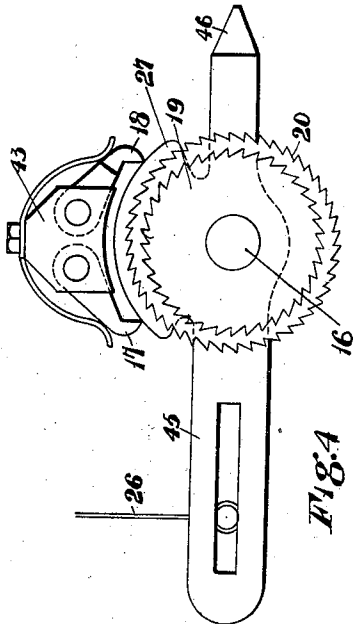


Fig. 4

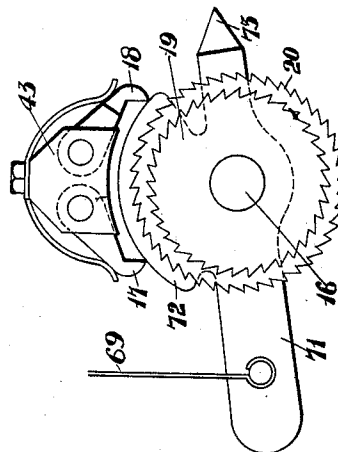


Fig. 5

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6 SHEETS—SHEET 6.

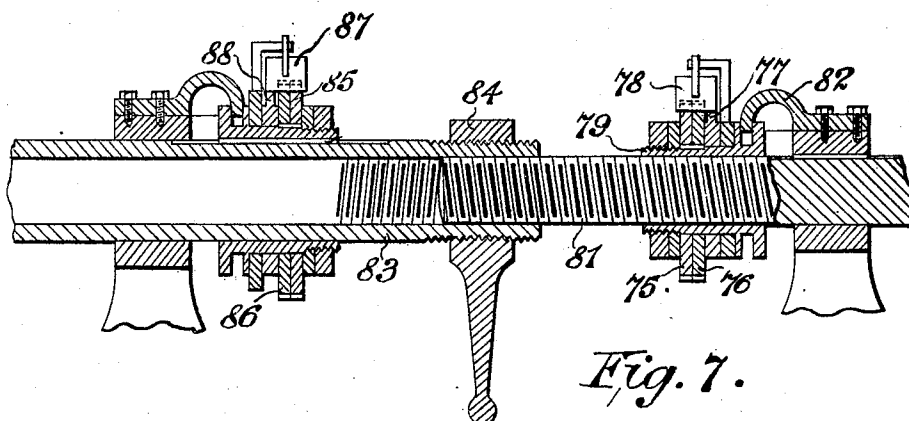


Fig. 7.

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UNITED STATES PATENT OFFICE.

JOSEPH HIGGINSON, JR., OF STOCKPORT, ENGLAND.

GAS-CONTROLLING APPARATUS.

No. 828,313.

Specification of Letters Patent.

Patented Aug. 14, 1906.

Application filed February 7, 1905. Serial No. 244,681.

To all whom it may concern:

Be it known that I, JOSEPH HIGGINSON, JR., a subject of the King of Great Britain and Ireland, residing at Sovereign Works, Stockport, in the county of Chester, England, have invented new and useful Improvements in Gas-Controlling Apparatus, of which the following is a specification.

My invention consists in an apparatus for controlling the delivery of a mixture of fluids in uniform proportions.

The accompanying drawings, which with the description belonging to them are used to exemplify my invention, illustrate apparatus intended for the supply of coal-gas and air to the burners of machines known as "gasing-machines," in which yarn or thread is rapidly passed over the flame from a burner. It is a great advantage to have a uniform mixture of gas and air supplied to this burner, not only so that economy may be promoted by making the best use of a given quantity of gas, but in order that the flame from each burner may be constant as regards its heating properties.

Referring now to the accompanying drawings, which, as aforesaid, illustrate apparatus intended for supplying gas and air to the burners of gasing-machines, Figure 1 is an elevation, partly in section, of the lower part of one convenient form of apparatus. Fig. 1^a is a sectional elevation of the upper part of the apparatus shown in Fig. 1, but on a smaller scale. Fig. 2 is a plan of Fig. 1. Fig. 3 is an enlarged end view of the ratchet-wheel driving and controlling mechanism viewed in the direction shown by the arrow A in Fig. 2. Figs. 4 and 5 further illustrate the ratchet mechanism, only certain members being shown in each of the two views and certain other members being distorted for the sake of clearness. Figs. 6 and 7 illustrate modifications of parts of the apparatus.

I shall first describe the form of apparatus shown in Figs. 1, 1^a, 2, 3, 4, and 5. *a* is a shaft which is provided with pulleys *b* *c*, one of these being a fast pulley and one a loose pulley. By means of the fast pulley the shaft receives power from any convenient source. A disk *d* is also mounted on the shaft *a*, the disk and pulleys being so arranged that they are pressed outward from a bearing *e* by means of a spring *f*. The disk *d* is employed as a friction driving-wheel, and the face of this disk is pressed by the spring *f* against the periphery of a friction-wheel *g*,

carried by the shaft *h*. This shaft is supported in bearings *k* and *m*. On the shaft *h* is keyed a pinion *n*, which gears with a spur-wheel *o*, which is rigid and coaxial with a spur-wheel *p*, which gears with a spur-wheel *q*, mounted on the shaft *r* of a rotary pump, of which the case is shown at *s*. The inlet-port to this pump is shown at *t*. *u* is the vertical delivery-pipe from the pump, which pipe leads to a compartment of a suitable reservoir or holder 8, which is supported in any convenient manner above the controlling mechanism herein described and is shown in the drawings at Fig. 1^a. The pipe *u* has a branch 6, which leads to a common gas-and-air-delivery pipe 7, which leads to the burners. The shaft *r* is geared by the wheels *v*, *w*, *x*, and *y* with the shaft *z* of a rotary gas-pump, of which the casing is shown at 2. The gas-inlet to this pump is at 3. 4 is the vertical gas-delivery pipe which leads to the gas-holder 8 and is provided with a horizontal pipe 9, which is connected by the horizontal pipe 10 with the common gas-and-air-delivery pipe 7. *q* is used as a change-wheel for altering the total capacity of the apparatus, and *y* is used as a change-wheel for altering the proportions of gas and air.

On the end of the shaft *h* is mounted a pinion 11, which gears with a wheel 12, which is mounted on a shaft which also carries the disk 13. This disk carries a pin 14, which can be adjusted radially, and this pin in its rotation gives a rocking movement to a lever, to one arm 15 of which it is connected by means of a connecting-rod 42, as shown clearly in Fig. 3. This lever is fulcrumed on the shaft 16, and its other arm 43 carries two pawls 17 18, which respectively gear with the ratchet-wheels 19 and 20. These ratchet-wheels are of the same diameter; but in Figs. 4 and 5 they are shown of unequal diameter and both of a smaller diameter than they should be in order that they may be clearly distinguished from each other and from the shields, which will be hereinafter referred to. These ratchet-wheels are keyed on the shaft 16 alongside each other, so that when one or other of the ratchet-wheels is operated the shaft 16 is rotated in one or other direction. The shaft 16 has a screw-threaded portion 57, on which is mounted a nut 58, which is provided with an arm 59, which is furnished with a forked end 60 61, which works in a groove in the boss 22 of the friction-wheel *g*, as shown in Fig. 2.

The rod 23 is connected to the top of the gas-holder bell 24, and the bottom end of this rod acts on one arm 44 of a lever carried by a bracket from a tube which incloses the portion of the rod 23 projecting below the holder 8 and is secured to the said holder, as shown at Fig. 1^a. The other arm 25 of the lever is connected by a light rod 26 with a lever 45, formed integral with a shield 27.

The lever and shield are best seen in Fig. 4, where certain other parts are omitted for the sake of clearness. When the rod 23 descends, it presses down the arm 44 of the lever 44 25. When the rod 23 ascends, the weight of the lever 45 keeps the arm 44 in contact with the lower end of the rod 23. The shield 27 therefore moves with the movement of the rod 23. This shield 27 is so arranged that when the gas-holder bell exceeds a certain height the shield is so placed as to prevent the one pawl engaging with its ratchet-wheel, and when the gas-holder bell is below a certain height the shield prevents the other pawl from engaging with the other ratchet-wheel. When the bell is anywhere between these two critical positions, the shield prevents both pawls from engaging with the ratchet-wheels. The consequence is that when the bell is between the two critical positions the shaft 16 is not rotated in either direction, and therefore the friction-wheel *g* is stationary as regards its axial position on the shaft *h*. When, however, the bell is above its upper critical position or below its lower critical position, the shaft 16 is rotated in one or other direction, so as to move the friction-wheel *g* to the right or to the left, and so alter the velocity ratio between the wheels *d* and *g*, so as to reduce or increase the speeds of rotation of the air and gas pumps.

The shield is provided with a tailpiece 46, which works between two adjustable screws 47 and 48, which limit the displacement of the shield.

On the shaft 16 are mounted two sliding collars 62, behind which are placed springs 63. These collars and springs limit the displacement of the nut 58.

The lever 44 25 is provided with a number of holes 70, and the light rod 26 is adapted to be connected to any one of these, so that the movement of the shield 27 can be adjusted.

A flanged disk 64 is pivoted to a lever 65, which is fulcrumed at 66 to the tube hereinbefore referred to as inclosing the rod 23, an aperture being cut in the tube to admit the disk. Rigidly attached to the disk 64 is a rod 67, which carries at one end a balance-weight 68, while the other end is connected by the light rod 69 to a lever 71, which is formed integral with a shield 72. The lever 71 and shield 72 are best seen in Fig. 5, where certain other parts are omitted for the sake of clearness. This shield 72 is situated

alongside the shield 27. It is of a similar nature to the shield 27, acting when required to keep the pawls 17 18 out of gear with the ratchet-wheels 19 20; but its purpose is to prevent hunting of the apparatus, as hereinafter described. The weight of the disk 64, the lever 65, and other parts causes the periphery of the disk 64 to press against the rod 23, so that an upward or a downward movement of the rod 23 has a tendency by friction to rotate the disk in one or other direction. There is no vertical movement of the disk 64, as its weight, together with that of the parts connected to it, is sufficient to maintain the disk in its lowest position while the rod is moving in an upward direction. When, therefore, the bell of the gas-holder commences to rise after a downward movement, the disk 64 is given a partial rotation in a direction to lower the rod 69. This lowers the lever 71 and tilts the shield 72 till its tailpiece 73 strikes the upper of the two adjustable stops 74. Any further upward motion of the bell gives no further movement to the shield 72; but whenever the bell commences to move downward, no matter at what height it is when this takes place, the rod 23 by friction on the disk 64 raises the rod 69, so as to lift the lever 71 and so tilt the shield in the other direction. The shield 72 is thus tilted from one side to the other by the reversal of the motion of the bell while the shield 27 is affected by the position of the bell.

When the shield 27 with its actuating mechanism is used alone, this may in many cases lead to the governor device hunting badly for the following reason: when the supply of gas has been exceeding the demand and the bell has risen above its normal height, the first shield 27 will be actuated so as to allow the ratchet-wheel 20 to rotate, and the shaft will be rotated in such a way as to reduce the supply of gas. When the supply of gas just meets the demand, the bell will cease to rise; but if it is above its upper critical position the shaft will still be rotating, so as to still further reduce the supply of gas, and the latter will therefore be diminished too much. The bell will in consequence fall and continue to fall until it passes its lower critical position, when the reverse operations will take place, but with the other pawl 17 in action. The bell may be thus constantly moving up and down after the demand for gas has remained constant. The shield 72, with its actuating device, comes usefully into action in such a case. When, for example, the bell has risen above its upper critical position and the shield 27 has come into action, so as to reduce the supply of gas, the bell comes to rest, when the supply of gas just meets the demand. With the shield 27 only in use the supply of gas would be still further reduced and the bell would commence to descend.

Immediately the bell commences to fall the shield 72 comes into action and stops any further operation of the pawl 18. The bell then either remains stationary or descends only very slowly as the gas-supply is now practically equal to the demand. A corresponding action takes place when the bell is in a low position due to a shortness of gas.

It will be observed from the drawings that the shield 72 is actuated very rapidly as compared with the shield 27; hence its utility for preventing hunting as hereinbefore described.

This duplex or compound governing device I have in many cases found to be very useful in preventing hunting, which would otherwise have been very objectionable. I may, however, whenever considered desirable, omit the shield 72 and its actuating mechanism and employ only the single governing device first described.

Referring now to Fig. 6, an alternative method of controlling the supply of air and gas is here illustrated. The shaft 16 is driven by gearing in the same way as shown in Figs. 1 and 2 or in any other suitable manner and is provided, as before described, with a screwed portion 57, on which works a nut 58. The shaft 16 is rotated in one or other direction by means of ratchet-wheels in the manner already described, according to the position and the direction of motion of the bell of the gas-holder. The nut 58 carries an arm 29, the forked end 30 of which works between two collars 31 32 on a rod 33, which is mounted so as to be capable of endwise motion. This shaft by means of collars 34 34 actuates a lever 35, which controls the throttle-valve 36 of the pipe 37, leading the gas to the gas-pump. The rod 33 is also provided with collars 38 38, which engage with a lever 39, which controls a throttle-valve 40 on the pipe 41, leading the air to the air-pump. The rotation of the shaft 16 in one direction or in the other therefore closes or opens the valves 36 and 40 and so allows a less or greater supply of air and gas to pass to the pumps.

Instead of arranging the throttle-valves on the suction sides of the pumps I may, if preferred, arrange them on the delivery sides of the pumps.

I do not wish to limit myself to an arrangement in which the supply of mixture is controlled by a plurality of valves.

The valves shown in Fig. 6 are intended to be only diagrammatic. I may employ any suitable kind of valve.

I do not wish to limit myself to the particular means employed in connection with the lever 44 25 for controlling the supply of air and gas, as said lever may be used with devices and connections other than those described.

A modification of the duplex or compound

governing device is illustrated in Fig. 7. Two ratchet-wheels 75 76 are provided, which are adapted to be actuated each by a pawl, the ratchet-wheels and pawls being arranged in conjunction with a shield 77, similar to the shield 27 mentioned as used with the previous form of my invention. One of the pawls can be seen at 78. The other cannot be seen; but the arrangement is the same as that already described. This shield is, as before, adapted to be actuated according to the position occupied by the gas-holder. Instead, however, of having the ratchet-wheels keyed on the shaft I key them on a nut 79, which is mounted on a screwed part of the shaft 81. This nut is allowed to rotate, but is prevented by the hook 82 from having any axial movement, so that when the nut rotates an endwise movement is given to the shaft. A continuation of the screwed portion of the shaft works into the interior threaded portion of a sleeve 83. This sleeve is externally threaded, and on the external screw-thread works a nut 84, which is capable of axial movement along the sleeve, but is prevented from rotating. When the shaft 81 is given an endwise movement, due to the rotation of one or other of the ratchet-wheels 75 76, and when no rotary motion is given to the sleeve 83, the endwise movement of the shaft 81 is transmitted to the sleeve and to the nut 84, and this axial motion given to the nut 84 is arranged to control the supply of gas. The device as far as it has already been described acts the same as the device in the first-described form of my invention without the auxiliary shield and its mechanism. In this case also I provide an auxiliary governing device. This in the present case consists in providing a second pair of ratchet-wheels 85 86 on the sleeve 83. These ratchet-wheels are prevented from having an axial movement. The sleeve 83 can, however, have an axial motion, but is forced to rotate with the ratchet-wheels mounted on it by means of a feather. A pair of pawls are arranged to gear one with each of these ratchet-wheels, one of the pawls being shown at 87, and a shield 88 is provided to keep one or other of these pawls out of contact with its ratchet-wheel. This shield 88 is adapted to be actuated by a roller or quadrant—such, for example, as the disk 64, Fig. 1, engaging by friction with a moving part on or attached to the gas-holder—such, for example, as the rod 23, Figs. 1 and 1^a—so that according as the gas-holder is moving up or is stationary after an upward movement or is moving down or is stationary after a downward movement one or other of the pawls is engaging with its ratchet-wheel. The external thread on the sleeve 83 is different from the internal thread, either by the one being right-handed and the other left-handed or by the two being of different pitch, so that the ro-

tation of one or other of the ratchet-wheels on the sleeve gives an axial movement to the nut 84, which, as already described, acts to control the supply of gas. The second pair of ratchet-wheels 85 86, with the roller or quadrant acting on the moving part of the bell, deals with small or gradual variations in the demand and is intended to be the chief factor in keeping the supply of gas equal to the demand. The pair of ratchet-wheels 75 76 acts when through any cause the bell has raised or lowered much beyond its normal position. The several screw-threads may be so arranged as to suit the special conditions in any particular case.

In all cases instead of employing a pair of ratchet-wheels I may, if desired, employ a single ratchet-wheel, which is adapted to be actuated by either pawl, and instead of employing a roller or quadrant which is actuated by friction from a moving part of the bell I may provide teeth on the roller or quadrant and on the moving part of the bell, provided that I furnish some slipping device, so that the shield is only changed in position when the bell changes its direction of motion.

Although I have described my invention in connection with the supply of a mixture of air and coal-gas, it can be used to control the supply of any mixture of gases or liquids. In every case a holder or tank will have to be used which is suitable to the nature of the fluid or fluids to be contained therein and which expands and contracts in order to vary its capacity.

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

1. In apparatus for controlling the delivery of a mixture of fluids in uniform proportions, in combination, pumps for delivering the said fluids, gearing connecting together said pumps, a reservoir for holding fluid delivered by one of said pumps, said reservoir having a part capable of movement so as to render the reservoir dilatable, means controlled by the degree of dilation of said reservoir for controlling the rate of delivery of the fluid from said pumps and means controlled by change of direction of movement of the movable part of said reservoir for controlling the rate of delivery of the fluid from said pumps, substantially as and for the purpose described.

2. In apparatus for controlling the delivery of a mixture of fluids in uniform proportions, in combination, pumps delivering the said fluids, gearing connecting together said pumps, a reservoir for holding fluid delivered by one of said pumps, said reservoir having a part capable of movement so as to render the reservoir dilatable, a pair of friction-wheels employed in driving said pumps, an arm adapted to alter the velocity ratio of said friction-wheels, a threaded shaft for actu-

ating said arm, a pair of ratchet-wheels keyed on said shaft, a pair of pawls adapted to engage said ratchet-wheels, each pawl with one ratchet-wheel, means for constantly rocking said pawls, a shield controlled by the degree of dilation of said reservoir and adapted to control the engagement of said pawls with said ratchet-wheels and a second shield controlled by change of direction of movement of the movable part of said reservoir and also adapted to control the engagement of said pawls with said ratchet-wheels, substantially as described.

3. In apparatus for controlling the delivery of a mixture of gases in uniform proportions, in combination, pumps delivering the said gases, change-gearing connecting together said pumps, a gas-holder provided with a bell for containing gas delivered by one of the pumps, a threaded shaft, a nut carrying an arm threaded on said shaft and adapted to be moved axially by the rotation of said shaft, means whereby the axial movement of said nut and arm controls the rate of delivery of gas from said pumps, a pair of ratchet-wheels keyed on said shaft, a pair of pawls adapted to engage with said ratchet-wheels, each pawl with one ratchet-wheel, means for constantly rocking said pawls, a lever actuated by the rise and fall of said bell, a shield adjustably connected to said lever and adapted to control the engagement of said pawls with said ratchet-wheels, a member engaging frictionally with a moving part of said bell, and a second shield actuated by the movement of said member and also adapted to control the engagement of said pawls with said ratchet-wheels, substantially as described.

4. In apparatus for controlling the delivery of a mixture of fluids in uniform proportions, in combination, pumps for delivering the said fluids, change-gearing connecting together said pumps, gearing driving one of said pumps, a dilatable reservoir for holding fluid delivered by one of said pumps, a threaded shaft, a nut threaded on said shaft and adapted to control the speed of the second-mentioned gearing, ratchet-wheels keyed on said shaft, pawls adapted to gear with said ratchet-wheels, means for constantly rocking said pawls, and a shield controlled by the degree of dilation of the said reservoir and adapted to control the engagement of said pawls with said ratchet-wheels, substantially as described.

5. In apparatus for controlling the delivery of a mixture of fluids in uniform proportions, in combination, pumps delivering the said fluids, gearing connecting together said pumps, a dilatable reservoir for holding fluid delivered by one of said pumps, a pair of friction-wheels employed in driving said pumps, an arm adapted to alter the velocity ratio of said friction-wheels, a threaded shaft for ac-

uating said arm, a pair of ratchet-wheels keyed on said shaft, a pair of pawls adapted to engage said ratchet-wheels, each pawl with one ratchet-wheel, means for constantly rocking said pawls, and a shield controlled by the degree of dilation of said reservoir and adapted to control the engagement of said pawls with said ratchet-wheels, substantially as and for the purpose described.

10 6. In apparatus for controlling the delivery of a mixture of gases in uniform proportions, in combination, pumps delivering the said gases, gearing connecting together said pumps, a gas-holder provided with a bell for
15 containing gas delivered by one of the pumps, a lever actuated by the rise and fall of said bell, a threaded shaft, a nut carrying an arm threaded on said shaft, and adapted to be

moved axially by the rotation of said shaft, a pair of ratchet-wheels keyed on said shaft, a 20 pair of pawls adapted to engage with said ratchet-wheels, each pawl with one ratchet-wheel, means for constantly rocking said pawls, a shield adjustably connected to said lever and adapted to control the engagement 25 of said pawls with said ratchet-wheels, and means whereby the movement of said arm controls the rate of delivery of gas from said pumps, substantially as described.

In testimony whereof I have signed my 30 name to this specification in the presence of two subscribing witnesses.

JOSEPH HIGGINSON, JUN.

Witnesses:

ROBERT MORRISON NEILSON.
VIVIAN ARTHUR HUGHES.