

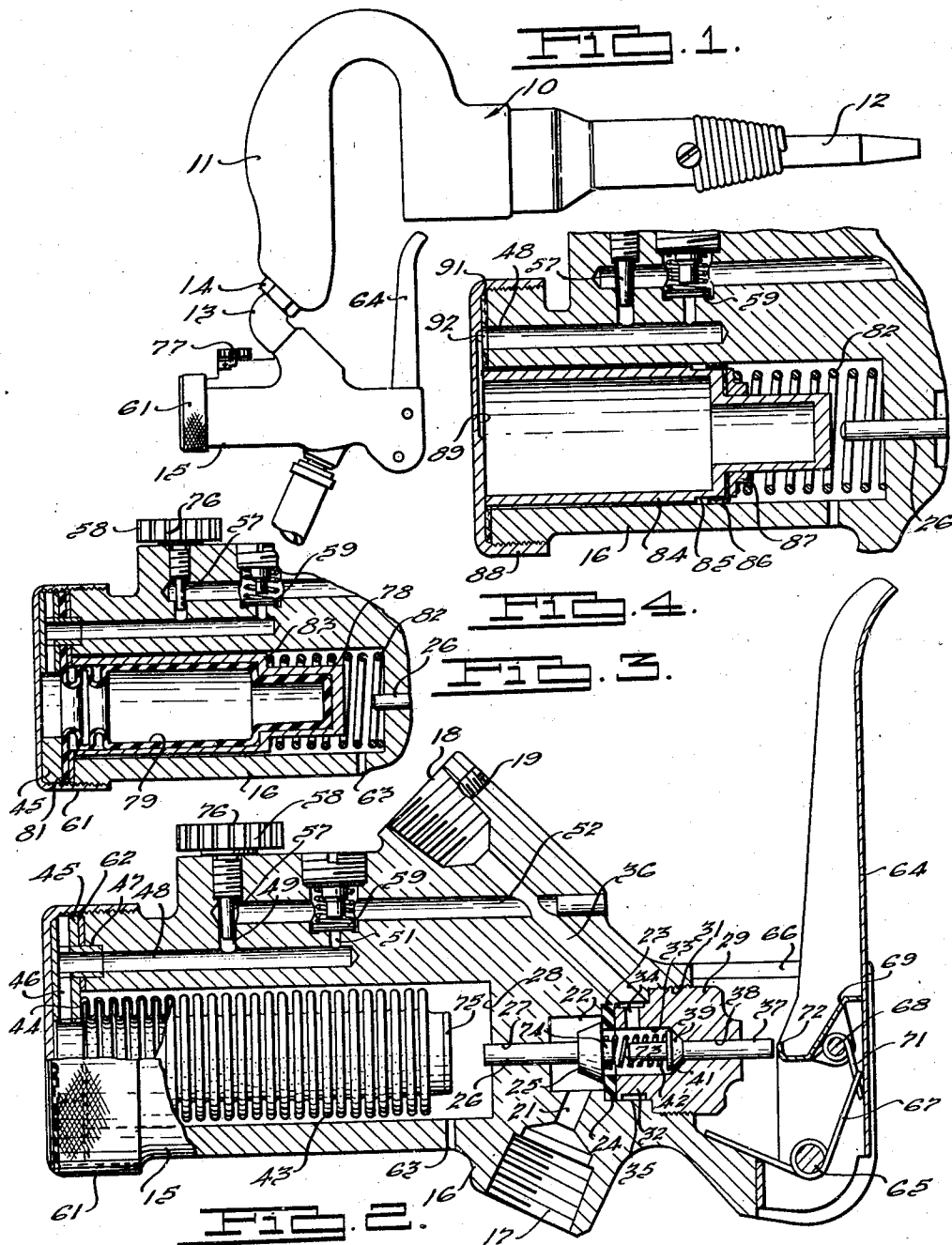
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A. H. HABERSTUMP ET AL
FLUID OPERATED TIMING DEVICE

2,397,103

Filed April 3, 1942

2 Sheets-Sheet 1



INVENTORS
Alfred H. Haberstump,
Lowell C. Freeman.
By
Harness, Dickey & Pierce,
ATTORNEYS.

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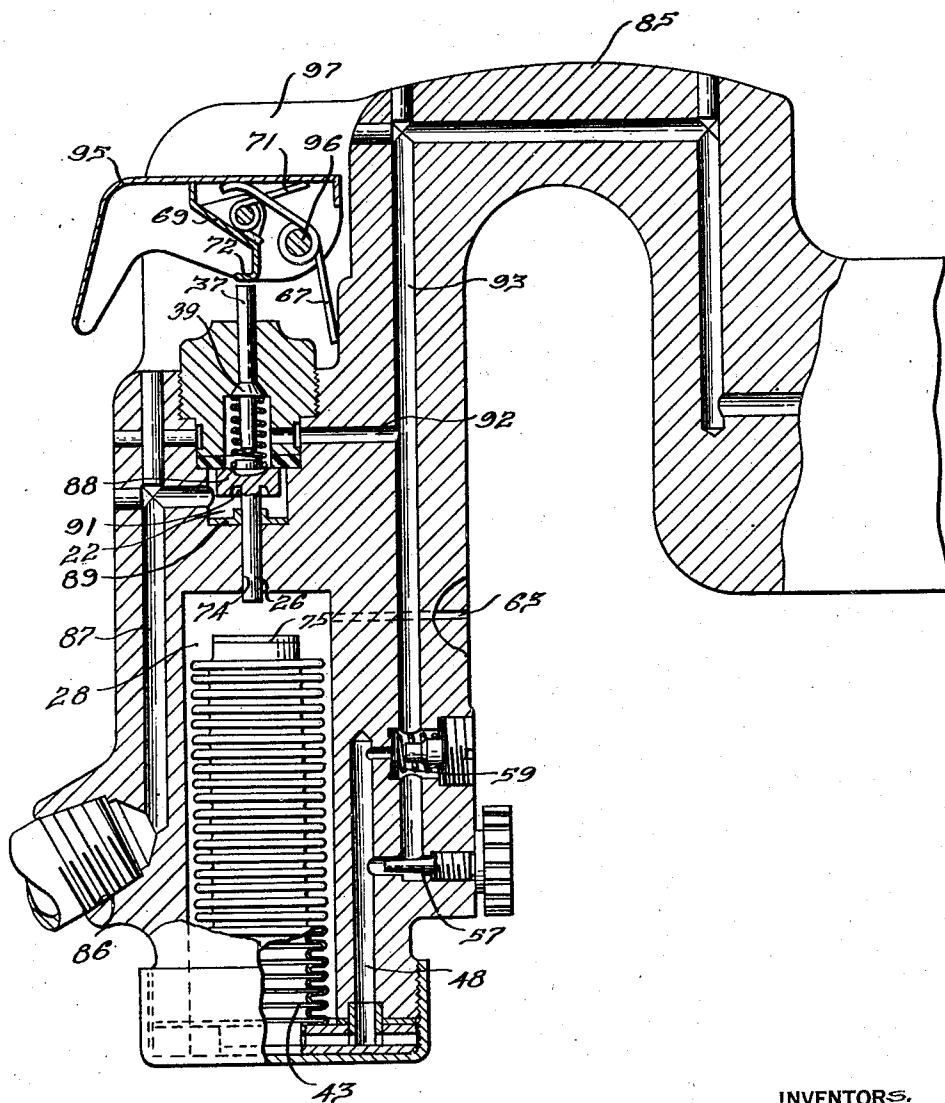
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FIG. 5.



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Lowell C. Freeman.
BY
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ATTORNEYS.

UNITED STATES PATENT OFFICE

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FLUID OPERATED TIMING DEVICE

Alfred H. Haberstump and Lowell C. Freeman,
 Detroit, Mich., assignors to The Murray Cor-
 poration of America, Detroit, Mich., a corpora-
 tion of Delaware

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18 Claims. (Cl. 137—139)

This invention relates to pneumatic timing devices, and particularly to a timing device operated by the fluid delivered to a riveting gun or similar mechanism for accurately controlling the time of its operation.

In the copending application of Alfred H. Haberstump et al., Serial No. 427,332, filed January 19, 1942, a timing device is illustrated for controlling the duration of operation of a riveting gun or similar mechanism. The timing device is operated by the fluid by which the gun is operated, and a control handle is provided which, after initiating the operation, is relieved of control for the duration of the operation cycle.

The present invention pertains to a similar device, one which is more compact and which requires less accuracy of manufacture of certain of the component parts. The timing device embodies a housing having a chamber in which a piston or similar element is disposed for axial movement. Material clearance is provided between the element and the wall of the chamber to eliminate the close tolerances and accuracy required between a bore and a piston when a sealed piston is employed. A Sylphon or metal bellows may be utilized as the moving element, or a hollow piston having a flexible tubular lining may be employed as a substitute for the bellows. A calibrated spring or the spring action of the Sylphon is employed for moving the element in one direction. In some instances a cup washer may be employed for engaging the wall of the chamber when a hollow piston is utilized to take the place of the rubber inner tube heretofore mentioned.

An operating valve is opened by the actuation of the control handle for admitting air through the timing device to the riveting gun, or other appliance, which is operated thereby. The air is also introduced through an adjustable valve into the hollow interior of the movable element where the pressure slowly builds up until such time as it is sufficient to overcome the spring tension resisting the movement of the element. The element is then advanced in the chamber to engage and move the operating valve toward closed position. Adjacent to closed position the air being admitted through the valve engages and quickly seals the valve against any further flow of air. A relief valve is connected by a by-pass around the adjustable valve to the interior of the element for relieving the pressure therewithin after the operation has been completed to permit the movement of the element to its initial position. It will be noted that the operation of the

device follows closely that of the device in the above mentioned copending application.

Accordingly, the main objects of the invention are: to provide a fluid operated timing valve with movable means having material clearance with the wall of the chamber in which it operates; to provide a timing device with a movable piston which is sealed to the fluid passage by a hollow flexible element; to employ a Sylphon as a movable element within a chamber of a fluid timing device and an adjustable valve by which air admitted to the Sylphon may be controlled to regulate the time required to build up a sufficient pressure to elongate the Sylphon; to provide a hollow piston within a chamber having a rubber tube therein which is extensible to permit the piston to advance within the chamber when sufficient air pressure has been built up therein; to provide a hollow element within a chamber of a timing device in which air may be collected to build up a pressure after a predetermined time interval sufficient to move the element against a spring of known calibration; and, in general, to provide a compact timing device which may be constructed within a mechanism or which may be an attachment secured thereto, which is positive in operation and economical of manufacture.

Other objects and features of novelty of my invention will be either specifically pointed out or will become apparent when referring, for a better understanding of my invention, to the following description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a view in elevation of a riveting gun and a fluid timing device embodying features of my invention;

Fig. 2 is an enlarged sectional view of the timing device illustrated in Fig. 1;

Fig. 3 is a broken view of structure similar to that illustrated in Fig. 1, showing a further form which our invention may assume;

Fig. 4 is a view similar to that illustrated in Fig. 3, showing a still further form of the invention; and

Fig. 5 is a view of a timing device similar to that illustrated in Fig. 2 built into the appliance which is actuated by the fluid pressure which operates the device.

In Fig. 1 a riveting gun 10 is illustrated, of conventional form, having a gripping handle 11 and a striking head 12. The handle 11 of the gun is provided with a passageway for air having a threaded opening in which an elbow 13 or similarly shaped conductor is threaded. A nut 14 locks the elbow in desired position on the gun

handle for supporting a timing device 15 which embodies the present invention.

Referring more particularly to Fig. 2, the timing device 15 embodies a casting 16 having a threaded inlet port 17 and a similar outlet port 18. The timing device is secured to the elbow 13 by the threaded port 18 locked in position by the set screw 19. The passageway 17 leads through an opening 21 into a chamber 22. The chamber is shouldered at 23 and supports a washer-like valve seat of rubber or similar flexible material 24. A valve 25 is held against the seat by the pressure admitted into the chamber 22 and is retained in aligned position by a pin 26 which extends through an opening 27 in the housing 16 into a chamber 28.

A cap 29 is threaded into an enlarged recess 31 in extension of the chamber 22 and shouldered portion 23. A projection 32 on the cap 29 engages the washer 24 and forces it in secured position against the shoulder. The extension 32 has a central recess 33 connected to a passageway 34 which communicates with an annular recess 35. The annular recess communicates with a passageway 36 which leads to the outlet opening 18 of the housing. An operating plunger 37 extends through an opening 38 in the cap 29 having a valve head 39 which is engageable with a valve seat 41 for sealing the pin 37 in the opening 38 against the passage of air therethrough. A spring 42 is disposed between the valve head 39 and the valve 25 for biasing them away from each other.

Within the chamber 28 a metal bellows or Sylphon 43 is mounted, having the endmost convolution 44 soldered or otherwise secured to a washer 45. The washer contains a passageway 46 which communicates with the interior of the Sylphon. The washer is provided with a tube 47 which joins the passageway 46 to a passageway 48 which communicates through the valve passageways 49 and 51 to the passageway 52 which joins with the supply passageway 36. A needle valve 57 extends within the passageway 49 and is provided with an adjusting knob 58 by which the flow of fluid to the passageway 49 is accurately controlled. A relief valve 59 is disposed between the passageway 51 and the passageway 52 for the purpose of relieving the pressure within the bellows when the flow of air is cut off from the passageways 52 and 36. A cap 61 is threaded on the end of the casting 16 for securing the washer 45 against a sealing gasket 62 on the end of the housing. An opening 63 is provided in the wall of the housing communicating with the chamber 28 for preventing any pressure from accumulating within the chamber which would restrict the movement of the bellows.

An operating handle 64 is secured by a pivot 65 within a slot 66 in the forward end of the housing as illustrated in Fig. 2. The handle is biased in a clockwise direction by a spring 67. The operating handle 64 is preferably made of a stamping of channel cross section having a pin 68 secured to the flanges thereof on which an actuating element 69 is pivoted. The element is biased in a clockwise direction by a spring 71 and has an actuating finger 72 which engages the end of the plunger 37 when the handle 64 is moved in a counterclockwise direction. The projecting end 73 of the plunger engages the projection 74 on the valve 25 and positively unseats the valve and permits the flow of air from the intake passage 17 to pass through the valve seat

24, passageway 36, to the riveting gun 10. The finger 72 on the actuating element 69 moves from the plunger 37 and permits the plunger to return to the position illustrated under the bias of the spring 42. It will be noted that once the handle is moved in a counterclockwise direction an amount sufficient to move the finger 72 from the end of the plunger 37, the further movement of the handle can in no way affect the completion of the riveting cycle.

For timing the operating cycle, air from the passageway 52 is bled through the needle valve 57 to the passageways 48 and 46 to the area within the bellows 43. The air will continue to accumulate within the bellows until a pressure is built up therein sufficient to cause it to extend. The extended movement of the bellows permits a wear plate 75 carried on its end to strike the pin 26 of the valve 25 and move the valve toward or to closed position. The air passing about the valve will usually engage and force the valve against the washer-like seat 24 to positively cut off the flow of air through the device and gun. The air pressure within the passageways 36 and 52 immediately drops and the pressure within the bellows and passageways 46 and 48 will open the relief valve 59 and exhaust the air therefrom and permit the bellows to collapse to its original position by the inherent spring tension therein.

By adjusting the knob 58 of the needle valve 57, the bleeding of the air through the valve is regulated to regulate the time required to accumulate sufficient pressure within the bellows to cause it to extend. Any time may be set for the operation of the device conforming to the time required by the gun or similar mechanism to perform an operation. Different sizes and lengths of rivets employed in the construction of airplane assemblies will require different time cycles for swaging the rivets. When a series of similar rivets is to be swaged by a riveting gun, the device is set for the particular time required for the swaging operation. The riveting operation is performed without the necessity of estimating the number of blows required to perform the operation, and the personal variable is therefore eliminated. The adjusting knob 58 is provided with a plurality of slots 76 which are numbered or otherwise marked for settings. A stop element 77 of spring material engages a selected slot and locks the knob against rotation.

Referring to Fig. 3, we have illustrated a further form of the invention, wherein the bellows 43 is eliminated and a hollow piston 78 substituted therefor. The piston may be made of plastic or other light material since clearance is provided between the outer surface of the plunger and the wall of the chamber 28. A tube 79, made of rubber or similar elastic material, is disposed within the hollow piston and provided with a flange 81 which is sealed to the end of the housing 16 by a washer 45 retained in position by the cap 61. A calibrated spring 82 is disposed within the chamber 28 bearing against a shoulder 83 on the end of the piston. The operation of the device is the same as that illustrated in Fig. 2, the air is admitted past the needle valve 57 within the flexible tube 79 where it accumulates until sufficient pressure is built up to operate the piston 78 against the tension of the spring 82. The end of the piston engages and moves the pin 26 for closing the valve 25. After the operation, the air within the tube 79 is exhausted through the relief valve 59.

permitting the spring 82 to return the piston 78 to its original position, that illustrated.

In Fig. 4 we have illustrated a further form which the invention may assume, that wherein a hollow piston 84 is provided, similar to the piston 78, with the exception that it has a shoulder 85 for receiving a cup washer 86 which is retained upon the piston by a washer 87 against which the spring 82 abuts. In place of the washer 45, a cap 88 is employed having a passageway 89 in the base which joins the passageway 48 and the interior of the piston 84. A sealing washer 91 seals the cap to the end of the housing 16, the washer being provided with an aperture 92 aligned with the passageway 48. When the riveting device or other mechanism is operated, air will bleed past the needle valve 57, pass through passageways 48, 92, and 89 to accumulate within the hollow interior of the piston 84. When sufficient time has elapsed to build up the necessary pressure, controlled by the adjustment of the needle valve 57, the piston will overcome the tension of the spring 82 and will move to advance the pin 26 which moves the valve 25 toward closed position.

After the flow of air is cut off by the valve 25, the air within the piston and passageways will be exhausted through the relief valve 59 and the tension of the spring 82 will move the piston to its initial position, that illustrated.

In Fig. 5 we have illustrated a handle 85 of a riveting gun or other mechanism which is to be operated by air under pressure. The time control mechanism is built into the handle which has been shaped somewhat similar to the housing 16 of the device illustrated in Fig. 2. Air is delivered through the threaded aperture 86 and a passageway 87 into the chamber 22. The pin 26 on a valve 88 is sealed relative to the passageway 74 and the chamber 28 by a shouldered washer 89. The washer prevents the escape of air from the chamber 22 when the valve 88 is opened into the chamber 28. The valve 88 is provided with a recess 91 which clears the shoulder of the sealing valve 89; otherwise the valve parts are the same as those illustrated in Fig. 2.

When the valve 88 is open, air is conducted from the passageways 92 and 93 to the operating chamber of the gun or other mechanism. Air is also passed in the opposite direction in the passageway 93 through the needle valve 57 and the passageway 48 into the interior of the metal bellows 43. The passageway 48 also communicates with the relief valve 59 through which the air in the bellows 43 is exhausted when the valve 88 is moved to closed position thereby. A thumb operated trigger 95 is pivoted on a pin 96 in a slot 97 in the upper part of the handle. The trigger carries the operating element 69 having the finger 72 which engages the projection 37 on the valve 39. The springs 67 and 71 bias the trigger 95 and elements 69 in a clockwise direction. It is to be understood that the modified form of constructions, illustrated in Figs. 3 and 4, may be built directly into mechanisms which are operated by air and are to be timed thereby the same as the structure of Fig. 2.

The timing device is compact and is positive in operation when accurately controlling the timing cycles. The variation which may occur due to friction and wear has been eliminated from the device. The wall of the piston is not depended upon to form a seal with the wall of the chamber in which the piston moves. Flexible means are employed which provides such

seal or renders such seal unnecessary. The seal may be a cup washer attached to one end of the piston or a flexible tube may be provided within the hollow piston. The piston and tube may form a single element such as a metal bellows or Sylphon, and in all of the devices shown the accumulation of air which may be accurately metered to build up a pressure over a predetermined period of time is employed for controlling the movement of the piston or element for moving the valve toward closed position.

We claim as our invention:

1. An air actuated timing device, a housing having a chamber, a valve for controlling the flow of air to the interior thereof, a rod extending within the chamber, a hollow element within the chamber having an end portion engageable with said rod for positively moving said valve to closed position, said valve being joined by a passageway with the hollow interior of said element which is directly moved by the pressure of air, and a regulating valve in said passageway for regulating the flow of air into said hollow interior.
2. An air actuated timing device, a housing having a chamber, a valve for controlling the flow of air to the interior thereof, a rod extending within the chamber, a hollow element within the chamber having an end portion engageable with said rod for positively moving said valve to closed position, said valve being joined by a passageway with the hollow interior of said element which is directly moved by the pressure of air, a regulating valve in said passageway for regulating the flow of air into said hollow interior, and a relief valve, said interior communicating through a by-pass about the control valve with said relief valve.
3. In an air actuated timing device, a housing having a chamber, a movable element within said chamber having a hollow interior, a control valve for controlling the flow of air to the interior of said element which is directly moved by the pressure of air, a rod extending in the chamber in position to be moved by said element for positively moving said valve to closed position, and a regulating valve for regulating the admission of air into the interior of said element for controlling the time required to build up sufficient pressure to move said element.
4. In an air actuated timing device, a housing having a chamber, a movable element within said chamber having a hollow interior, a control valve for controlling the flow of air to the interior of said element which is directly moved by the pressure of air, a rod extending in the chamber in position to be moved by said element for positively moving said valve to closed position, a regulating valve for regulating the admission of air into the interior of said element for controlling the time required to build up sufficient pressure to move said element, and a relief valve, said relief valve being joined to the interior of said element by a by-pass about said control valve.
5. In an air actuated timing device, a housing having a chamber, a movable element within said chamber having a hollow interior, a control valve for controlling the flow of air to the interior of said element, a rod extending in the chamber in position to be moved by said element for closing said valve, a regulating valve for regulating the admission of air into the interior of said element for controlling the time required to build up sufficient pressure to move said element, and a

relief valve, said relief valve being joined to the interior of said element by a by-pass about said regulating valve, a trigger for operating said control valve to open position, and an element on said trigger which renders said trigger ineffective to control the position of said valve during the operating cycle which follows the opening of said valve by the full movement of said trigger.

6. An air actuated timing device embodying a housing having a chamber, a metal bellows within said chamber having one end closed and the opposite end communicating with a supply passageway for the air, a regulating valve in said supply passageway for regulating the flow of air to the interior of the bellows which is directly moved by the pressure of air, a control valve in position to be positively moved by said bellows to closed position to shut off the flow of air in said supply passageway and metal bellows, and an operating element for unseating said control valve.

7. An air actuated timing device embodying a housing having a chamber, a metal bellows within said chamber having one end closed and the opposite end communicating with a supply passageway for the air, a regulating valve in said supply passageway for regulating the flow of air to the interior of the bellows, a control valve having a rod extending into the chamber in position to be moved by said bellows to closed position, an operating element for unseating said control valve, and means which renders said operating element inoperative to control the position of the control valve during the ensuing operating cycle when said operating element is fully actuated and which permits the operator to regulate the time of operation when said element is only partially actuated.

8. An air actuated timing device embodying a housing having a chamber, a metal bellows within said chamber having one end closed and the opposite end communicating with a supply passageway for the air, a regulating valve in said supply passageway for regulating the flow of air to the interior of the bellows, a control valve having a rod extending into the chamber in position to be moved by said bellows to closed position, an operating element for unseating said control valve, means which renders said operating element inoperative to control the position of the control valve during the ensuing operating cycle when said operating element is sufficiently actuated, and a relief valve by-passing said regulating valve and communicating with the interior of said bellows.

9. An air actuated timing device embodying a housing having a chamber, a hollow piston within said chamber, a spring for urging said piston toward one end of the chamber, a rubber tube disposed within said chamber and sealed to the end of the housing, a control valve in said housing controlling the flow of fluid, to the interior of said tube, through a passageway, a regulating valve in the passageway for regulating the flow of fluid into said tube, means for moving said control valve toward open position, and means between said control valve and said moving means for rendering said moving means inoperative to control the position of the valve during the ensuing operating cycle when said moving means is sufficiently actuated.

10. An air actuated timing device embodying a housing having a chamber, a hollow piston within said chamber, a spring for urging said piston toward one end of the chamber, a rubber tube disposed within said chamber and sealed to the

end of the housing, a control valve in said housing controlling the flow of fluid, to the interior of said tube, through a passageway, a regulating valve in the passageway for regulating the flow of fluid into said tube, means for moving said control valve toward open position, means between said control valve and said moving means for rendering said moving means inoperative to control the position of the valve during the ensuing operating cycle when said moving means is sufficiently actuated, and a relief valve by-passing said regulating valve and communicating with the interior of said tube.

11. An air actuated timing device embodying a housing having a chamber, a hollow rigid piston within said chamber, means for sealing said piston to the wall of the chamber, a spring for urging said piston toward one end of the chamber, said housing having a passageway which communicates with the interior of said piston, a regulating valve in the passageway controlling the flow of air to said interior, a control valve communicating with said passageway having a stem extending into the chamber in a position to be engaged by and moved by said piston, and means for moving said control valve to open position.

12. An air actuated timing device embodying a housing having a chamber, a hollow piston within said chamber, means for sealing said piston to the wall of the chamber, a spring for urging said piston toward one end of the chamber, said housing having a passageway which communicates with the interior of said piston, a regulating valve in the passageway controlling the flow of air to said interior, a control valve communicating with said passageway having a stem extending into the chamber in a position to be moved by said piston, means for moving said control valve to open position, and additional means for preventing the moving means from controlling the position of the control valve during the ensuing operating cycle when said moving means is sufficiently actuated.

13. An air actuated timing device embodying a housing having a chamber, a hollow piston within said chamber, means for sealing said piston to the wall of the chamber, a spring for urging said piston toward one end of the chamber, said housing having a passageway which communicates with the interior of said piston, a regulating valve in the passageway controlling the flow of air to said interior, a control valve communicating with said passageway having a stem extending into the chamber in a position to be moved by said piston, means for moving said control valve to open position, additional means for preventing the moving means from controlling the position of the control valve during the ensuing operating cycle when said moving means is sufficiently actuated, and a relief valve by-passing said regulating valve and communicating with the interior of said piston.

14. A timing device including, a housing having a chamber, a movable element within said chamber having a hollow interior, and an operating end which is urged toward an inoperative position within said chamber, an air control valve moved to closed position by said element, and means controlling the admission of air from said control valve to the hollow interior of said element for controlling the time required to build up sufficient pressure to move said element for engaging and moving said control valve to closed position to thereby time the open period of said valve.

15. In an air actuated timing device, a housing having a chamber, a valve controlling the flow of air to the chamber, a hollow element within the chamber separable from said valve, the interior of which is joined by a passageway from the outlet side of said valve, and a regulating valve in said passageway for regulating the flow of air to said hollow interior for moving said element after a predetermined time cycle, said element moving said control valve to closed position.

16. An air actuated timing device comprising a housing having a passage extending between an inlet port and an outlet port, a control valve for alternately closing and opening said passage, manipulative means for operating said control valve, said housing having a chamber, a hollow element within the chamber and having a movable end wall which is separable from said valve, a passageway extending between the outlet side of said passage to said chamber for supplying live air thereto only when the control valve is open, a regulating valve in said passageway for adjusting the flow of air into said chamber, and motion transmitting means interposed between said movable end wall and the control valve for closing the latter on predetermined movement of said movable end wall.

17. An elastic fluid actuated timing device embodying a housing having a chamber, a valve controlling the flow of the elastic fluid through said device from an inlet port to an outlet port, a hol-

low elastic fluid operated element operably movable within said chamber separable from said valve, said housing having a passageway on the outlet side of said valve in open communication with said chamber and the interior of said hollow element, and adjustable means in said passageway for regulating the flow of the elastic fluid to the interior of said hollow element for controlling the time required to build up sufficient elastic fluid pressure to operably move said hollow element within the chamber and thereby close said valve.

18. An elastic fluid actuated timing device embodying a housing having a chamber, a valve controlling the flow of the elastic fluid through said device from an inlet port to an outlet port, a hollow elastic fluid operated element separable from said valve and comprising a cumulative pressure reservoir for the elastic fluid and of which at least a portion is operably movable within said chamber, said valve having a passageway leading to the outlet side of said valve in open communication with said chamber and the interior of said hollow element, and an adjustable means in said passageway for regulating the flow of the elastic fluid to the interior of said hollow element for controlling the time required to build up sufficient elastic fluid pressure to operably move said hollow element within the chamber and thereby close said valve.

ALFRED H. HABERSTUMP.
LOWELL C. FREEMAN.