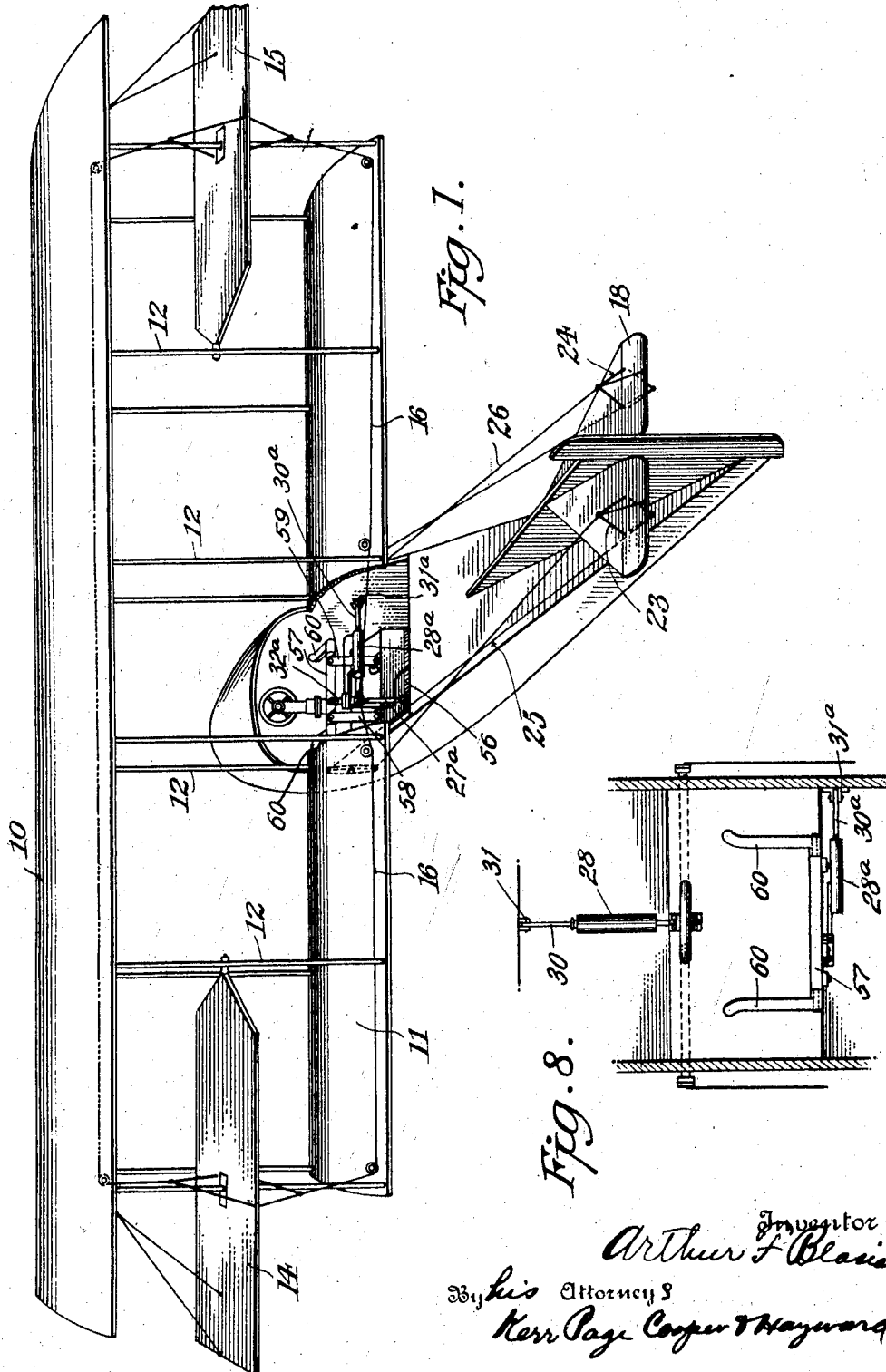


A. F. BLASIAR.
CONTROL FOR AERIAL MACHINES.
APPLICATION FILED APR. 7, 1916.

1,385,658.

Patented July 26, 1921.
3 SHEETS—SHEET 1.



Inventor
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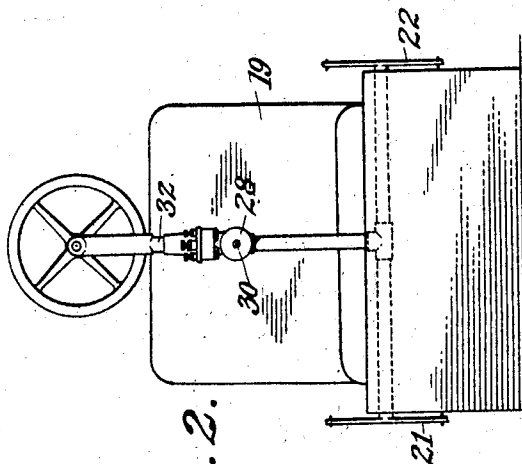


Fig. 2.

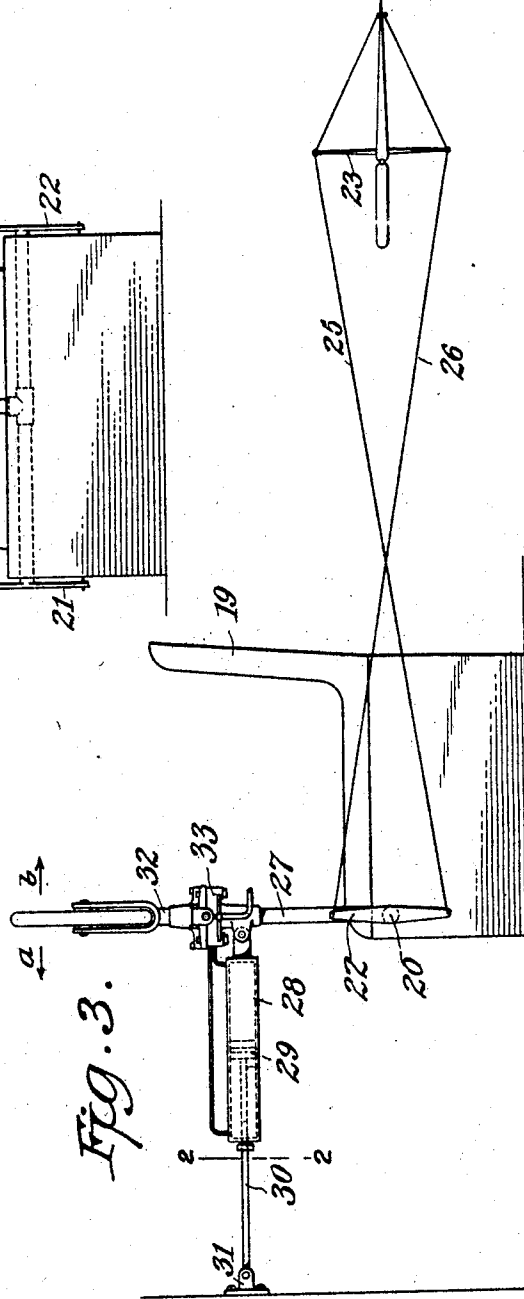


Fig. 3.

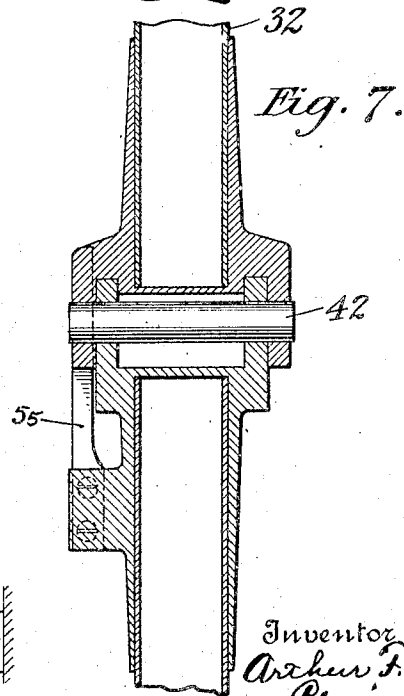
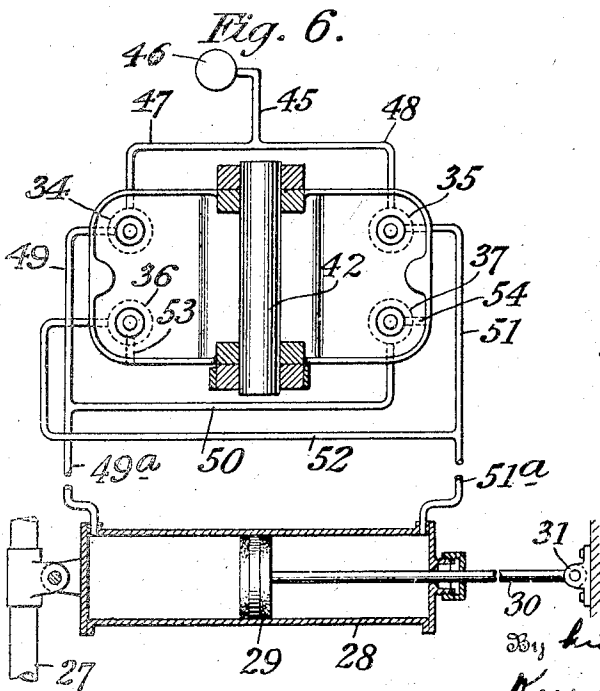
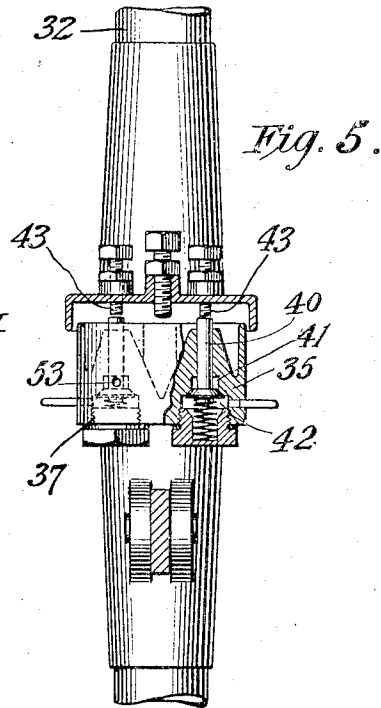
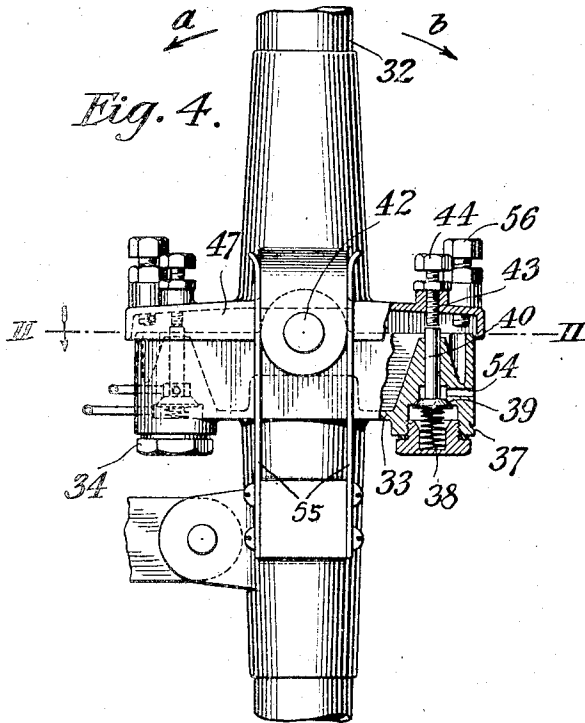
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

ARTHUR F. BLASIAK, OF GUILFORD, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS,
OF FORTY-NINE PER CENT. TO WILLIAM BOHLEBER, OF NEW YORK, N. Y.

CONTROL FOR AERIAL MACHINES.

1,385,658.

Specification of Letters Patent. Patented July 26, 1921.

Application filed April 7, 1916. Serial No. 89,517.

To all whom it may concern:

Be it known that I, ARTHUR F. BLASIAK, a citizen of the United States, residing at Guilford, county of Chenango, and State of New York, have invented certain new and useful Improvements in Controls for Aerial Machines, of which the following is a full, clear, and exact description.

The invention which constitutes the subject matter of this application relates to an intermediary control particularly and preferably adapted for use in connection with aerial machines.

It has been customary heretofore to connect the control cables of aeroplanes, etc., directly to hand operated levers located within reach of and adapted to be directly operated by the aviator. It is very obvious that the direct operation of a flying machine becomes more and more difficult in proportion to the size of the same, and it is quite apparent that there is a limit to the size of the machine which an aviator can directly operate in this fashion. My invention therefore, while particularly applicable to the heavier type machines, is not limited in its use thereto, as it may be used to equal advantage with present machines rendering them easier to manipulate and control, and relieves the pilot of nervous and physical fatigue due to handling the present make of controls, particularly in long flights. The invention is designed for operating an aerial machine at any desired angle relative to the horizontal and for steering, and is capable of being readily installed to operate any and all controls, viz. rudder, elevator, ailerons, etc. Furthermore, the invention is capable of installation upon all makes and types of aerial machines, whether monoplane, biplane, flying boat, hydro-tractor biplane, etc.

Further objects and advantages will appear from the description below taken in connection with the accompanying drawings, in which—

Figure 1 is a perspective view of one type of machine illustrating the application of my invention thereto.

Fig. 2 is a front view of the control lever and control post taken on the line 2—2 of Fig. 3.

Fig. 3 is a side view of the intermediary

control showing, in this instance, its connection to the horizontal rudder at the rear of the aeroplane.

Fig. 4 is a view partly in section, looking from the front of the control lever and control post.

Fig. 5 is a side view of the same showing one of the inlet and one of the exhaust valves, the former being sectional.

Fig. 6 is a diagrammatic plan view of one form of pressure-fluid control system.

Fig. 7 illustrates the pivoted connection between the control arm and the control post showing in conjunction with Figs. 4 and 5 the preferred means for maintaining the control post and control lever in proper relative and normal positions.

Fig. 8 illustrates the application of my invention to effect the automatic control of the ailerons, or if a Wright type of machine, the control of the warping of the planes.

Referring to the drawing in detail the reference numerals 10 and 11 represent respectively the upper and lower planes of what is commonly known as a bi-plane flying machine, said planes being separated from each other by posts 12 and braced by suitable means not shown. The flying machine is provided with the usual ailerons 14 and 15 to which is connected the usual operating cord or cable 16. To the planes 10 and 11 of the embodiment illustrated there is connected a fuselage 17 which is provided with a horizontal or other form of rudder 18. The parts just described, aside from the combinations defined, constitute in themselves no part of my invention as they are parts of flying machines which are old and well known to those skilled in the art and so far as my invention is concerned these elements or any other elements for performing the same function may be used in conjunction with it.

The propulsion means together with its associated mechanism is not illustrated as any type desired may be employed with my invention.

Suitably and conveniently located upon the flying machine is a seat 19 for the aviator (see Fig. 3) and adjacent to this seat and preferably in front of the same is located the intermediary control mechanism which constitutes the subject matter of my

invention and which I will now proceed to describe.

Located near the seat 19 is a pivoted walking beam 20 provided with levers 21 and 22 on the ends thereof. In order to connect these levers with the king posts 23 and 24 of the rudder the control wires 25 and 26 are employed. Located between the ends of the pivoted walking beam 20 is an upwardly projecting control post 27 to which the pneumatic cylinder 28 is pivotally connected. This cylinder is provided with a piston 29 and a piston rod 30 the outer end of the latter being pivotally connected to some rigid part 31 of the machine. Supported upon the upper portion of the control post 27 is a valve mechanism actuated by the control lever 32, so as to admit fluid to and permit the same to exhaust from either side of the piston 29. It may then be briefly stated at this point that whenever it is desired to impart a given movement to any part of the steering mechanism, say the rudder 19, a corresponding movement of the control arm 32 will be required. The latter movement actuates the part controlled in proportion to or substantially in proportion to the extent of its own movement. That is to say a slight movement of the arm 32 will admit fluid pressure to one side of the piston 29 which in turn moves the post 27 about its axis 20 and therefore imparts a corresponding movement of the rudder through the levers 21 and 22, connections 25 and 26 and king posts 23 and 24.

Referring now to the control mechanism in detail the control post 27 is provided adjacent its upper end with a horizontal extension or web 33 which carries a plurality of inlet valves 34 and 35 and a plurality of exhaust valves 36 and 37. Each of these valves is provided with a valve proper 38 shaped to seat upon a conical or other seat 39 and a stem 40 extending without the casing. The valve proper divides the interior of the valve casing into two compartments or chambers 41 and 42, one above the valve proper and one below the same. The control arm 32 is provided with a base or web 43 having adjustable set-screws 44 which engage with the valve stems 40 and force the valves from their seats whenever the control arm 32 is rocked about its pivot 42. The main supply pipe 45 which connects with the pressure tank 46 is provided with two branches 47 and 48 which connect to the lower chambers in the valve casings 34 and 35 respectively. To the upper chamber of valve 34 is connected the pipe 49 which leads to one end of the cylinder 28. This pipe 49 is in turn provided with a branch pipe 50 which leads to the normally closed exhaust valve 37. Similarly connected to the upper chamber of valve 35 is a pipe 51 which leads to the other end of the cylinder 28 and which

is provided with a branch pipe 52 leading to the normally closed exhaust valve 36. The valve casings 36 and 37 are respectively provided with exhaust ports 53 and 54. It will be apparent that the portions 49^a and 51^a of pipes 49 and 51 serve as both inlets to and exhausts from the cylinder 28.

The operation is substantially as follows: Suppose the control arm 32 is moved to the left as indicated by the arrow *a* in Figs. 3 and 4. The set screws 43 will then contact with the valve stems 40 of the inlet valve 34 and the exhaust valve 36 admitting fluid under pressure through pipes 49—49^a in front of the piston 29. It will be noted that the piston, in this instance, is fixed and that the cylinder 28 moves. This movement of the cylinder 28 imparts a rocking movement to the control post 27, the effect of which is to impart a proportional movement to the rudder or other steering mechanism. The movement of the control arm in the other direction, that is in the direction indicated by the arrow *b*, will, in similar manner, open the inlet valve 35 to and the exhaust valve from the cylinder 28, the inlet valve connecting the cylinder through the pipe 51—51^a and the exhaust connecting the cylinder through pipe 49^a, pipe 50 and exhaust port 54. This movement of the control arm, as will be understood, will move the control post 27 in the opposite direction.

Fig. 3, among others, shows the parts in normal position. The control arm 32 and control post 27 in effect move in both directions as one continuous lever the construction being such that the said arm and said post are always in substantially the same straight line. Of course there will be a very slight movement of the control arm about its pivot 42 but with a proper selection of valves and other associated mechanism this relative movement of the control arm and control post may be made almost negligible. If desired springs 55 preferably attached to the control post 27 and bearing against the arm 32 may be employed to properly balance the control arm. Set screws 56, carried by the web 43, are employed so as to adjust the amount of rocking movement of the control arm 32 about its pivot 42, and thereby control the amount of opening of the inlet and exhaust valves. This is accomplished by one of the set screws contacting with one side of the web 33 when moved in one direction and by the other set screw contacting with the opposite side of said web when moved in the opposite direction. If the parts be properly proportioned and constructed this will probably only happen when the control arm is suddenly moved through a substantial distance. This limited oscillatory movement of the control arm 32 about its pivot is quite important if for some unknown and unforeseen reason the intermediary control

should break down during flight as this would enable the pilot to control the machine in the ordinary way, the control arm in conjunction with the control post, in that case, serving as the ordinary control lever.

It will be very apparent from the foregoing discussion that the control arm will be just as easy to manipulate or to maintain in a given position regardless of the atmospheric disturbances. A gust of wind impinging against the rudder will of course have a tendency to move the control post in a certain direction but this movement of the control post automatically opens one of the inlet valves to admit pressure into the cylinder to resist this movement. The force therefore upon the control arm, in any event, will only be what is required to open one of the inlet valves and the corresponding exhaust valve.

The above description applies specifically to a control for the horizontal steering rudder 18. In Figs. 1 and 8, however, I show another application of the invention for controlling the ailerons 14 and 15. These ailerons are provided with king posts to which the cable or cables 16 are attached. For purposes of illustration the cable 16 is a continuous one and connects with both ailerons. The ends of this cable are each connected to a control post 27^a pivoted to a suitable base 56, and pivotally mounted upon the control post 27^a is a control arm 32^a, these parts being similar in construction and operation as the control post 27 and control arm 32 previously described. The control arm is pivotally connected to the link 57 which is parallel to the base 56 and the ends of which are pivotally connected to two upwardly projecting parallel arms 58 and 59. To these movable arms 57—58—59 are attached shoulder arms 60 and between these arms the aviator is normally sitting. When the aviator therefore desires to manipulate the ailerons it is only necessary to move his body to the right or left which imparts a corresponding movement to the control arm 32^a which brings the intermediary control into operation. This intermediary control may be connected up to the same air pressure supply tank as the intermediary control previously described. The control post is pivotally connected to the cylinder 28^a and the piston rod 30^a is suitably connected to some fixed part of the machine at 31^a.

The embodiments of my invention which I have above described in some detail are merely the preferred forms and arrangements thereof and from the teachings of the forms illustrated and described it will be obvious that the invention can be readily adapted by the ordinary mechanic to other steering means of an aerial machine. And it is, of course, to be understood that I do not limit myself to the exact construction

or constructions shown and described as many changes may be made and other embodiments and uses resorted to without necessarily deviating from the true spirit and scope of my invention.

What I claim is:

1. An intermediary control for flying machines comprising a control post, a control arm manually operated and pivotally mounted upon the control post, a fluid pressure mechanism connected to and adapted to actuate said control post, and means actuated by the control arm for admitting fluid to said pressure mechanism.

2. An intermediary control for flying machines comprising a fluid pressure actuating means, in combination with means connected to a part of the machine to be controlled and actuated by the said actuating means, and a manually movable means pivoted to said actuated means for controlling the flow of fluid to and the exhaust from said actuating means, said actuating means adapted to move substantially in synchronism with the movement of the manual means.

3. An intermediary control for flying machines comprising a fluid pressure actuating means, in combination with a control post operatively connected to a part of the machine to be controlled and actuated by said actuating means, valve mechanism carried by said control post, and a manually operated arm pivoted to said control post and adapted to actuate said valve mechanism to control the flow of fluid to and the exhaust from said actuating means.

4. An intermediary control for flying machines comprising a fluid pressure actuating means, in combination with a control post operatively connected to a part of the machine to be controlled and actuated by said actuating means, valve mechanism carried by said control post, and a manually operated arm pivoted to said control post and adapted to actuate said valve mechanism to control the flow of fluid to and the exhaust from said actuating means, said fluid pressure actuating means adapted to move substantially in synchronism with the movement of said manually operated control arm.

5. An intermediary control for aerial machines comprising a fluid pressure actuating means, in combination with a control post operatively connected to said actuating means and to an element of the machine to be controlled, a control arm pivotally connected to the control post, and means actuated by the control arm upon movement of the control post to admit a flow of fluid to and exhaust from said pressure actuating means to resist the movement of the element to be controlled.

6. An intermediary control for aerial machines comprising a fluid pressure actuating means, in combination with a control post

actuated by said pressure actuating means, said control post operatively connected to an element of the machine to be controlled, and provided with valve mechanism thereon to permit the flow of fluid to and exhaust of fluid from said pressure actuating means, a manually operated control arm, and means on said control arm to actuate said valve mechanism upon the movement of the control post to resist the movement of the element to be controlled.

7. A control for flying machines comprising a motor power actuating means in combination with means connected to a part of the machine to be controlled and adapted to be actuated by the actuating means, manually movable means carried by said actuated means for controlling the motor power actuating means, and means on said manual means for operating said actuated means upon the failure of operation of the motor power means.

8. A control for flying machines comprising means connected to a part of the machine to be controlled, in combination with a servo-motor, and means carried by the aforesaid means adapted to actuate the latter directly or adapted to actuate the same indirectly through the instrumentality of said servo-motor.

9. A control for flying machines comprising means connected to a part of the machine to be controlled, a servo-motor, in combination with actuating mechanism carried by and having pivotal movement with respect to said means, and means actuated by the movement of said mechanism about its pivot for controlling the servo-motor.

10. A control for flying machines comprising a pivotally mounted control post connected to a part of the machine to be controlled, a servo-motor for actuating the control post, and an actuating means carried by the control post and movable therewith and relative thereto for controlling the servo-motor.

11. In a control for flying machines, a movable cylinder connected to a part of the machine to be controlled, a piston and a piston rod for said cylinder fixed relative to said machine, and means for admitting fluid under pressure to and for exhausting fluid from the opposite sides of said piston comprising valve mechanism containing a plurality of inlet and outlet ports, valves for said ports, and means for actuating said valves to move said cylinder, the movement of said cylinder being proportional to the movement of said actuating means.

12. A flying machine, in combination with an intermediary control comprising motor controlling mechanism adapted to be operated to actuate a part of the machine to be controlled, manual means carried by said controlling mechanism to operate the same,

said means also adapted to actuate said part manually upon the failure of the controlling mechanism.

13. A control for flying machines comprising a motor actuating means, in combination with means connected to a part of the machine to be controlled and adapted to be actuated by the said actuating means and manually movable means carried by the second mentioned means and adapted to control the actuating means so that said part will be motor actuated and adapted to actuate said part manually at the will of the pilot.

14. A control for flying machines, comprising a pivotally mounted control post connected to a part of the machine to be controlled, a servo-motor for actuating the control post and an actuating arm pivotally connected to the control post and movable relative thereto for controlling the servo-motor and for directly actuating said control post.

15. A control for flying machines, comprising a control post connected to a part of the machine to be controlled, a servo-motor for actuating said control post in opposite directions, and a control arm secured to the control post and movable in the same directions for controlling the servo-motor and for directly actuating the control post.

16. A flying machine, in combination with an intermediary control for the same comprising a control post, fluid pressure actuated means connected to said control post for moving the latter in opposite directions, a manually operated control arm movable in the same directions and adapted to control said fluid pressure actuated means, and also adapted to directly actuate said control post.

17. A flying machine, in combination with an intermediary control for the same, comprising a pivotally mounted control post, fluid pressure actuated means connected to said control post for moving the latter in opposite directions about its pivot, a pivotally mounted and manually operated control arm movable in the same directions and in its movements adapted to control said fluid pressure actuated means and also adapted to directly actuate said control post.

18. A flying machine, in combination with an intermediary control for the same, comprising a pivotally mounted control post, a servo-motor connected to said control post to actuate the same, and a control arm mounted upon said control post and movable in the plane of movement of said control post to control said servo-motor or to directly actuate said control post.

19. An intermediary control for flying machines comprising a control post, a manually operated control arm carried by the control post, a fluid pressure mechanism con-

connected to and adapted to actuate said control post, and means actuated by the control arm for admitting fluid to said pressure mechanism.

5 20. An intermediary control for flying machines comprising a control post, a manually operated control arm carried by and having a relative movement with respect to the control post, a fluid pressure mechanism
10 connected to and adapted to actuate said control post and means actuated by the relative movement of the control arm for admitting fluid to said pressure mechanism.

15 21. A flying machine comprising a control post connected to a part of the machine to be controlled, and a fluid pressure actuated means operatively connected to said control post, in combination with manually operated means a single movement of which is adapted
20 to actuate said control manually or adapted to actuate the same through the instrumentality of said fluid pressure actuated means.

25 22. An intermediary control for flying machines comprising an actuated means connected to a part of the machine to be controlled, manually movable means carried by and adapted to actuate the actuated means,
30 and a fluid pressure actuating means responsive solely to the movement of said manually movable means connected to and also adapted to operate said actuated means.

35 23. An intermediary control for flying machines comprising a pivotally mounted control post connected to a part of the machine

to be controlled, manually and relatively movable means carried by and adapted to actuate said control post, and a fluid pressure actuating means responsive solely to the movement of said manually movable means
40 connected to and also adapted to operate said actuated means.

24. A control system for flying machines comprising in combination, a control member, a steering plane, a servo-motor connected
45 to said plane to operate the same, a manually operable element carried by and connected to said member for directly operating the latter through a lost motion connection, means whereby manual movement of
50 said element, to an extent less than that required to take up said lost motion, controls the operation of said plane by said servo-motor, and means for operating said plane directly on further manual movement of
55 said element.

25. A control system for flying machines comprising in combination, a pivotally mounted control rod, a handle carried by said rod and connected thereto by means of
60 a lost motion connection, a steering plane, a servo-motor, means for causing said servo-motor to actuate said steering plane on predetermined movement of said handle, and means for actuating said steering plane di-
65 rectly on further manual movement of said handle.

In testimony whereof I affix my signature.

ARTHUR F. BLASIAR.