June 3, 1924. 1,496,324

H. M. ROCKWELL

SYNCHRONIZER

Original Filed June 11, 1918 2 Sheets-Sheet 1

Fig. 1

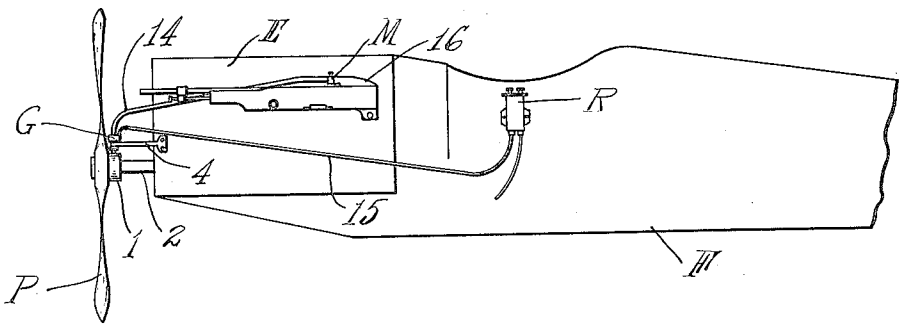


Fig. 2

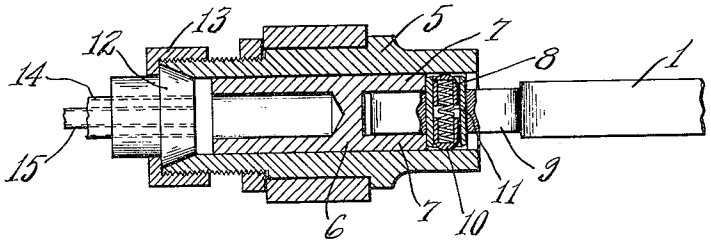


Fig. 3

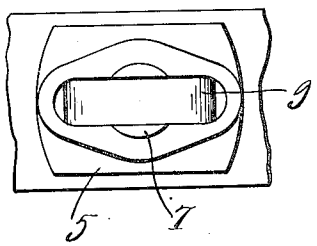
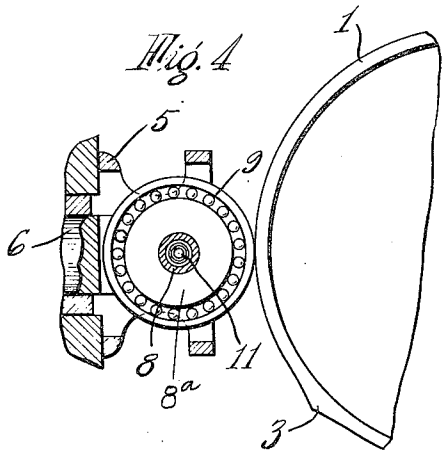


Fig. 4



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Original Filed June 11, 1918 2 Sheets-Sheet 2

Fig. 5

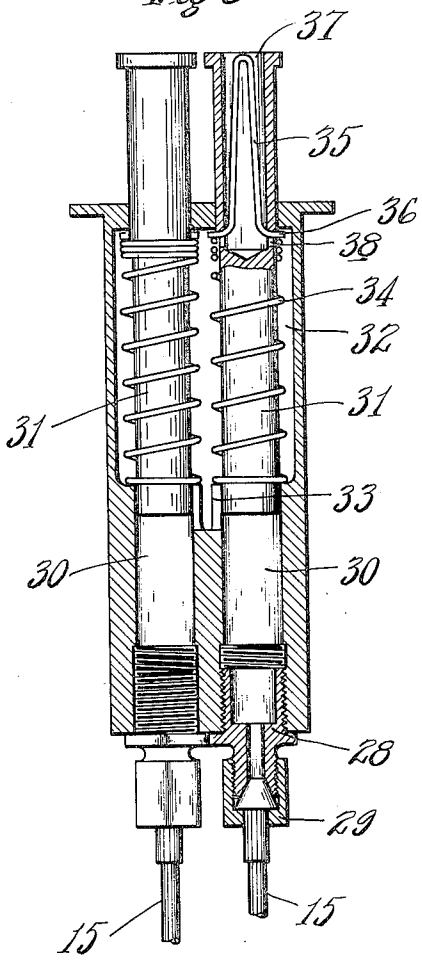


Fig. 6

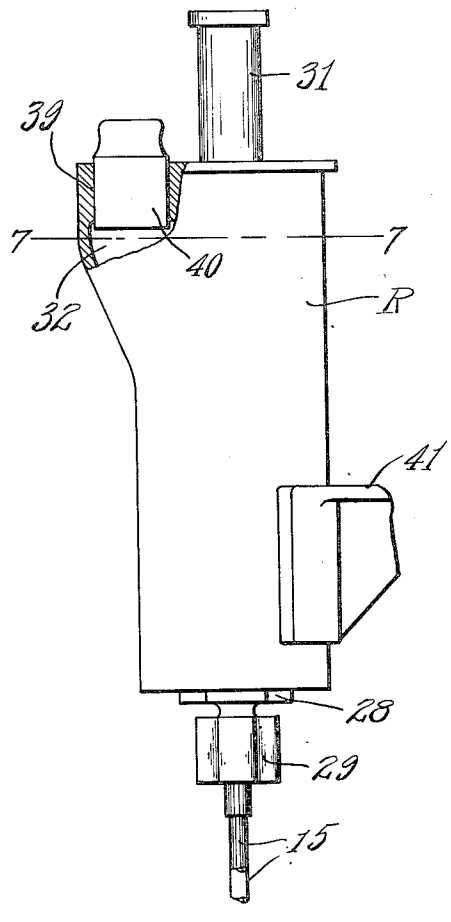


Fig. 7

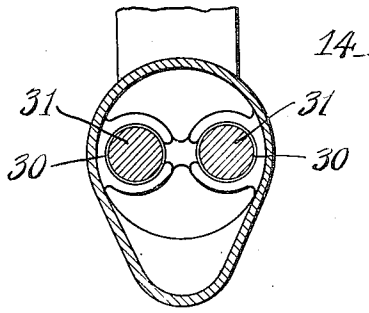
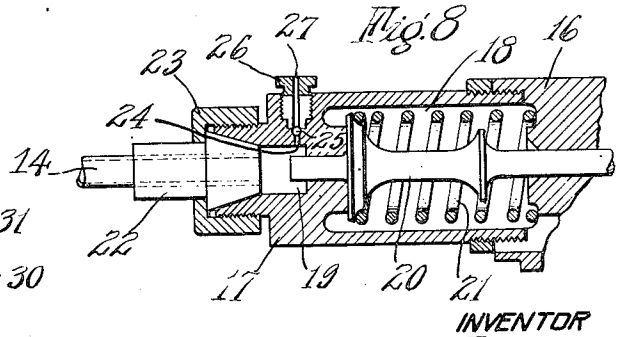


Fig. 8



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UNITED STATES PATENT OFFICE.

HUGH M. ROCKWELL, OF BRISTOL, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE MARLIN FIREARMS CORPORATION, OF NEW HAVEN, CONNECTICUT, A CORPORATION OF DELAWARE.

SYNCHRONIZER.

Original application filed June 11, 1918, Serial No. 239,414. Divided and this application filed October 3, 1919. Serial No. 328,162.

To all whom it may concern:

Be it known that I, HUGH M. ROCKWELL, a citizen of the United States, and a resident of Bristol, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Synchronizers, of which the following is a specification.

This invention relates to control devices and has for its object to synchronize the operation of a plurality of movable members.

This object is attained by providing a generator comprising a housing in which is reciprocatively mounted a piston. The cylinder of this piston communicates with a chamber from which lead two tubes or pipes. One of these pipes leads to a motor which comprises a housing having a chamber into which said pipe leads, and a cylinder in which is mounted a piston. The other pipe leads to a reservoir or tank provided with a pump. The generator piston is adapted to contact with a cam member suitably operated while the motor piston contacts with an element to be vibrated. A suitable fluid is introduced into the said reservoir and is pumped from it into the said tubes, chambers and cylinders, and put under pressure. A movement of the generator piston is transmitted through the fluid column to the motor piston, thereby causing the two to move in unison. The transmission of impulses through the system is controlled by varying the amount of fluid introduced into the system.

A specific embodiment of my invention is disclosed in the accompanying drawings, wherein

Fig. 1 is a diagrammatic view of the fuselage of an airplane with an automatic gun mounted thereon and my synchronizer applied thereto;

Fig. 2 is a longitudinal section through the generator;

Fig. 3 is an end elevation, partially broken away, of the generator;

Fig. 4 is a fragmentary sectional view thereof;

Fig. 5 is a vertical section of the reservoir;

Fig. 6 is an elevation of the same partially broken away;

Fig. 7 is a section on the line 7—7 of Fig. 6;

Fig. 8 is a longitudinal section through the motor.

In Fig. 1, P is the propeller of an airplane, E, the engine, and F, the fuselage. A rotary cam-carrying member 1 is shown as mounted on the propeller shaft 2, although it may be carried upon a separate shaft driven from the propeller shaft. One or more cams or projections 3, suitably spaced, are provided on the member 1. Carried by a suitable bracket 4 and arranged adjacent the member 1 is a generator G comprising a housing or cylinder 5, in which is reciprocatively mounted a piston 6, forked at one end to provide arms or the like 7. Extending between the arms 7 is a hollow pin or bushing 8 carrying the disk 8^a upon which is mounted by means of antifriction balls the wheel 9 adapted to contact with the rotary member 1. In the bushing 8 is located a friction member comprising two caps 10 with the spring 11 interposed therebetween. The spring is of proper size and strength to sufficiently force the outer ends of the caps into contact with the cylinder to maintain the piston in position against vibration but not sufficiently to prevent the reciprocation thereof necessary to the proper functioning of the generator. The end of the housing or cylinder 5 adjacent the wheel 9 is enlarged and recessed to receive the major portion of the wheel and serves to maintain the wheel and piston against turning, thus always presenting the wheel 9 in proper position relative to the cam-carrying member 1. The rear end of the cylinder 5 is closed by a plug 12 held in place by the cap 13.

Extending through the plug 12 and communicating with the interior of the cylinder 5 are a large and a small pipe or tube 14 and 15 respectively. The larger tube 14 is arranged approximately centrally of the plug 12 and extends to the trigger motor M attached to or carried by the lock container 16 of the gun. The trigger motor comprises a housing 17, having a bore 18 therein, communicating with a chamber 19. In the bore 18 is reciprocatively mounted one end of the trigger motor piston 20, the other end

of which extends into the lock container. A spring 21 normally holds the piston in the position shown in Fig. 8. The tube 14 carries at its end a plug 22 which closes the chamber 19 and is held in place by the cap 23. A vent is provided for the chamber 19 and consists of an aperture 24, the upper end of which is concaved to provide a seat for the ball 25. Coacting with the ball is the split screw plug 26 through which extends a hole 27, the inner end of which is recessed to fit the ball 25.

The smaller tube 15 leads to the reservoir R, and is attached to the bottom thereof by any suitable means, such as a plug 28 and cap 29. The reservoir is provided with a bore or cylinder 30 into which the piston or plunger 31 may be inserted. In Fig. 5 two of these cylinders and plungers are disclosed, each of which is adapted to operate a different synchronizer. The reservoir may be provided with as many cylinders and plungers as are desirable. A chamber 32 communicates with each of the cylinders through a slot 33 in the wall of each cylinder near the top thereof. Interposed between the top of each cylinder and a suitable stop or abutment on the plunger is a spring 34 adapted to keep the piston raised. The abutment or stop in this case is formed by a piece of spring wire 35 bent into a general V shape with the extremities 36 thereof turned outwardly, and inserted into the hollow upper portion 37 of the plunger with the extremities 36 extending through suitable apertures 38 to engage the upper end of the spring 34. This arrangement also provides a stop to limit the upward movement of the plunger. A filling opening 39, of a size to allow the introduction therethrough of the spring 34, and a tool to position said spring in alinement with the plunger 31 is closed by a stopper 40. The bracket 41 serves to support the reservoir.

In the operation of this system any suitable non-compressible fluid may be used and I do not intend to limit myself to the use of any particular fluid. I have found, though, that a medium oil is very satisfactory, especially for airplane work where very low temperatures are encountered.

To remove air and completely fill the synchronizer with liquid, the vent in the trigger motor is opened and oil pumped from the reservoir by the pump until it flows out of the vent. With the pump plunger 31 still down, the vent is closed. A release of the pump plunger will allow oil to flow through the slot 33 into the cylinder, filling it. When the piston is again forced down, enough more liquid is forced into the synchronizer to force the wheel into contact with the cam-carrying member and to put all the oil under pressure. The cam 3 on the member 1 when it contacts with the wheel 9 forces in the piston 6. The movement of the piston generates an impulse which is transmitted through the column of liquid to the trigger motor where it operates the trigger motor piston 20 against the action of its spring. As soon as the cam 3 passes the wheel 9 the pressure is released. The spring 21 then forces the trigger motor piston back and with it the column of oil, which in turn moves the wheel again into contact with the cam-carrying member. Thus at each movement of the generator piston 6 a like movement is induced in the trigger motor piston 20. If the plunger 31 be released, the pressure on the system is relieved. The effect of a movement of the generator piston is now to force back a slight amount of oil into the reservoir instead of moving the trigger motor piston 20. When this is done, there is nothing to return the wheel 9 into contact with the member 1 and so no impulses are generated.

The pump plungers are compactly arranged so as to bring the adjacent portions of the rims thereof into close relationship. Thus, when it is desired to operate a plurality of guns, it is possible to force down all of the plungers with one hand, or if desired to shoot but one gun, one plunger alone can be operated.

It is, of course, understood that the particular device shown and described in the present application illustrates merely a preferred form of construction and arrangement of parts, which, it has been found, will successfully carry out the principles of my invention, and that various changes and modifications of detail may easily be made without departing from the spirit of my invention as defined in the appended claims.

This application is a division of my copending application, Serial No. 239,414, filed June 11, 1918.

What I claim is:

1. In a synchronizer, means for generating impulses, means operated by impulses, means for transmitting impulses from said first-named means to said second-named means, and means for rendering said impulse transmitting means operative or inoperative at will.

2. In a synchronizer, a generator including a piston, a motor having a piston, means to cause said pistons to move in unison, and means to render said last-named means operative and inoperative at will.

3. In a synchronizer, a generator including a piston, a motor having a piston, means including a column of liquid to cause said pistons to move in unison, and means to render said last-named means operative and inoperative at will.

4. In a synchronizer, a generator including a piston, a motor having a piston, means including a column of liquid to cause said

pistons to move in unison, and means to render said liquid column ineffective for transmitting impulses.

5. In a synchronizer, a generator having a movable member, a motor having a movable member, a connecting member between said generator and motor, means in the connecting member to transmit movement of one of said movable members to the other, and means to render said transmitting means operative or inoperative.

6. In a synchronizer, two units, a movable member in each unit, a tube extending from one unit to the other, a liquid in said tube to transmit movement of one member to the other when said liquid is under pressure, and means whereby said liquid is rendered effective or ineffective for transmitting movement.

7. In a synchronizer, a generator member including a movable element, a motor including a movable element, a tubular member connecting said generator and motor, a liquid in said tubular member whereby movement of one movable element is transmitted to the other movable element when said liquid is under pressure, a reservoir containing a supply of said liquid, a tubular connection between said reservoir and one of said members, and a plunger operable in said reservoir whereby the amount of liquid in said tubular member may be varied to render the liquid in said tubular member effective or ineffective for the transmission of movement.

8. In a synchronizer, a generator member including a movable element, a motor including a movable element, a tubular member connecting said generator and motor, a liquid in said tubular member whereby movement of one movable element is transmitted to the other movable element when said liquid is under pressure, a reservoir containing a supply of said fluid, a tubular connection between said reservoir and one of said members, a plunger operable in said reservoir whereby the amount of liquid in said tubular member may be varied to render the liquid in said tubular member effective or ineffective for the transmission of movement, and a valve in said tubular member.

9. In a hydraulic synchronizer, a vent comprising a socket having a recessed end, a tubular plug in said socket, said plug being recessed at its inner end, a passageway leading from said recessed end, and a member adapted to be enveloped by said recesses to close said vent.

10. In a hydraulic synchronizer, tubes adapted to contain liquid, a vent in communication with one of said tubes, means to close said vent, and means in connection with the other of said tubes to pump a liquid into said tubes.

11. In a synchronizer, a generator comprising a housing, a piston reciprocatively mounted therein, a roller carried by the exposed end of said piston, the end of said housing being recessed to nearly envelop said roller.

12. In a synchronizer, a generator comprising a cylinder, a piston reciprocating therein, and friction means carried by said piston and contacting with the wall of said cylinder.

13. In a synchronizer, a generator comprising a cylinder, a piston reciprocating therein, friction means carried by said piston and contacting with the wall of said cylinder, and friction means comprising a helical spring carrying heads at either end thereof.

14. A reservoir, comprising a casing, a plunger, the upper end of which is tubular, operating therein, an inverted U-shaped spring having its ends bent laterally contained in said tubular portion, the bent ends extending through apertures in the plunger, and contacting with said casing to prevent the withdrawal of said plunger therefrom.

15. A reservoir, comprising a casing, a plunger, the upper end of which is tubular, operating therein, an inverted U-shaped spring having its ends bent laterally contained in said tubular portion, the bent ends extending through apertures in the plunger, and a coiled spring surrounding said plunger, the adjacent end thereof contacting with said ends of the first-mentioned spring.

16. In combination, a housing, a movable member therein and friction means carried by said member, said means comprising a helical spring carrying headings at either end thereof to contact with said housing.

HUGH M. ROCKWELL.