

J. J. M. A. E. SCHNEIDER.
 APPARATUS FOR ACTUATING BY MEANS OF AUXILIARY ENGINES, DEVICES SUCH AS THE
 RUDDERS OF AEROPLANES, SHIPS, AND THE LIKE.
 APPLICATION FILED MAY 10, 1920.

1,365,347.

Patented Jan. 11, 1921

3 SHEETS—SHEET 1.

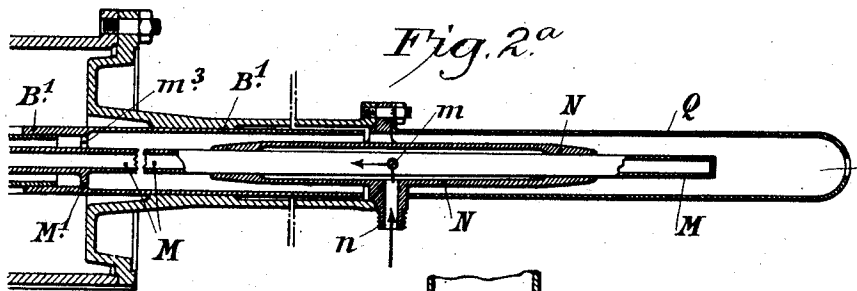
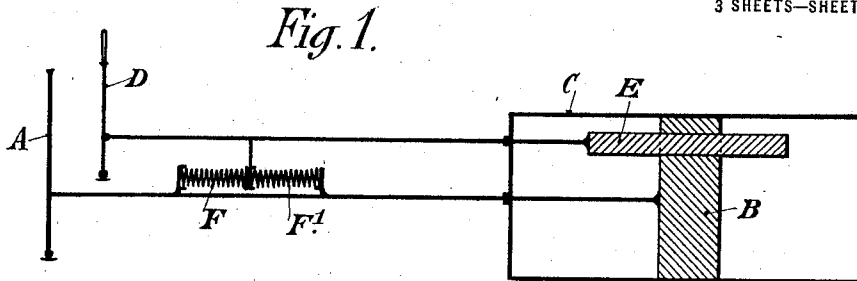
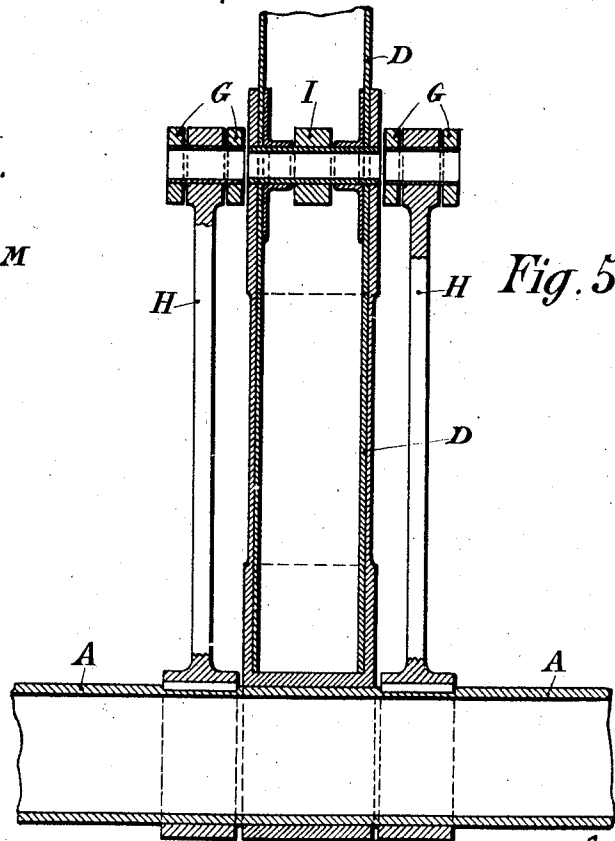
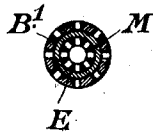


Fig. 4.



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3 SHEETS—SHEET 2.

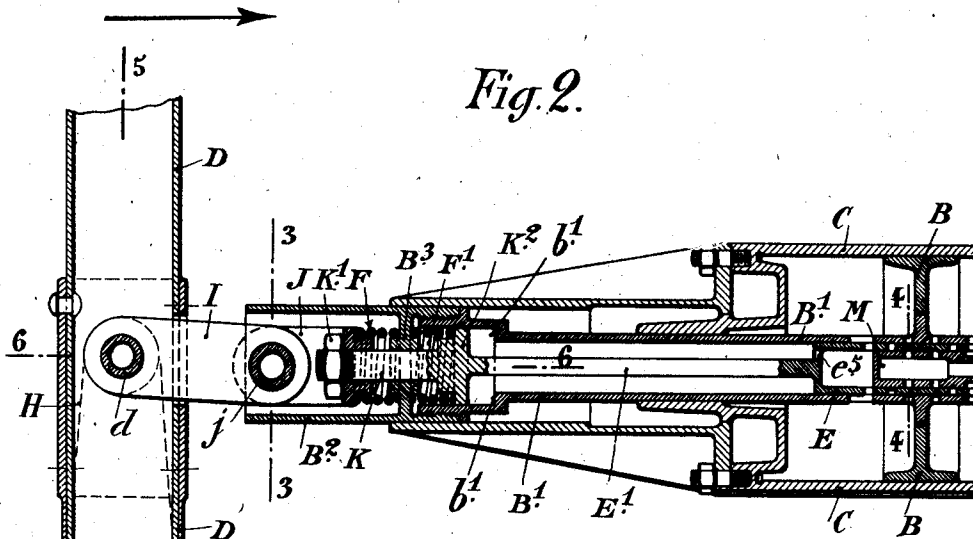


Fig. 2.

Fig. 3.

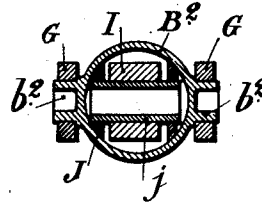
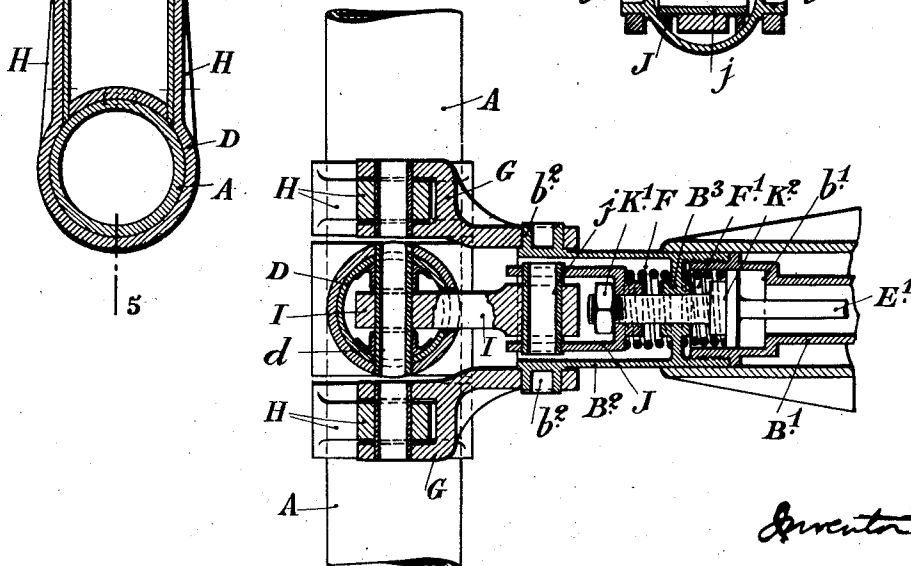


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

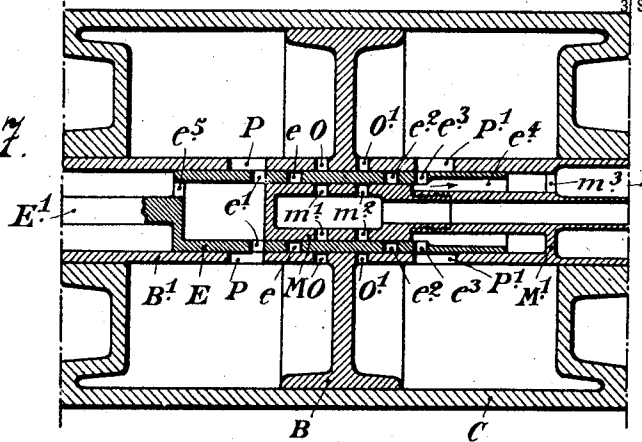


Fig. 8.

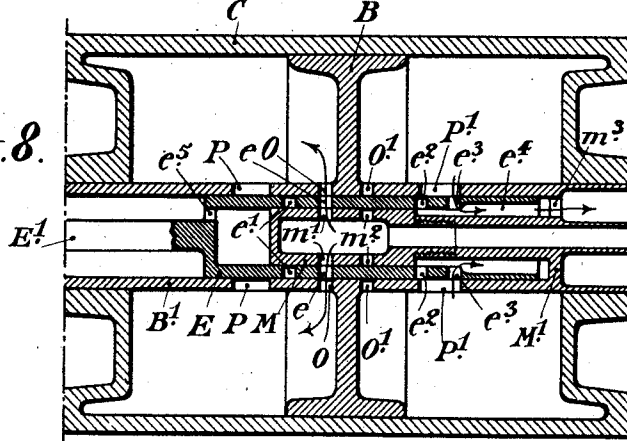
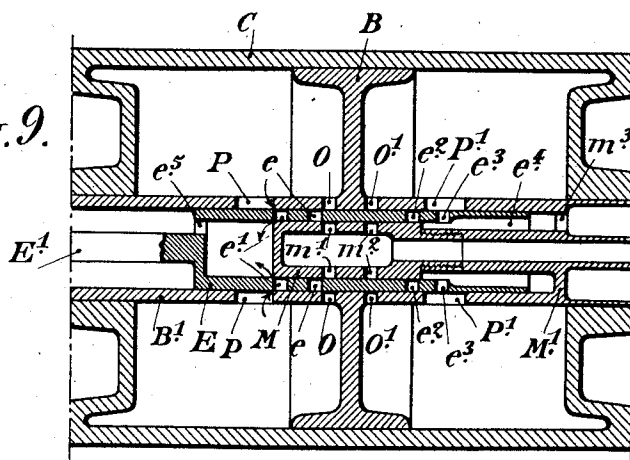


Fig. 9.



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APPARATUS FOR ACTUATING BY MEANS OF AUXILIARY ENGINES, DEVICES SUCH AS THE RUDDERS OF AEROPLANES, SHIPS, AND THE LIKE.

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Specification of Letters Patent.

Patented Jan. 11, 1921.

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To all whom it may concern:

Be it known that I, JEAN JULES MARIE ANTOINE EUGÈNE SCHNEIDER, a citizen of the Republic of France, resident of Paris, France, have invented new and useful improvements in apparatus for actuating by means of auxiliary engines, devices such as the rudders of aeroplanes, ships, and the like, which invention is fully set forth in the following specification.

When using auxiliary engines for actuating devices such as the rudders of aeroplanes, ships and the like, it is very important to reduce to a strict minimum the consumption of the motive fluid.

The present invention has for its object to provide an improved auxiliary engine that will enable this result to be achieved.

For this purpose, the hand-control of the device to be actuated is associated with the hand-control of the motive fluid distributing mechanism of the auxiliary engine allotted for actuating the same device, this association being such as to produce a simultaneous movement of the same extent, of the slide valve and piston of said auxiliary engine so long as the resistance to be overcome by the actuation does not exceed a determined value; the auxiliary engine remaining inoperative up to that moment.

Whereas on the contrary as soon as the resistance to be overcome exceeds the said determined value, the actuation of the control lever will produce a relative movement between the slide valve and the piston of the auxiliary engine and thus cause an admission of fluid into the cylinder of the auxiliary engine, whereby the latter is brought into operation.

In practice, as illustrated in diagram in Figure 1 of the accompanying drawings, the piston B of the auxiliary engine C is coupled directly to the device A to be actuated, whereas the control lever D which is common to the hand control and to the slide valve E of the auxiliary engine, is independent of the said device and is coupled to the slide valve; springs F, F¹ of determined initial tension being interposed between the slide valve and the piston. The result is that the operator by acting upon the control lever D acts also upon the slide valve with a constant tendency to compress one or the other of the interposed springs accord-

ing to the direction of the movement. But, if the resistance coupled by means of A to the piston of the auxiliary engine is smaller than the force necessary to compress the springs, the operator will through the medium of the slide valve and the non-compressed springs, move the piston B of the auxiliary engine as well as the device A to be actuated. If, on the contrary, the resistance coupled to the piston B is greater than the force necessary for compressing the spring interposed between the slide valve and the piston of the auxiliary engine, the operation of the control lever D will produce first the said compression which has for effect to cause a relative movement between the slide valve E of the auxiliary engine and the piston which has not yet been moved. This relative movement will produce an admission of the motive fluid upon one of the faces of the said piston, and consequently bring the auxiliary engine into action.

A constructional form of this invention is illustrated by way of example in Figs. 2 to 9 of the accompanying drawings where:

Complementary Figs. 2 and 2^a are longitudinal sections of a compressed air auxiliary engine constructed according to this invention, designed for actuating for instance the horizontal rudders of an aeroplane.

Figs. 3, 4 and 5 are cross sections respectively on the lines III—III, IV—IV and V—V of Fig. 2.

Fig. 6 is a partial horizontal section on the line VI—VI of Fig. 2.

Fig. 7 is a partial section on a larger scale corresponding to Fig. 2.

Figs. 8 and 9 are sections similar to Fig. 7 showing however the parts in other positions of operation.

In these figures, A is the device to be actuated, such as a shaft or the post of a rudder which is intended to receive angular motion. The piston B working in the cylinder C of the auxiliary engine is coupled to the said device. For this purpose the tubular piston rod B¹ is provided at one end outside the cylinder with a socket B², to the trunnions b² of which are jointed short connecting rods G which are jointed at their other ends to levers H fixed on the shaft A. By this connection any movement of the piston

B will cause the shaft A to rotate around its axis.

D is the control lever; it is loose on the shaft A and is coupled to the slide valve E of the auxiliary engine. In the example shown, this coupling consists of a connecting rod I jointed at one end to the said lever around a pin d , and at its other end to a pin j mounted in a fork J which can slide on an extension K of the rod E^1 of the slide valve E. This extension K is guided in a partition B^3 formed in the socket B^2 of the piston rod. This partition which is a fixed point of the piston rod, constitutes one of the abutments of the springs F, F^1 interposed between the piston B and the slide valve E. One of these springs F has its other abutment on the fork J which bears in its turn against a stop nut K^1 that allows of adjusting the initial tension of the springs. The other spring F^1 has its second abutment on a shoulder K^2 formed on the rod extension K. In this way is formed a limited slip-joint between the valve-stem and the piston-rod that is normally held extended by the springs F F^1 , thereby constituting a limited yielding connection between the valve and piston that permits limited relative movements of said members.

The slide valve E fitted in the tubular piston rod, is able to move therein, and its stroke is limited toward the right hand by the shoulder K^2 abutting against the shoulders b^1 of the said rod B^1 .

The distribution is effected by the positions of the ports in the slide valve relatively to the ports in the piston rod, the latter comprising the tubular element B^1 that envelops the slide valve and carries the piston B; and an axial tubular element M fitted in the cavity of the slide valve and fixed to the rod B^1 by a partition M^1 . This element is closed at both ends; it is guided in a fixed casing N into which the compressed air supply duct opens at n . The air entering the said casing is able to pass into the axial element M of the piston rod through apertures m . By means of two rows of apertures m^1 and m^2 in this tubular axial element, the air is able, when the slide valve is occupying the desired position relatively to the said element, to pass through apertures e or e^1 or e^2 or e^3 of the slide valve. At its forward end the slide valve is in constant connection, by its cavity e^4 into which the apertures e^3 open, with an aperture m^3 , and thence with the exhaust passage which is formed by the sheath Q fixed to the cylinder C. At the rear end the exhaust can take place through an aperture e^5 in the end of the slide valve and the tubular piston rod.

The improved apparatus operates as follows:

At rest, the parts occupy the positions shown in Figs. 2 and 7.

The two sides of the piston communicate with the exhaust; the left hand side through the apertures P of the piston rod B^1 and the apertures e^1 , e^5 of the slide valve; the right hand side through the apertures P^1 of the piston rod B^1 , the apertures e^3 and the passages e^4 of the slide valve, and the aperture m^3 of the partition M^1 .

The compressed air admitted through n and the apertures m cannot enter into the cylinder because the apertures m^1 , m^2 are situated opposite a solid portion of the slide valve.

If the control lever D be operated toward the right, it will first turn idly around the shaft A; but it immediately carries around with it the connecting rod I and through the latter the fork J, tending to compress the spring F between it and the partition B^3 coupled to the resisting device. If the resistance of this device is smaller than the force required to compress the spring F, the fork J immediately on beginning to compress the said spring, will move with it the partition B^3 , that is to say, the piston B and through the latter, the coupling H—H and the shaft A. The piston and the slide valve thus move simultaneously and substantially to the same extent. In any case their relative motion is insufficient to have any effect upon the distribution; the two sides of the piston remain connected with the exhaust. In other words, the control is effected exclusively by hand and without any consumption of motive fluid.

If on starting or at any moment the resistance of the device coupled to the piston is greater than the force necessary to compress the spring F, the piston B coupled to said device acts as an abutment by the partition B^3 . The action of the operator upon the lever D has the effect of compressing the spring F and moving with it the rod K— E^1 of the slide valve, and consequently the latter. The movement of the slide valve relatively to the piston brings these parts into the relative positions shown in Fig. 8 where the apertures e of the slide valve are situated opposite the apertures m^1 and O of the piston rod. The compressed air will thus be admitted through m^1 — e —O into the left hand space of the cylinder, the right hand space remaining in communication with the exhaust by way of P^1 , e^3 , e^4 , m^3 . From this moment onward the piston B will be moved to the right by the action of the compressed air, and it will carry with it the shaft A through the coupling G—H. The admission will cease immediately the movement of the piston relatively to the slide valve will have been such that the apertures O, m^1 are no longer in communication with the apertures e (position shown in Fig. 9).

The control lever may be let go in this position wherein the ports e , e^1 of the slide valve are covered only to a very slight extent by the solid portions of the sheaths B^1 and M ; there being no risk of any untimely return movement of the piston. As a matter of fact as soon as such a movement would tend to take place, communication would be restored between the apertures O and m^1 of the piston rod and the apertures e of the slide valve, and a fresh inflow of compressed air would return the piston into the position shown in Fig. 9.

Besides, notwithstanding the small extent of covering of the ports e , e^1 in this position of equilibrium, the chances of a leakage of the air confined in the left hand space of the cylinder are greatly diminished owing to the arrangement of the slide valve between two sheaths concentric to the piston rod. This air in order to escape is compelled to undergo a double wire-drawing, namely, a first wire-drawing between the sheath B^1 of the piston rod and the slide valve E in order to pass from P to e^1 , and a second wire-drawing between the slide valve and the sheath M in order to pass out of e^1 , as indicated by the arrows.

This is one of the subsidiary advantages of the arrangement of the slide valve E between an enveloping sheath B^1 formed by the distributing piston rod and an axial sheath M constituting an admission duct, the exhaust taking place likewise axially. This manner of construction is the result of the arrangement of springs F , F^1 around the rod E^1 of the slide valve between stops J , K formed on this rod and a partition B^2 formed in the tubular piston rod B^1 . The grouping of the slide valve, piston rod and springs around the axis of the auxiliary engine affords a very great sensibility of the apparatus and a very compact arrangement, while as shown, it reduces the chances of leakage.

It is to be noted that in case the supply of compressed air or other motive fluid should happen to stop, the shaft A can still be actuated by hand. According to the direction of the actuation the spring F or the spring F^1 will be compressed. In the first case the butting of the fork J against the partition B^2 would cause the piston rod B^1 to be moved along. In the second case the shoulder K^2 by butting against the said partition would effect the said movement. In both cases that end of the cylinder toward which the piston should move is placed in communication with the exhaust.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In control mechanism for an auxiliary engine, the combination of a cylinder and a

piston movable therein by fluid-pressure, said cylinder being provided with supply and exhaust ports for the admission and discharge of the fluid-pressure, an element to be actuated connected with the piston, a valve controlling the supply and exhaust ports of the cylinder and movable with or relatively to the piston, the opening of the ports being unaffected by approximately co-extensive movements of the valve and piston and modified by relative movements of said elements, and a controlling lever having a direct connection with the valve and a limited yielding connection with the piston so that movement of said lever will impart approximately coextensive movements to the piston and valve within the limits of the yielding connection without affecting the opening of the ports until the resistance of the element to be actuated overcomes the yielding connection with resulting relative movements of the piston and valve and a consequent modification of the opening of the ports to admit fluid-pressure to the cylinder to move the piston and the element to be actuated connected to said piston.

2. In control mechanism for an auxiliary engine, the combination of a cylinder and a piston movable therein by fluid-pressure, said cylinder being provided with supply and exhaust ports for the admission and discharge of the fluid-pressure, an element to be actuated connected with the piston, a valve controlling the supply and exhaust ports of the cylinder and movable with or relatively to the piston, the opening of the ports being unaffected by approximately coextensive movements of the valve and piston and modified by relative movements of said elements, a controlling lever having a direct connection with the valve and a limited slip-joint connection with the piston, and a spring interposed in the connection between the lever and the piston to extend the slip-joint, movement of said lever operating to move the valve and the piston approximately co-extensively without affecting the opening of the ports until the resistance of the element to be actuated compresses the spring with resulting relative movements of the piston and valve and a consequent modification of the opening of the ports to admit fluid-pressure to the cylinder to move the piston and the element to be actuated connected with said piston.

3. In control mechanism for an auxiliary engine, the combination of a cylinder and a piston movable therein by fluid-pressure, a tubular rod attached to the piston and communicating with a source of fluid-pressure and provided with supply and exhaust ports opening into the cylinder, an element to be actuated connected with the piston-rod, a valve in the piston-rod controlling said ports, said valve being movable with or rela-

tively to the piston-rod, the opening of the ports being unaffected by approximately co-extensive movements of the valve and piston-rod and modified by relative movements of said elements, a stem for said valve extending through the tubular piston-rod and having a limited slip-joint connection with the same, a spring interposed between the valve-stem and piston-rod to extend the slip-joint, and a controlling lever connected with the valve-stem so that movement of said lever will impart approximately coextensive movements to the piston-rod and valve until the resistance of the element to be actuated compresses the spring with resulting relative movements of the piston-rod and valve and a consequent modification of the opening of the ports to admit fluid-pressure to the cylinder to move the piston and the element to be actuated connected to the piston-rod.

4. In control mechanism for an auxiliary engine, the combination of a cylinder and a piston movable therein by fluid-pressure, a tubular rod attached to the piston and provided with supply and exhaust ports opening into the cylinder and having supply and exhaust passages leading to and from said ports, an element to be actuated connected with the piston-rod, a valve in the piston-rod controlling said ports, said valve being movable with or relatively to the piston-rod, the opening of the ports being unaffected by approximately coextensive movement of the valve and piston-rod and modified by relative movements of said elements, a stem for said valve extending through an abutment across the tubular piston-rod and having stops on opposite sides of said abutment, springs interposed between said abutment and the stops normally operating to hold the valve-stem relatively to the piston-rod to position the valve to close the supply ports, and a controlling lever connected with the valve-stem so that movement of said lever will impart approximately coextensive movements of the piston-rod and valve until the resistance of the element to be actuated compresses one or the other of the springs with resulting relative movements of the piston-rod and valve-stem and a consequent movement of the valve to modify the port openings to admit fluid-pressure to one side or the other of the cylinder to move the piston and the element to be actuated connected to the piston-rod.

5. In control mechanism for an auxiliary engine, the combination of a cylinder and a piston movable therein by fluid-pressure, said cylinder having opposite heads with tubular extensions, a tubular rod attached to the piston and guided in the tubular extensions of the cylinder heads, the tubular piston-rod having supply and exhaust ports opening into the cylinder and pro-

vided with conduits leading to the supply ports and from the exhaust ports, an element to be actuated connected with the piston-rod, a valve in the piston-rod controlling said ports, said valve being movable with or relatively to the piston-rod, the opening of the ports being unaffected by approximately coextensive movements of the valve and piston-rod and modified by relative movements of said elements, a stem for said valve extending through the tubular piston-rod and having a limited slip-joint connection with the same, a spring interposed between stops on the valve-stem and piston-rod to extend normally the slip-joint connection, and a controlling lever connected with the valve-stem so that movement of said lever will impart approximately coextensive movements to the piston-rod and valve until the resistance of the element to be actuated compresses the spring with resulting relative movements of the piston-rod and valve and a consequent modification of the opening of the ports to admit fluid-pressure to the cylinder to move the piston and the element to be actuated connected to the piston-rod.

6. In control mechanism for an auxiliary engine, the combination of a cylinder and a piston movable therein by fluid-pressure, said cylinder having opposite heads with tubular extensions, a tubular rod attached to the piston and guided in the tubular extension of the cylinder heads, the tubular piston-rod having supply and exhaust ports opening into the cylinder and provided with an exhaust passage leading from the exhaust ports, a casing fixed in the tubular extension of the rear cylinder head and provided with a supply duct, a tubular element fixed in the piston-rod in axial alinement with the same and slidable in the fixed casing, said tubular element forming a conduit for the fluid-pressure from the supply duct in said fixed casing to the supply ports in the piston-rod to the cylinder, a valve in the piston-rod controlling the supply and exhaust ports to the cylinder, said valve being movable with or relatively to the piston-rod, the opening of the ports being unaffected by approximately coextensive movements of the valve and piston rod and modified by relative movements of said elements, a stem for said valve extending through the forward part of the tubular piston-rod and having a limited slip-joint connection with the same, a spring interposed between stops on the valve-stem and piston-rod to extend normally the slip-joint connection, and a controlling lever connected with the valve-stem so that movement of said lever will impart approximately coextensive movements to the piston-rod and valve until the resistance of the element to be actuated compresses the spring

with resulting relative movement of the piston-rod and valve and a consequent modification of the opening of the ports to admit fluid-pressure to the cylinder to move the
5 piston and the element to be actuated connected to the piston-rod.

Dated this 30th day of January, 1920.

In testimony whereof I have signed this specification.

JEAN JULES MARIE ANTOINE EUGÈNE SCHNEIDER.

Witnesses:

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