March 30, 1926. 1,579,049

C. D. AINSWORTH

RETARDATION DEVICE

Filed May 19, 1921

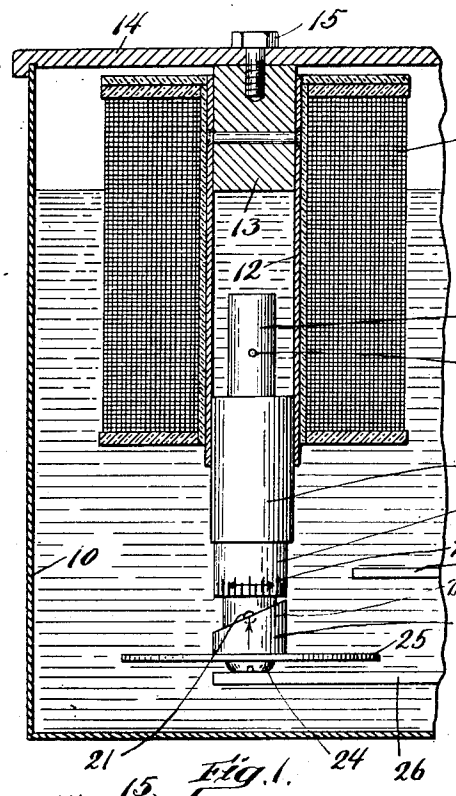


Fig. 1.

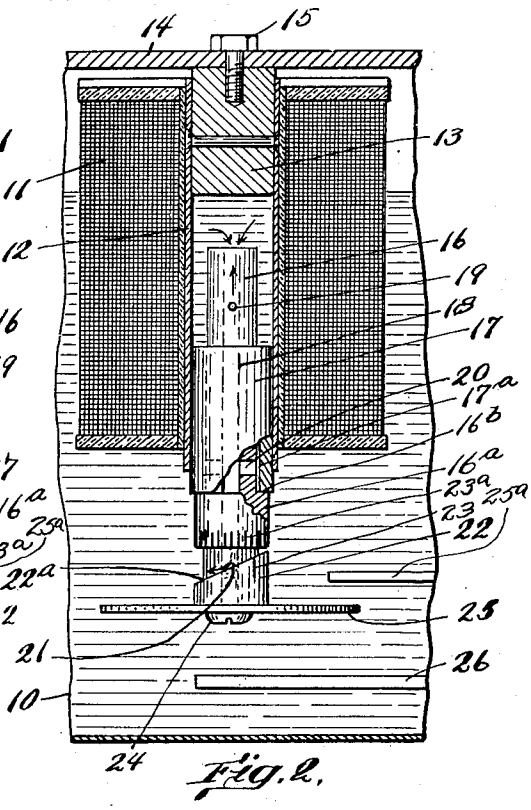


Fig. 2.

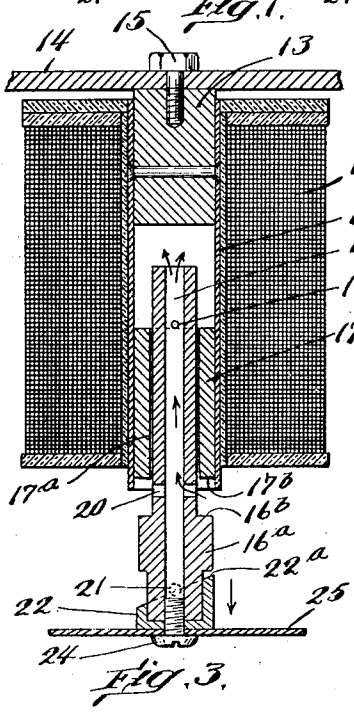


Fig. 3.

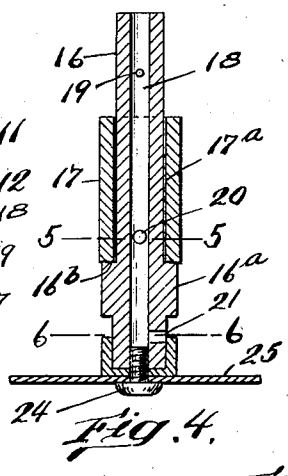


Fig. 4.

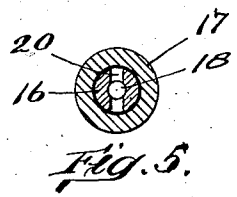


Fig. 5.

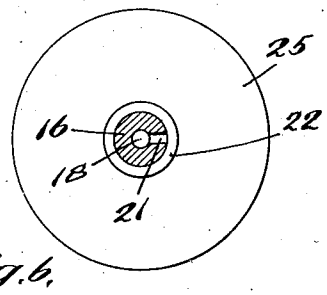


Fig. 6.

Inventor.

Chester D. Ainsworth

by

Atty

Patented Mar. 30, 1926. 1,579,049

UNITED STATES PATENT OFFICE.

CHESTER D. AINSWORTH, OF WOLLASTON, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CONDIT ELECTRICAL MANUFACTURING CORPORATION, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

RETARDATION DEVICE.

Application filed May 19, 1921. Serial No. 471,004.

To all whom it may concern:

Be it known that I, CHESTER D. AINSWORTH, a citizen of the United States, residing at Wollaston, in the county of Norfolk and State of Massachusetts, have invented an Improvement in Retardation Devices, of which the following is a specification.

This invention relates to retardation devices and particularly to an electrically-controlled retardation device adapted to delay the control of an electric circuit and has for its object to improve the construction of retardation devices of the type set forth.

Fig. 1 is a sectional elevation of the invention applied to the overload coil of an electric switch.

Fig. 2 is a view similar to Fig. 1 but with the movable elements thereof disposed in an attracted position.

Fig. 3 is a sectional elevation illustrating the relative position of the various elements to provide a rapid return or resetting of the movable elements.

Fig. 4 is a sectional elevation of the movable elements of the device.

Fig. 5 is a section along line 5—5 of Fig. 4, and illustrating more particularly the fluid passages for obtaining rapid resetting of the device.

Fig. 6 is a section along line 6—6 of Fig. 4 and illustrating more particularly the leak passage.

As here shown, the device embodying the invention is contained in the receptacle 10 which may also contain the stationary and movable switch members, not shown, of an electric switch; and is immersed in the oil therein; and the oil serves as the fluid acted upon by the movable elements of the device.

The retardation device includes the solenoid having the winding 11 disposed on the tube 12, which latter forms a cylinder. The upper end of the tube is sealed by the plug 13 which constitutes the fixed pole-piece of the solenoid; and said solenoid may be secured to a fixed support 14 by a bolt 15 threaded into the top of the core piece.

The movable core of the solenoid, which comprises the piston of the retardation device, includes the stem 16 formed of magnetic material, and the sleeve 17 which also is preferably of magnetic material although it is not essential that it be so formed. Said stem is cylindrical and of substantial length and is formed with an axially disposed oil passage 18 which extends preferably from end to end of it. Said stem is also formed, at its lower end with an enlarged or shoulder portion 16^a; and the upper face 16^b of said shoulder portion is arranged to form a valve seat adapted to be engaged by the lower face of said sleeve.

Said sleeve 17 is also cylindrical in form and is arranged to be a relatively close sliding fit in said tube 12 whereby to reduce oil leakage between it and said cylinder. Said sleeve is formed with an axial opening 17^a in which said stem 16 is loosely received; and said sleeve and stem are relatively movable, movement of said sleeve upwardly on said stem being limited by engagement with a pin 19 carried by said stem, and movement of said sleeve downwardly on said stem being limited by engagment with the shoulder portion 16^a of said stem. It is not of especial importance that said sleeve be a close sliding fit on said stem and it is desirable that the sleeve be freely movable thereon.

Passages 20 of relatively large cross section are formed in said stem a short distance above the face 16^b of the shoulder 16^a to establish free oil communication between said passage 18 and the main body of oil in the receptacle 10.

The lower face 17^b of said sleeve is normally adapted to engage the face 16^b of the shoulder 16^a of said stem, and the contact is adapted to be substantially oil tight whereby to prevent appreciable oil leakage through said passages 20 when the core is moving upward. Preferably, said faces are adapted to contact throughout their radial extent. It will be obvious that as said sleeve is moved into engagement with said face 16^b or away therefrom to uncover said passages 20 the flow of oil through said passages will be restricted or permitted.

A leak passage 21 is formed in said stem below the shoulder portion 16^a and said passage extends from said passage 18 to the side of said stem. An adjustable cap-member 22 is formed with a recess in which the lower end of said stem is received and said cap extends upwardly on said stem and is adapted to be substantially in oil tight contact therewith. The top face 22^a of said cap-member is tapered so that one

portion of its side wall is higher than its opposite portion and the higher portion is adapted to extend above and cover said passage 21 and thereby prevent flow of oil through when the cap is adjusted in proper position. It is obvious that as said cap-member is rotated on the end of said stem, the opening of said passage will be gradually uncovered and that any desired extent of opening, and therefore the amount of restriction of flow of oil therethrough may be varied by a proper adjustment of said cap-member. Preferably the side wall of said cap-member is provided with a witness mark 23 and the shoulder portion 16^a of said stem is provided with a series of graduations 23^a which may indicate the time required for operation of the device in specific adjustments thereof.

Said cap-member is held in place by the screw 24 which extends through said member and is threaded in the end of said passage 18. A striking disc 25 may be interposed between the head of said screw and said cap to engage the arm 25^a when the piston is moved to its upper position and trip the switch or otherwise control an electric circuit.

A stop-member 26 may be disposed below said core to support it in its normal or low position and said stop-member may be adjustable vertically in a well known manner to vary the current value at which the device will operate. Normally the core is at its lowermost position and is supported upon the member 26 and the sleeve 17 is in contact with the face 16^b of the shoulder 16^a of the stem 16 and free flow of oil through said stem is thereby prevented. When the solenoid winding is sufficiently energized the piston will be moved upwardly within the tube 12 and oil will be forced out of the space above the piston through the passage 18 in said core and the leak passage 21; and the rate of flow of oil and consequently the rate of upward movement of the core will be governed by the setting of the cap-member 22. When the core has moved upwardly sufficiently to control the circuit and the solenoid becomes de-energized, the stem 16 will drop and the shoulder portion 16^a will be moved from contact with the sleeve to uncover the passages 20 and admit oil freely into the space above the core; whereby the core will return rapidly by gravity to its normal position. After the stem has descended to its low position the sleeve 17 will subsequently descend to engage the shoulder 16^a of said stem and close the passage for the free flow of oil; and the device will be in condition for a second operation.

While it is not essential that said sleeve 17 be formed of magnetic material, yet it is preferably so formed for the reason that it will be held firmly against the face 16^b of the shoulder 16^a of the stem by magnetic attraction, inasmuch as said stem extends above said sleeve toward the fixed pole piece 13, and an oil tight contact with said shoulder is assured thereby.

It is obvious that the invention may be incorporated in other structures without departing from the spirit of the invention.

I claim:

1. A retardation device including a cylinder, and a piston therefor including a stem having a fluid passage therein which has an opening at the top of the stem and a second and lower opening in the side of the stem, and a sleeve conformed with and movably fitting within said cylinder and surrounding and free for axial movement on said stem to control fluid flow through said fluid passage.

2. A retardation device including a cylinder, and a piston therefor including a stem having a fluid passage therein which has an opening at the top of the stem and a second and lower opening in the side of the stem, and a sleeve conformed with and movably fitting within said cylinder and surrounding and free for axial movement on said stem to cover and uncover said second opening.

3. A retardation device including a cylinder, and a piston therefor including a sleeve conformed with and movably fitting within said cylinder and a stem extended through an aperture in said sleeve and movably axially therein, said stem having a fluid passage therein which has an upper opening at the top of the stem above said sleeve and a lower opening in the side of the stem below said sleeve, said stem also having a shoulder portion below said lower opening, and said sleeve and shoulder cooperating to form a valve to control fluid flow through said passage.

4. A retardation device including a cylinder and a piston therefor including a sleeve movable in engagement with said cylinder and a stem extended through an aperture in said sleeve and movable therein, said stem having a fluid passage in it which has an upper opening in the top of said stem and a lower opening in the side of said stem, said stem having a shoulder portion below said lower opening arranged to cooperate with said sleeve to form a valve to control flow of fluid in said stem-passage, said stem also having a leak opening in communication with said passage and means to vary the dimensions of said leak opening.

5. A retardation device including a cylinder, and a piston therefor including a sleeve movable within said cylinder, a stem movable within an aperture in said sleeve and extended downwardly beyond said sleeve, said stem having a fluid passage

therethrough which has an upper opening in the top of the stem and a second opening in the side of the stem and a leak opening in the side of the stem, said stem having a shoulder portion below said second opening, said shoulder and sleeve arranged to form a valve to control flow of fluid through said stem-passage, and a cap received on the lower end of said stem having its side wall extended upwardly and arranged to control the extent of opening of said leak opening.

6. A retardation device including a cylinder, and a piston therefor including a sleeve movable within said cylinder, a stem movable within an aperture in said sleeve and extended downwardly beyond said sleeve, said stem having a fluid passage therethrough which has an upper opening in the top of the stem and a second opening in the side of the stem and a leak opening in the side of the stem, said stem having a shoulder portion below said second opening, said shoulder and sleeve arranged to form a valve to control flow of fluid through said stem-passage, an adjustable cap received on the lower end of said stem having its side wall extended upwardly and arranged to control the extent of opening of said leak opening, and means to lock said cap in adjusted position.

7. A retardation device including a cylinder, and a piston therefor including a sleeve movable within said cylinder, a stem movable within an aperture extended on both sides beyond said sleeve, said stem having a passage extended from end to end of it with an upper and a lower opening in the side of the stem communicating with said passage, said stem having a shoulder portion disposed below said upper opening arranged to cooperate with said sleeve to form a valve to control flow of fluid through said opening, a cap disposed over the lower end of said stem which has its side wall extended upwardly and arranged to control the extent of opening of said lower opening, and a screw passed through said cap and threaded in the lower end of said passage in said stem.

8. A retardation device including a solenoid having a tube comprising a cylinder, a fixed pole piece closing the upper end of said cylinder, and a piston for the cylinder including a magnetic sleeve movable in said cylinder, a magnetic stem movable in an aperture in said sleeve and extended beyond said sleeve in both directions, said stem having a fluid passage which has an upper opening in the top of the stem and a lower opening in the side of said stem, said stem having a shoulder portion below said lower opening arranged to cooperate with said sleeve to form a valve to control fluid flow in said passage, said sleeve arranged magnetically to be held in contact with said shoulder, and said stem having a leak opening communicating with said passage.

9. A retardation device having a cylinder, and a piston therefor having a sleeve movable within and in engagement with the cylinder, a stem movable in said sleeve having a fluid passage which has an upper opening in the top and a lower opening in the side of the stem, said stem having a shoulder portion below said lower opening arranged to cooperate with said sleeve to form a valve arranged to control fluid flow through said passage, and means to hold said stem and sleeve magnetically in contact.

10. A retardation device comprising a solenoid having a tube comprising a cylinder, a core piece fixed in the upper end of said cylinder, a piston including a stem of magnetic material having a fluid passage therein which has an opening through the upper portion of the stem and a lower opening in the side of the stem, said stem having an enlarged head below said lower opening, and a sleeve of magnetic material movable in said cylinder and on said stem to cover and uncover the lower opening in the stem and engageable with the head of the stem to prevent flow of fluid through the passage in the stem, said stem arranged to extend upward above said sleeve toward the fixed core piece in the cylinder.

In testimony whereof, I have signed my name to this specification.

CHESTER D. AINSWORTH.