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S. E. ALLEN ET AL

1,933,694

ELECTRICALLY CONTROLLED ACTUATING DEVICE

Filed April 30, 1930

Fig. 1.

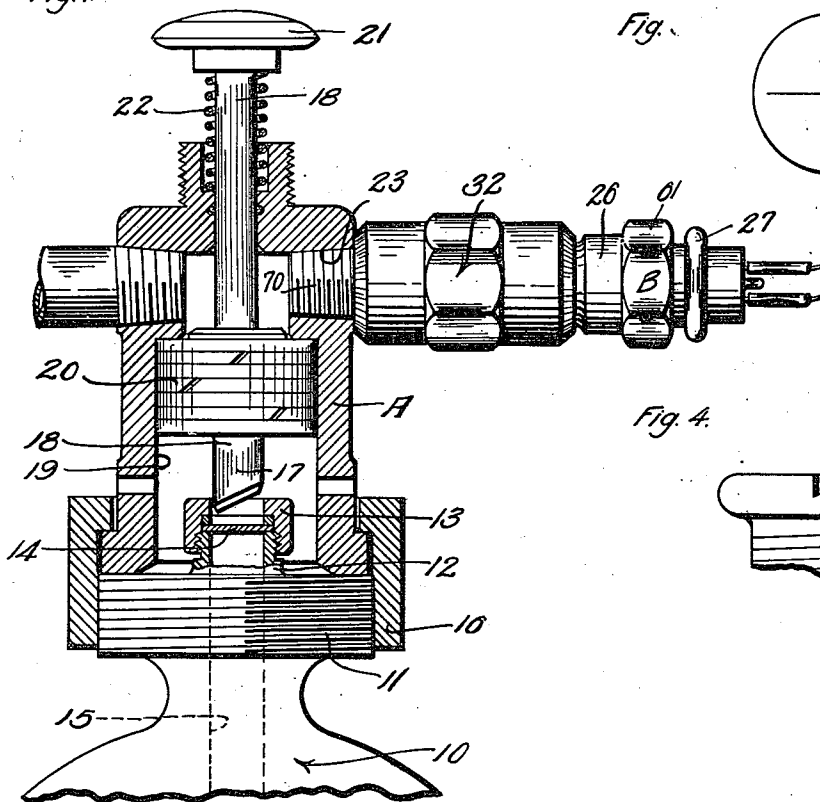


Fig.

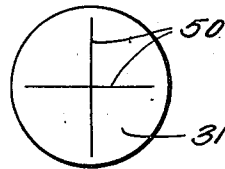


Fig. 4.

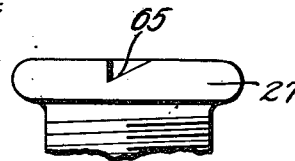
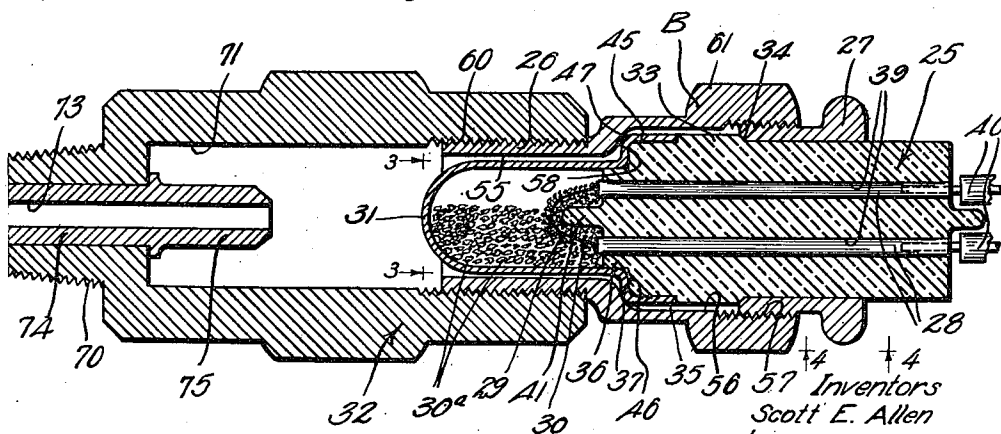


Fig. 2.



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ELECTRICALLY CONTROLLED ACTUATING
DEVICE

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C-O-Two Fire Equipment Company, Newark,
N. J., a corporation of Delaware

Application April 30, 1930. Serial No. 448,673

12 Claims. (Cl. 60-44)

This invention relates to an electrically-controlled actuating device, and it is a general object of the invention to provide a simple, practical, dependable device for generating pressure suitable for use in various situations.

The device provided by this invention is capable of various uses and applications. The device has been successfully used for actuating control heads of fire-extinguishing equipment, and particularly heads on containers of CO₂ gas, and the like. For the purpose of facilitating an understanding of the invention, we will describe it as applied to the control head of a fire-extinguishing unit, it being understood that such reference is not to be considered as limiting or restricting the scope or range of application of the invention.

Fire-fighting equipment employing carbon dioxide gas usually includes a container or vessel in which the gas is sealed by means of a penetrable disc, or the like. A control head is applied to the container and carries a punch or other device operable to penetrate the sealing disc when it is desired to liberate the gas. In our co-pending application entitled Device for puncturing closure disc, Serial Number 208,717, filed July 27, 1929, we disclose a control head provided with a cylinder and piston mechanism whereby the punch or seal-breaking device is operable by fluid pressure.

The device provided by this invention is operable to generate pressure and is particularly suited for use in connection with control heads such as we have just referred to. The device of this invention is electrically controlled, and when actuated develops or generates pressure in a manner to effectively and dependably actuate a mechanism such as a control head, or the like.

An object of the present invention is to provide an actuating device which is simple and inexpensive of manufacture and dependable and effective in operation.

It is another object of the present invention to provide an actuating device of the character mentioned embodying a construction whereby inflammable material employed for generating pressure is sealed so that it is not impaired by air or moisture.

Another object of the invention is to provide an actuating device of the character mentioned which is electrically actuated and which effectively and permanently breaks the actuating circuit upon the device being actuated.

A further object of the present invention is to provide an actuating device of the character mentioned embodying a simple, effective, and im-

proved means of igniting the inflammable material by the resistance element of the electrical control means whereby dependable instantaneous operation of the device is assured.

It is another object of this invention to provide an actuating device of the character mentioned which operates without discharging solid matter such as fragments of ruptured parts into the mechanism operated by the device.

Another object of this invention is to provide a device of the character mentioned with a modifier whereby the force or pressure developed upon actuation of the device may be modified when the full and direct force is not required.

A further object of this invention is to provide a simple, effective, and dependable seal for the inflammable material employed in the device, which seal is formed and constructed so that it readily opens or is ruptured by internal pressure, that is, by pressure generated through combustion of the inflammable material, but which will withstand high external pressures.

The various objects and features of our invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is had to the accompanying drawing, in which:

Fig. 1 is a vertical detailed sectional view through a control head on a container of fluid under pressure, the head being constructed for fluid pressure actuation and being equipped with the actuating device provided by this invention. Fig. 2 is an enlarged longitudinal detailed sectional view of the device provided by this invention. Fig. 3 is an end view of the sealing cap embodied in the device, being a view taken as indicated by line 3-3 on Fig. 2, and Fig. 4 is a side elevation showing the clamp ring of the mounting of the device taken as indicated by line 4-4 on Fig. 2.

In the drawing we have illustrated the upper or neck portion 10 of a typical container for carrying fluid under pressure. The neck portion of the container is provided with an enlarged threaded part 11 for receiving a control head and is provided with an upwardly projecting part 12 which carries a clamp ring 13 that holds a sealing disc 14 over the end of the opening 15 provided through the neck of the container.

The control head which we have illustrated in the drawing includes a body A to be mounted on the neck portion 10 of the container by means of a mounting ring 16, or the like, a punch 17 arranged in the body A so that it can be operated

to penetrate the disc 14, a stem 18 projecting from the punch into a cylinder 19 of the body, and a piston 20 on the stem 18 and slidably fitting the cylinder 19. The stem 18 projects through the end of the cylinder to a point beyond the body A where it is provided with an operating knob 21. The assembly or unit including the punch 17, stem 18, piston 20, and knob 21 may be normally yieldingly held in an unactuated position by means of a suitable spring 22. In the construction illustrated the spring is arranged under compression between the upper end of the body A and the knob 21 on the upper end of the stem 18. The head that we have just described may be operated by depressing the knob 21 or by applying pressure to the upper end of the piston 20.

The actuating device provided by this invention is suitable for use in connection with a head such as we have just described for generating pressure suitable for actuating the piston 20. The body A of the head is provided with one or more openings 23 communicating with the upper end portion of the cylinder 19 so that pressure can be admitted into the cylinder to operate on the upper side of the piston.

The construction or device provided by the present invention includes, generally, a core 25 of insulating material, a mounting B for the core including a body 26 and a clamp ring 27, a pair of conductors 28 extending longitudinally through the core, a resistance element 29 connecting the conductors 28 at the inner end of the core, inflammable material 30 associated with the element 29 to be ignited when the element becomes heated, a sealing cap 31 at the inner end of the core and closing the resistance element 29, a charge 30^a of inflammable material carried in the cap 31, and a modifier 32 that may be used in connection with the other parts as circumstances require.

The core 25 is formed of non-conducting heat-resisting material such as bakelite, or the like. The core is round in cross section and is provided adjacent its inner end portion with a flange 33 which presents an outwardly-facing shoulder 34 and an inwardly-facing shoulder 35. The extreme inner end portion 36 of the core is of reduced diameter forming an inwardly-facing shoulder 37 near the inner end of the core. The conductors 28 are fitted tightly in spaced openings 39 extending longitudinally through the core from one end to the other. The inner ends of the conductors form terminals to which the ends of the resistance element 29 are connected, while the outer ends of the conductors form terminals for the reception of suitable lead lines 40 by which the device may be connected in an operating circuit. In accordance with the present invention a spacer rib 41 projects from the inner end of the core between the inner ends of the terminals forming a separator between the terminals to positively prevent arcing between the terminals after the resistance element has fused. The resistance element 29 may be a fine wire of suitable conductivity connected between the inner terminal ends of the conductors 28 so that it extends over or around the spacer rib 41. The element is of such character as to become heated and then fuse upon a suitable current being passed through it.

The inflammable material 30 associated with the resistance element 29 is preferably a powder that will ignite readily and which will burn or explode rapidly. In accordance with our inven-

tion the inflammable material 30 is applied to the resistance element or to the inner end portion of the core by applying an inflammable adhesive material such as a nitro-cellulose solution to the parts on which the material 30 is desired and then applying the material 30 so that when the adhesive material dries the material 30 is effectively bonded in place. In practice we have found it practical to dip the inner end portion of the core, that is, the terminal ends of the conductors, the spacer rib 41, and the resistance element 29, in a nitro-cellulose lacquer and then dip the parts in the desired inflammable material or powder. It will be apparent that the binder or bond thus used is of itself inflammable, and therefore operates to aid in igniting the material 30.

The sealing cap 31 is applied to the inner end portion of the core 25 to seal the inflammable material against air and moisture. The cap is preferably a cup-shaped part formed of a single piece of material. The cap is made to fit over the inner end portion of the core. In the case illustrated the cap has an enlarged rim portion 45 which fits over the inner end portion of the core so that its end engages the shoulder 35. By enlarging the rim of the cap, the cap is provided with an internal shoulder 46 adapted to seat on the shoulder 37 of the core and it is provided with an external shoulder 47 adapted to seat in the body of the mounting as will be hereinafter described. The cap fits tightly onto the end portion of the core, and when the mounting is in place or set, air and moisture are completely excluded from the material 30. In accordance with our invention the sealing cap has a rounded or spherically shaped end, and suitable depressions or scorings 50 are provided in the rounded end so that the cap is not materially weakened against external pressure but is materially weakened against internal pressure. We have found it practical to provide crossed scorings 50 on the end of the cap as shown in Fig. 3 as this causes the end of the cap to readily open when subjected to internal pressure and yet does not materially weaken it against external pressure. This manner of forming the cap not only accomplishes the function stated but also causes the cap to open without fracture except along the lines of scoring and therefore without parts becoming detached. In practice we form the sealing cap of copper.

A charge of powder 30^a is carried in the cap 31 to be ignited by the inflammable material or primer 30. In practice we use the same character of powder for the charge 30^a as we do in the material 30.

The mounting B includes the body 26 and the clamp ring 27. The body is a tubular part, the inner end portion of which has an opening 55 receiving the sealing cap 31. The middle portion of the body has an enlarged opening 56 receiving the flanged portion of the core, while the upper end of the body has an inwardly threaded part 57 receiving the clamp ring 27. A shoulder 58 is formed in the body between the openings 55 and 56, which shoulder receives the shoulder 47 of the sealing cap. The clamp ring 27 screw threads into the threaded opening 57 of the body and engages the shoulder 34 so that the core 25 and sealing cap are tightly clamped together. It will be apparent from Fig. 2 of the drawing how tightening of the clamp ring into the body causes the flange portion 33 of the core to be forced downwardly so that the shoul-

der 47 of the sealing cap is forced tightly against the shoulder 58 in the body. The inner end portion of the body is externally threaded at 60 to screw thread into an opening 23 in the body A of the control head or into the modifier 32 which in turn is applied to the control head; further, suitably flattened parts 61 may be provided on the exterior of the body to facilitate applying the body. In accordance with the present invention the clamp ring is provided at its exposed portion with a notch 65 which allows it to be engage and operated in one direction but makes it difficult, if not impossible, to engage it for operation in the other direction. The notch 65 is designed so that the ring can be easily operated to tighten it into the body but cannot be operated to remove it from the body. In practice the clamp ring is made very tight in the body when the device is assembled so that extreme force will have to be applied to it to remove it, making it apparent or evident that the device has been tampered with.

The modifier 32 is intended to be used when the full force or power of the device is not needed. The modifier is a tubular member internally threaded at one end to receive the threaded part 60 of the mounting B and provided with an externally threaded projection 70 at the other end to fit the opening 23 of the head. The opening 71 through the modifier is fairly large in diameter so that it forms an expansion chamber. The opening 73 through the threaded projection 70 is comparatively small so that it operates to check or retard the discharge of pressure from the modifier into the head to which the device is applied. In accordance with the present invention a sleeve 74 is set in the reduced threaded part 70 and has its inner end portion 75 projecting into the expansion chamber or large opening 71 in the manner clearly shown in Fig. 2. The inner end of the sleeve 74 is beveled so that any part or object striking it is deflected away from the opening through which the pressure is discharged. By providing a projection of this character in the expansion chamber, any part, such as a part of the sealing cap that may become dislodged as a result of the force of the ignition of the material 30, will be caught in the large opening 71 of the modifier and will not lodge in the outlet opening in a manner to interfere with the operation of the device.

From the foregoing description it will be apparent that the device may be applied to a control head, or the like, with or without the modifier 32. When it is desired to actuate the control head, suitable current passed through the element 29 will cause the inflammable material 30 and charge of powder 30 to burn or explode, opening the sealing cap and allowing the discharge of pressure into the cylinder of the control head to force the piston downwardly so that the punch penetrates the sealing disk. The cap acts to cause a high pressure to be developed or built up before pressure enters the body to act on the piston. We have found that by thus employing a cap we obtain a pressure condition which causes the piston to be operated even though the head or body may have several outlets. Further, by our construction we obtain substantially complete burning of the charge. In the event that the control head to which the device is connected is connected in a battery or installation including other device so that pressure may come on the device from the control head, the formation of the sealing cap is such as to effectively resist such pressure, leav-

ing the device always in condition for operation.

Having described only a typical preferred form of our invention, we do not wish to limit ourselves to the specific details set forth, but wish to reserve to ourselves any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims:

Having described our invention, we claim:

1. An actuating device of the character described including, a core of insulating material, a permanent body carrying the core and adapted to be mounted on the device to be actuated, spaced conductors extending longitudinally through the core, means holding the core in the body a fusible element connecting the conductors at the inner end of the core, a combustible charge at the fusible element, the charge being fixed to the element, and a frangible cap at an end of the body attached to the core and encasing the element and combustible charge.

2. A device of the character described including a body, a frangible cap on the body, an inflammable charge carried in the cap, a modifier attached to the body and confining the cap, the modifier having a restricted outlet opening, and a tubular part in the outlet opening projecting toward the body to prevent parts of the cap from clogging the outlet opening when the cap is broken by ignition of the charge.

3. A device of the character described including a body, a frangible cap on the body, an inflammable charge carried in the cap, and a modifier attached to the body and confining the cap, the modifier having an outlet opening and a tubular part in the outlet opening projecting toward the body, to prevent parts of the cap from clogging the outlet opening when the cap is broken by ignition of the charge the projecting end of said part being beveled.

4. An actuating device of the character described including, a permanent tubular body, a core of dielectric material attached to and extending into the body, spaced conductors extending longitudinally through the core, a fusible element connecting the conductors at the inner end of the core, a combustible charge at the element, and a frangible cap on the inner end of the core sealing the combustible charge, the body being screw threaded for attachment to the device to be actuated.

5. An actuating device of the character described including, a permanent tubular body, a core of dielectric material attached to and extending into the body, spaced conductors extending longitudinally through the core, a fusible element connecting the conductors at the inner end of the core, a combustible charge at the element, and a frangible cap on the inner end of the core sealing the combustible charge, the cap having a spherical outer end scored so as to rupture without disintegration upon ignition of the charge.

6. An actuating device of the character described including, a tubular body to be mounted at an opening in the device to be actuated, a core extending into the outer end of the body, a clamp ring surrounding the core and attaching the core to the body, the core and ring closing the outer end of the body, a combustible charge at the inner end of the core, means carried by the core for igniting the charge, and a frangible cap on the inner end of the core enclosing the charge, the cap having a spherical end so as to withstand high external pressures.

7. A device of the character described including, a tubular body adapted to be arranged in

an opening in a device to be actuated, a core of insulating material extending into the body, a cap on the inner end of the core, an inflammable charge in the cap, the body being such that it is not destructible by said charge, and means holding the core in the body and clamping the cap on the end of the core.

8. A device of the character described including, a tubular body adapted to be arranged in an opening in a device to be actuated, a core of insulating material extending into the body, a cap on the inner end of the core, an inflammable charge in the cap, the body being such that it is not destructible by said charge, and means holding the core in the body and clamping the cap on the end of the core, the cap being scored to fracture when the charge is ignited.

9. A device of the character described including, a tubular body adapted to be arranged in an opening in a device to be actuated, a core of insulating material extending into the body, a frangible cap on the inner end of the core, an inflammable charge in the cap, the body being such that it is not destructible by said charge, and means holding the core in the body and clamping the cap on the core including a shoulder in the body, and a ring threaded to the outer end of the body and holding the core in a position where the cap is clamped between the shoulder and the core.

10. A device of the character described including, a tubular body adapted to be arranged in an opening in a device to be actuated, a core of insulating material extending into the body, a cap

on the inner end of the core, an inflammable charge in the cap, the body being such that it is not destructible by said charge, and means holding the core in the body and clamping the cap on the end of the core, the end of the cap being spherically rounded and scored to fracture without disintegration when the charge is ignited.

11. A device of the character described including, a tubular body adapted to be arranged in an opening of a device to be actuated, a core of insulating material extending into the body, a frangible cap on the inner end of the core, means holding the core in the body and clamping the cap on the core, an electrical conductor extending through the core to a point within the cap, an element in the cap fusible by current passed through the conductor, and a combustible charge in the cap fixed to the said element.

12. An actuating device of the character described, including a permanent tubular body, a core of dielectric material attached to and extending into the body, spaced conductors extending longitudinally through the core, a fusible element connecting the conductors at the inner end of the core, a combustible charge at the element, a frangible cap on the inner end of the core sealing the combustible charge, an internal shoulder in the body, and a ring threaded to the body and clamping the core in the body in a position where the cap is clamped between the end of the core and said shoulder.

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