

Oct. 15, 1935.

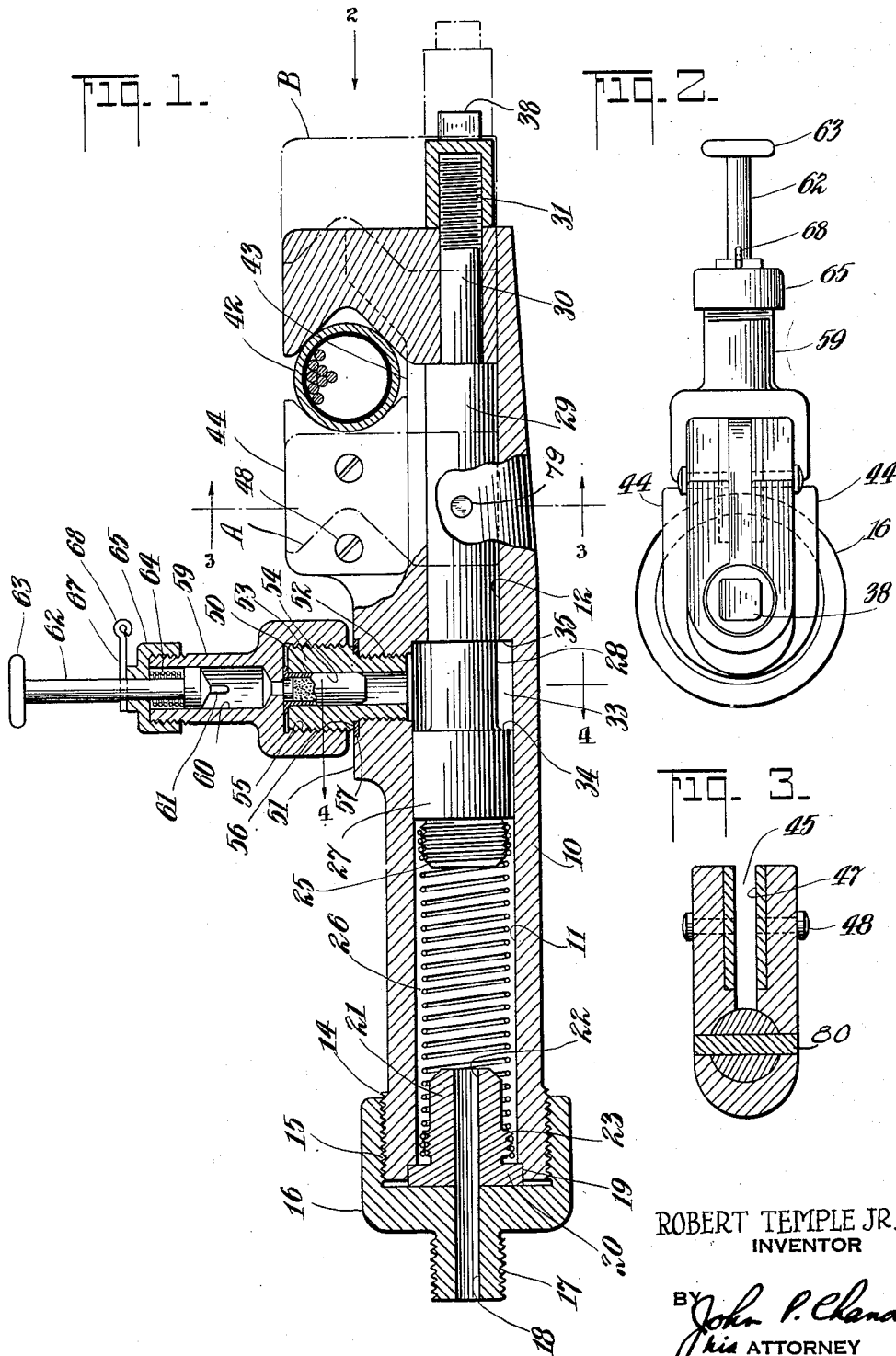
R. TEMPLE, JR

2,017,329

EXPLOSIVELY ACTUATED DEVICE

Filed April 24, 1933

2 Sheets-Sheet 1



ROBERT TEMPLE JR.
INVENTOR

BY *John P. Chandler*
his ATTORNEY

Oct. 15, 1935.

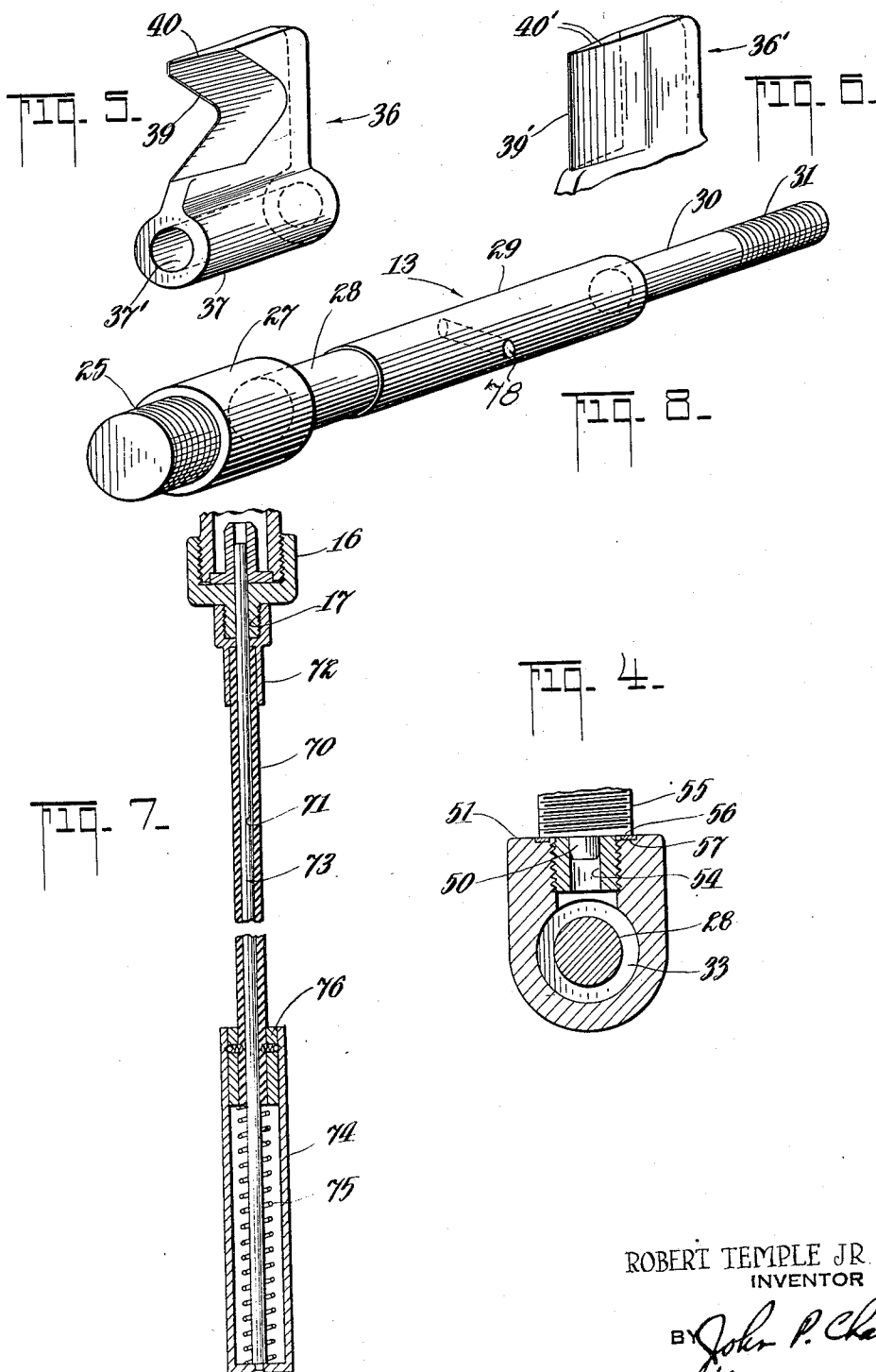
R. TEMPLE, JR

2,017,329

EXPLOSIVELY ACTUATED DEVICE

Filed April 24, 1933

2 Sheets-Sheet 2



ROBERT TEMPLE JR.
INVENTOR

By *John P. Chandler*
his ATTORNEY

UNITED STATES PATENT OFFICE

2,017,329

EXPLOSIVELY ACTUATED DEVICE

Robert Temple, Jr., Brooklyn, N. Y.

Application April 24, 1933, Serial No. 667,686

9 Claims. (Cl. 140—145)

This invention relates to explosively actuated cutting devices and relates more particularly to an explosively operated device for cutting high amperage concentric cables while under a full load and without any appreciable arc and without danger to the operator.

Electric current is generally transmitted from the power house to the various divisions of the city or locality under high voltage and the voltage then stepped down in the divisional sub-station. The low voltage current is then transmitted to the individual users by means of a rubber insulated, lead covered, concentric cable. These cables frequently carry a current having four and five thousand amperes and when the rubber insulation becomes defective a short circuit occurs between the central portion of the cable and the lead covering, which latter is, of course, grounded. When the short circuit occurs it is not expedient to open the entire circuit to replace the cable because large portions of the community would be without current. The cable must, accordingly be cut as closely as possible to the short circuited portion. This is an exceedingly dangerous task and one slight error in the judgment of the operator will mean instant and violent death. In the event that the cable is not promptly cut, however, there is a tremendous loss in cable since the short circuit travels relatively rapidly in the direction of the power house and in the course of a few hours many thousands of dollars worth of cable are ruined.

The present invention is directed particularly to an explosively actuated device provided with a knife which passes through the cable so quickly that the momentary short circuit occasioned by the passage of the knife therethrough will cause no damage to the apparatus nor danger to the operator.

To this end the invention comprises an elongated structure having at one end thereof a semi-circular transverse recess in which the cable may be placed. A longitudinal slot provides a passageway in which the knife travels. The knife is mounted on a piston which is actuated by explosive means employing a more or less conventional blank cartridge. The relation between the cable supporting element, or recess, and the knife is such that when the cartridge is fired the knife moves through the cable and moves completely past the cable supporting element. In other words, the longitudinal recess, in which the knife travels, extends beyond the cable supporting element in order that the knife may move past

the point where the cable is supported. In this fashion there can be no danger of the knife causing a short circuit after the cable has been cut. Also, there can be no return of the knife into the cable supporting element inasmuch as the device is so constructed that the explosive gases are retained intact in the explosion chamber after the explosion takes place and it is some minutes before these gases finally escape through the substantially air-tight spaces between the piston and the cylinder or barrel which supports same. This retention of the gases, after the explosion takes place, likewise eliminates all recoil.

Another object of the invention is to provide a device of this kind wherein the knife, in its passage through the cable, will travel with tremendous speed due to the fact that the initial movement of the piston which carries the knife is retarded until the explosive gases have built up their maximum pressure, thereby securing the maximum efficiency from the relatively small charge of powder required to actuate the device.

The invention further contemplates the provision of a light and compact cable cutting tool which is mounted on a handle of sufficient length that the device may be operated by inserting same into a manhole wherein the cable is normally located and the operator may actuate the device from the street, thereby eliminating all possible danger of operation.

Other objects and advantages of the invention will be hereinafter specifically pointed out, or will become apparent, as the specification proceeds.

With the above indicated objects in view, the invention resides in certain novel constructions and combinations and arrangements of parts, clearly described in the following specification and fully illustrated in the accompanying drawings, which latter show embodiments of the invention as at present preferred.

In the drawings:

Fig. 1 is a longitudinal, vertical section taken substantially through the center of the embodiment.

Fig. 2 is an elevation of the cutting end of the device.

Fig. 3 is a section taken on line 3—3 of Fig. 1.

Fig. 4 is a broken section taken on line 4—4 of Fig. 1.

Fig. 5 is a perspective view of the knife or cutting member.

Fig. 6 is a broken perspective view of the knife in a slightly modified form.

Fig. 7 is a longitudinal section taken through the center of the handle structure.

Fig. 8 is a perspective view of the piston.

Referring now to the drawings by reference numerals, the cable cutting embodiment, in its preferred form, includes an elongated barrel 10 which is constructed of hardened steel. The barrel is provided with a longitudinal aperture 11 extending the full length thereof, said aperture having a reduced portion 12 adjacent to the cutting end of the device. Within this aperture a piston 13 is positioned and is adapted for longitudinal movement therein.

One end of the barrel is provided with an externally threaded portion 14, said threads being engaged by the internal threads 15 of a screw cap 16. The entire structure is supported, when in use, on a handle structure, described hereafter, the handle structure being screwed onto an externally threaded extension portion 17 of the cap 16. The cap is further provided with a longitudinal aperture 18 for a purpose hereinafter set forth. The aperture 11 in the barrel is provided with an enlarged portion 19 at the outer end thereof to admit the flange portion 20 of a bushing 21 which functions as a buffer for the piston after the longitudinal movement thereof is completed. The bushing has a central aperture 22, aligned with the aperture 18 in the cap, and is provided also with an externally threaded portion 23.

The piston 13 is provided with a threaded portion 25 at the end adjacent to the cap 16, said threaded portion and the threaded portion 23 of the bushing 21 being engaged by opposite ends of a tension spring 26 which urges the piston in the direction of the cap. Adjacent to the threaded end portion 25 of the piston is a smooth portion 27 of the same diameter as the longitudinal aperture 11 in the barrel.

Immediately adjacent to the portion 27 is a reduced portion 28 of substantially the same length as the portion 27. Another and somewhat longer portion 29 is adjacent to the portion 28, said portion 29 closely fitting the portion 12 of the longitudinal aperture 11. An immediately adjoining portion 30 is of substantially half the diameter of the portion 29 and is provided with a threaded portion 31 at the end thereof.

The explosion chamber, which is designated as 33 prior to the detonation, is defined at one end thereof by the shoulder portion 34 on the piston, and at the other end thereof by the shoulder portion 35 which is formed by the reduction in diameter of the aperture 11, all as illustrated in Fig. 1. The piston moves rapidly toward the cap 16 and its movement is arrested when its end portion comes in contact with the bushing 21. Inasmuch as there is no opportunity for the explosive gases to escape due to the precise fitting of the piston within the aperture, there is no recoil as a result of the explosion. It is appreciated, of course, that within a few minutes after the explosion the gases will have gradually escaped.

In Figs. 5 and 6 I have illustrated two forms of the knife, or cutting element, which is designated in Fig. 5 as 36. The knife includes a cylindrical portion 37 at the lower end, said cylindrical portion having a longitudinal aperture 37' therethrough. The end portion 30 of the piston passes through this aperture and the knife is secured thereon by means of a cap nut 38. The cutting edge 39 is angular in shape and is provided with a bevel 40 on one side only,

as illustrated in Fig. 5. In Fig. 6, however, the knife 36' is illustrated as having a straight cutting edge 39' and a double bevel 40'.

The cable, which is designated as 42, is placed in a recess 43 in the cable supporting element 44. The knife is adapted to pass through a longitudinal slot or recess 45 in the cable supporting element, said recess being of sufficient length so that when the knife has completed its stroke and is in the position designated in broken lines at A in Fig. 1, no portion thereof will remain in the recess 43. Each side of the recess 45 is provided with a removable liner 47 which is held in place by means of a screw 48 in order that it may be removed if any wear occurs due to any slight arc which may take place.

The following means are provided for supporting and detonating the blank cartridge which is designated as 50. The barrel includes an upper flat surface which is designated as 51. A threaded aperture 52 passes from the upper surface of the barrel into the explosion chamber. Within this threaded aperture a cartridge supporting element or bushing 53 is positioned, said bushing having a longitudinal aperture 54 to receive the cartridge. The bushing further includes an enlarged threaded portion 55, the lower end of which provides a shoulder 56 which engages a copper gasket 57 in order to seal the explosion chamber and prevent the outward passage of the gases. A breeching or firing pin supporting element 59 is screwed on to the enlarged portion of the bushing. This breeching has a longitudinal aperture 60 therein in which a firing pin 61 passes. The firing pin is mounted at the lower end of the rod 62 having a handle 63 at the upper end thereof. The firing pin is urged downwards by means of a coil spring 64, said spring being supported at its upper end by means of a screw cap 65, said cap also serving to close the upper end of the aperture 60. The rod 62 which carries the firing pin is normally held in an upward position by means of a pin 67 having a ring 68 at one end thereof. Thus, when it is desired to fire the device a cord (not shown) which is attached to the ring 68, is pulled thereby allowing the firing pin to come in contact with the cartridge.

As heretofore stated, it is desirable to mount the entire structure upon a handle in order that the operator need not be too close to the device when it is actuated. The handle 70, which is illustrated in Fig. 7, is made from suitable insulating material and is provided with a longitudinal aperture 71 therethrough. The handle is secured within a socket 72 which is mounted on the threaded portion 17 of the cap 16. Within the aperture 71 of the handle, a rod 73 is mounted, said rod being secured at its outer end to a slidable handle structure 74 which is adapted for sliding movement on the handle 70. The handle structure 74 is urged to an outward position by means of a spring 75 which is mounted on the rod 73. The outward movement of the handle structure 74 is limited by stop members 76.

The tension spring 26 normally holds the piston in engagement with the bushing 21, in which position the knife is located in the longitudinal recess 45 in the position shown in broken lines at A. When a cable is to be cut, the handle structure 74 is moved forward, thereby causing the rod 73 to move the piston forward to the position wherein the knife will be located as shown in broken lines at B. The cable is then inserted into the recess 43 and the knife moves forward,

by virtue of the spring 26, to the position shown in full lines in Fig. 1, in which position it engages the cable. The pin 67 is then withdrawn thereby causing the firing pin to engage the cartridge. Thus, the knife moves swiftly through the cable and completely into the recess as shown at A.

It is important that the knife engage the cable, as shown, before the cartridge is fired, since the cable offers a resistance to the movement of the knife until the maximum pressure of the explosive gases has been built up in the explosion chamber, accordingly giving far greater momentum to the knife than would be the case if no resistance were afforded. In some instances where greater speed of the knife is required, a more positive resistance than is offered by the cable may be provided. This may be accomplished in the following manner. An aperture 78 is provided in the piston and another aperture 79 is provided in the barrel, the latter aperture being aligned with the former when the piston is in the starting position as shown in Fig. 1. A shear pin 80 of copper or other suitable metal is inserted with the aperture, as shown in Fig. 3, just prior to the firing. Thus, the movement of the piston is positively retarded, apart from the resistance afforded by the cable, until the explosive gases have been built up to their maximum pressure and when this is accomplished the pin 80 will be cut as well as the cable.

The hereinbefore described construction admits of considerable modification without departing from the invention; therefore, it is the wish not to be limited to the precise arrangements shown and described, which are as aforesaid, by way of illustration merely. In other words, the scope of protection contemplated is to be taken solely from the appended claims, interpreted as broadly as is consistent with the prior art.

What I claim is:

1. In a device of the class described, a cutting element, means for supporting the cutting element, explosive means for actuating the cutting element, and means for confining the explosive gases for preventing recoil of the supporting means.

2. In a device of the class described, an apertured barrel member having a transverse recess at one end thereof and a longitudinal recess adjacent to the transverse recess, a piston carried within the aperture of the barrel, a knife mounted on said piston and adapted for movement in the longitudinal recess, explosive means for actuating the piston and means for confining the explosive gases after the charge is set off.

3. In an explosively actuated cable cutting tool, an elongated barrel having a longitudinal aperture extending therethrough, a portion of the aperture adjacent to the cutting end of the tool being smaller than the aperture at the opposite end thereof, a bushing positioned within said opposite end and a screw cap to secure said bushing in place, a piston positioned within said aperture, said piston having a reduced portion to provide a shoulder to receive the impact from the explosive gases, said barrel having at the cutting end thereof, a cable supporting portion having a semi-circular recess to support the cable, said latter portion also having a longitudinal recess, a knife carried on said piston and adapted to

move within said recess, said recess being of sufficient length to allow the knife to pass completely past the cable supporting recess after the cable has been cut, a cartridge supporting bushing mounted on said barrel, a cartridge supported within said bushing and means for firing the cartridge.

4. In a device of the class described, a cutting element, means for supporting said cutting element, means for actuating said cutting element, said latter means comprising a confined explosive charge, and means for retarding the initial movement of the cutting element until a substantially maximum pressure of the explosive gases has been built up, and means for moving the cutting element beyond the member to be cut after same has been severed.

5. In an explosively actuated cable cutting tool, an elongated barrel having a longitudinal aperture therein, a longitudinally movable element positioned within said barrel, a cutting member carried at one end of said element and explosively actuated means positioned at the opposite end thereof, and a bifurcated cable supporting element through and beyond which the cutting member may pass after the cable has been severed.

6. In an explosively actuated tool for cutting live cable, an elongated barrel having a longitudinal aperture therein, a longitudinally movable elongated element positioned within said barrel, a cutting member carried at one end thereof, and a piston member carried at its opposite end, explosively actuated means positioned between said piston and said cutting element, and a cable supporting element beyond which the cutting member may pass after the cable has been severed.

7. In an explosively actuated device for cutting live cable, an elongated barrel having a longitudinal aperture therein, a longitudinally movable elongated piston positioned within said barrel, a cutting element carried at one end thereof, a shouldered portion at the opposite end thereof to form a piston portion against which the explosive gases may act, and a slotted cable supporting element through and beyond which the cutting element may pass after the cable has been severed.

8. In a cable cutting device of the class described, the combination of an apertured barrel member, having a longitudinal recess at one end thereof, and a cable supporting element adjacent to said recess, a longitudinally movable element positioned within said barrel, a cutting device carried at the rear end of said element and adapted to move within said recess and pass beyond said cable supporting element after the cable has been severed, a shouldered portion at the front end of said longitudinally movable element which forms a piston, and explosively actuated means adjacent to said piston for actuating same.

9. In a device of the class described, the combination of an explosively actuated cutting element and a support for the article to be cut, said support having a slot through which the cutting element may pass after the article has been severed, the slot being of sufficient length to permit the cutting element to pass completely beyond the severed article.

ROBERT TEMPLE, Jr.