No. 814,287. PATENTED MAR. 6, 1906.

R. HARTWIG.

EXPLOSION ENGINE.

APPLICATION FILED FEB. 25, 1904.

Fig. 1.

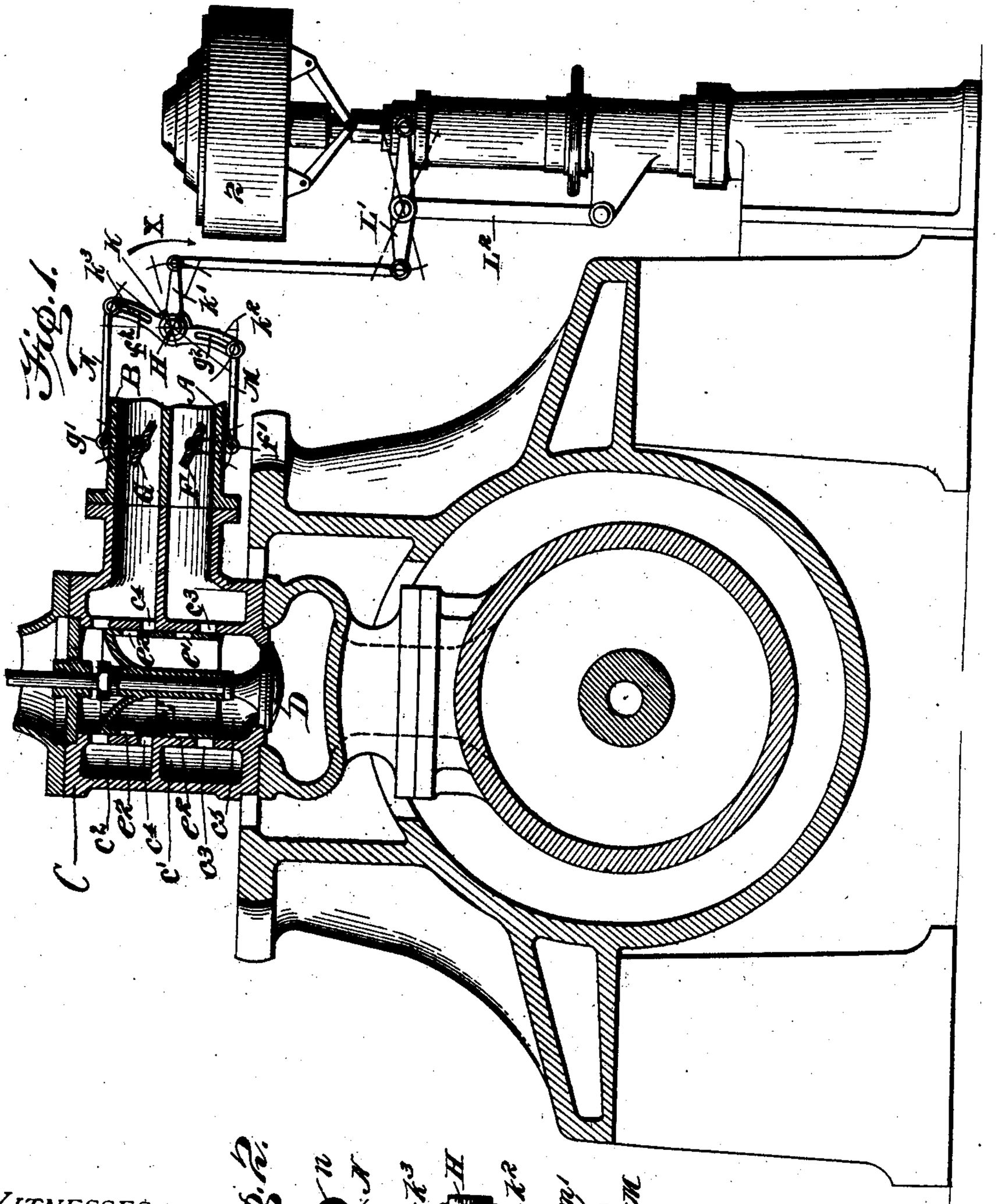
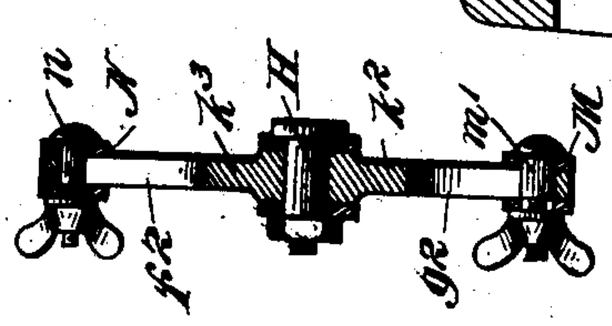


Fig. 2.



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EXPLOSION-ENGINE.

No. 814,287. Specification of Letters Patent. Patented March 6, 1906.

Application filed February 25, 1904. Serial No. 195,288.

To all whom it may concern:

Be it known that I, RUDOLF HARTWIG, a subject of the German Emperor, and a resident of Rüttenscheid, near Essen-on-the-Ruhr, Germany, have invented certain new and useful Improvements in Explosion-Engines, of which the following is a specification.

The present invention relates to means for altering the composition of air and gas in explosion-engines, and particularly to means which regulate the power by means of cut-off devices inserted in the pipes for gas and air and controlled by the governor. The connection between the governor and at least one of the cut-off devices is arranged in such a manner that the ratio of transmission between the movement of the governor and the movement of the cut-off device can be varied.

In the accompanying drawings, Figure 1 is a diagrammatical view showing an embodiment of my invention, by way of example, connected to an explosive-engine and a governor. Fig. 2 is a detail sectional view of the three-armed lever.

The feed-pipes A and B for gas and air are in the customary manner united into a double pipe and joined to the valve-chest C of the inlet-valve D, where they terminate in two separated chambers c' c^2. The chambers c' c^2 communicate, by means of slots c^3 c^4, with a cylindrical mixing-chamber c^5, centrally arranged in the chest C and closed at the bottom by the inlet-valve D. In the mixing-chamber c^5 a piston-valve E is placed, which is rigidly connected to the inlet-valve D. The piston-valve E is provided with slots e' e^2, which when the inlet-valve D is opened register with the slots c^3 and c^4, leading to the chambers c' and c^2, and permit the mixture to enter the explosive-chamber of the engine 1.

In each of the pipes A and B a throttle-valve F and G is inserted that is automatically operated by the governor 2. The connection between the governor and the throttle-valves consists of a three-armed lever K, secured on a shaft H and having an arm k' connected with the governor 2 by means of a rod L and double-armed lever L′, pivoted to a swinging lever L^2. The arms k^2 k^3 of the lever k are by means of bolts m' n' linked to the rods M N, that by means of the arms f' g' engage the shafts of the throttle-valves F and G. The parts k^2 M f' and the parts k^3 N g' thus form double bell-crank connections. The arms f' and g' are of the same length and disposed at an angle of one hundred and eighty degrees to each other, so that when the lever k moves to one side or the other both throttle-valves will be rocked simultaneously to open or shut the pipes A and B. Each of the lever-arms k^2 k^3 is provided with a slot f^2 g^2, curved in an arc that is concentric with the connection-point of the arm f' g' and the levers M N. The bolts m' and n' are adjustably seated in said slots.

When the inlet-valve D is closed, the slots c^3 c^4 are covered by the piston E and neither gas nor air can enter the mixing-chamber c^5. At each suction-stroke the inlet-valve D is in the known manner opened wide by the valve-gear, and, as before said, the slots e' e^2 of the piston E will then register with the slots c^3 c^4, and if the throttle-valves are opened gas and air are drawn in. The amount of the mixture of gas and air is drawn in depends naturally upon the cross-sectional area of the space left open by the throttle-valves in the pipes A and B, decreasing as the governor 2 rises and increasing as the governor falls. When the governor as the work required decreases reaches its highest position, the various parts of the device assume the position shown in the drawings, both throttle-valves being closed, and consequently no new charge can be drawn in. When the governor falls as a result of increased loading, it shifts the lever k' in the direction of the arrow x and opens both the throttles to the same extent more and more till when the governor is in its lowestt position they are wide open. If the load or the work required of the engine does not vary, the governor does not move, and consequently the throttles do not move either, so that the same amount of charge mixture is always drawn in.

The composition of the charge mixture depends on the cross-sectional area of the spaces left open by the throttle-valves, and the said area depends on the distance between the bolts m' n' and the turning shaft H of the lever K. On the drawings the bolts m' n' are indicated as being at the same distance from the shaft H, and consequently

the movement of the lever-arm k' will be transmitted at the same ratio to the shafts of both throttle-valves F G by means of the double bell-crank levers k^2 M f' and k^3 N g'. As therefore the movement of both double bell-crank levers and of the throttle-valves connected therewith in this instance is the same, the throttles will cause amounts of air and gas to pass through the two pipes A and B that have the same relative proportion for any position of the governor, and the composition will therefore be constant for any position of the governor. In this special instance, where the ratio of the effective lengths of the arms k^2 and k^3 is one to one, the charge will be composed of equal amounts of gas and air. If the heating power of the gas is altered, such as it may when blast-furnace gas or generator-gas is used, the composition must be varied, too, so as to work under like favorable conditions. When such is the case, all that is necessary is to suitably shift the bolt m' or n' in the curved slots of the arm k^2 or k^3 so as to alter the effective length of one of the arms k^2 k^3, thereby varying the ratio of transmission between the movement of the governor and that of the throttle-valves. The variation of the said ratio of transmission of course results in an alteration of the cross-sectional area of the spaces left open by the throttle-valves, thereby changing the composition of the charge mixture. As before said, the curved slots k^2 k^3 are concentric with the connection-point of the levers M N with the arms f' g', respectively, and the throttle-valves will therefore also in case that the bolts m' n' are located at unequal distance from the shaft H open simultaneously when the governor commences its downward movement and close simultaneously when the governor reaches its highest position. During the movement of the governor the two cut-off devices do not open to the same extent. Nevertheless when the governor assumes its lowest position they are both open to their fullest extent for this adjustment. As now by differentiating effective lengths of the arms k^2 k^3 the bolts m' n', according to the arrangement illustrated are located approximately diametrically opposite each other the technical laws for the transmission of motion by means of link-gears will prove that also in the case of the arms k^2 k^3, being of different effective length, the composition of gas and air will be approximately constant for any position of the governor. Thus it will be seen that by means of the device described the composition of the charge can be regulated to agree with the heating power of the gas, and this regulation is effected in such a manner that during the entire working time of the engine the gas is utilized to the greatest extent possible.

In place of throttle-valves cocks, balanced valves, or slide-valves may of course be used.

Having thus described my invention, what I claim is—

1. The combination with an air-conduit, a gas-conduit, a pair of valves one for each conduit, and a governor, of means connecting the valves and the governor to transmit motion simultaneously to said valves adjustable to vary the ratio of transmission from the governor as between the valves and maintaining such ratio in every position of the governor.

2. The combination with an air-conduit, a gas-conduit, a pair of valves one for each conduit, and a governor, of a three-armed bell-crank lever one arm of which is connected to the governor and the other two each have connection with one of the valves, and means for varying the effective length of one of said latter arms.

3. The combination with an air-conduit, a gas-conduit, a pair of valves one for each conduit, and a governor, of a three-armed bell-crank lever, one arm of which is connected to the governor, and the other two are provided with curved slots and connections between the valves and the two latter arms of the bell-crank, adjustable in said slots.

4. The combination with an air-conduit, a gas-conduit, a pair of valves one for each conduit, and a governor, of a three-armed bell-crank lever one arm of which is connected to the governor and the other two have connections each with one of the valves, and means for varying the effective length of both of said latter arms.

5. The combination of two valves, one of the valves controlling the admission of air and the other of gas or vapor, a part moved by the governor, links connecting the valves to such part, and means for altering the point of connection of one of the links.

The foregoing specification signed at Düsseldorf this 26th day of January, 1904.

RUDOLF HARTWIG.

In presence of—

WILLIAM ESSENWEIN,
PETER LIEBER.