Dec. 29, 1964 W. F. BROSKE ETAL 3,163,200

EXPLOSIVELY ACTUATED CRIMPING TOOL

Filed Jan. 12, 1959 2 Sheets-Sheet 1

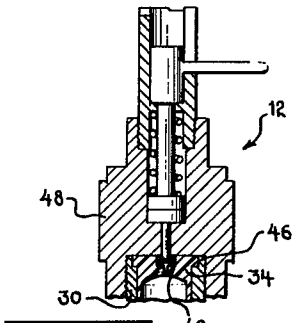


Fig. 5

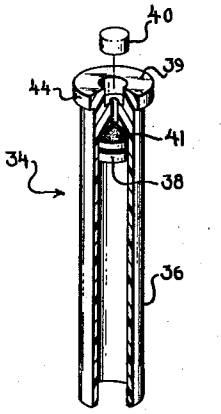


Fig. 4

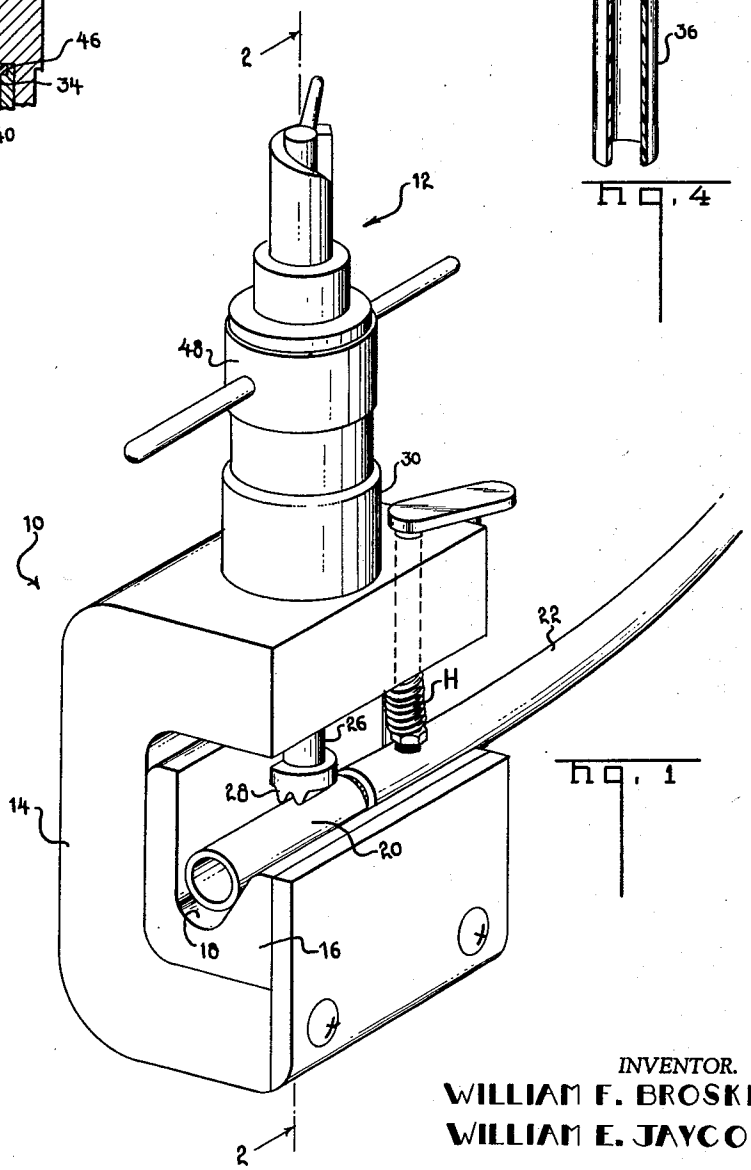


Fig. 1

INVENTOR.
WILLIAM F. BROSKE
WILLIAM E. JAYCOX

Curtis, Morris & Safford

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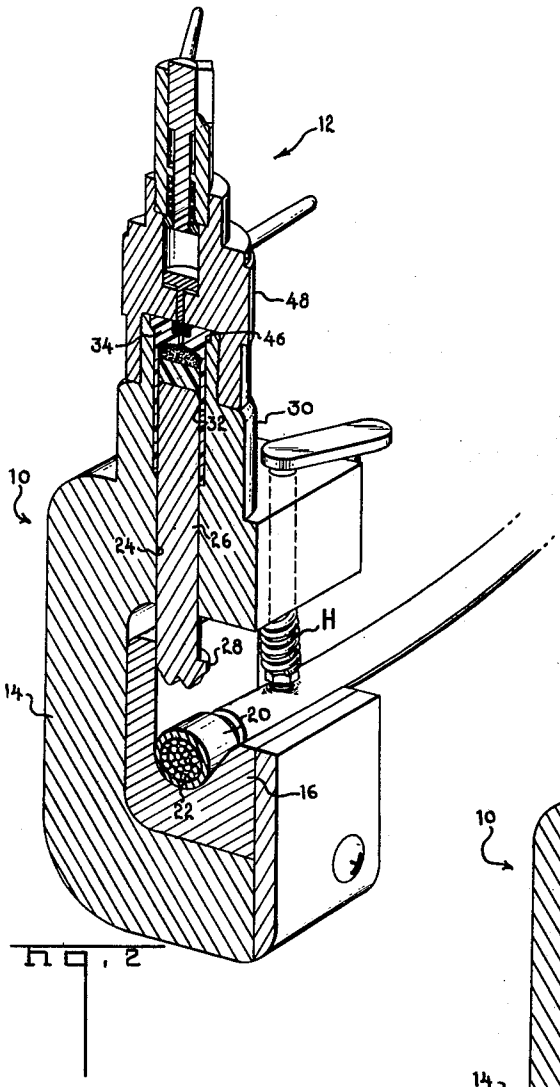


Fig. 2

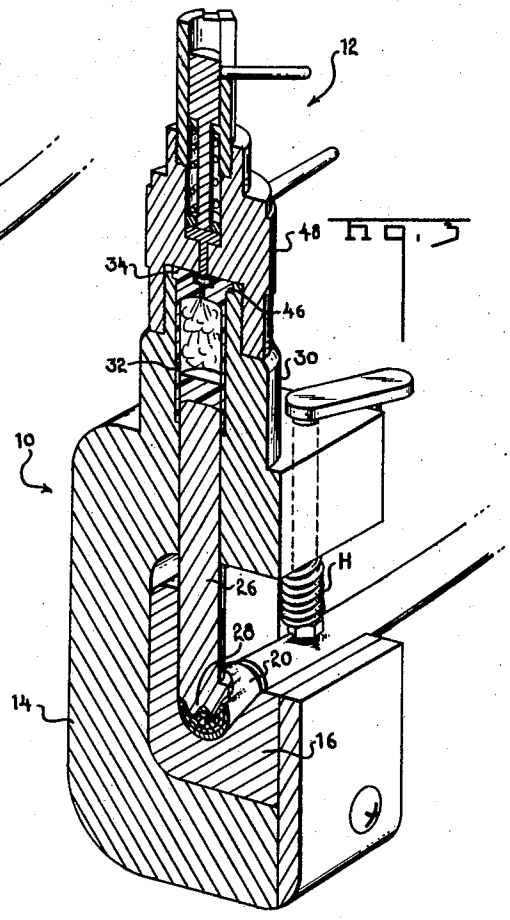


Fig. 3

INVENTOR.
WILLIAM F. BROSKE
WILLIAM E. JAYCOX

Curtis, Morris & Safford

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EXPLOSIVELY ACTUATED CRIMPING TOOL

William F. Broske, Camp Hill, Pa., and William E. Jaycox, Bel Air, Md., assignors to AMP Incorporated, Harrisburg, Pa.

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3 Claims. (Cl. 153—1)

In the art of making crimped electrical connections it is desirable to generate high pressure by low weight, inexpensive tools capable of crimping large size connectors (e.g. one-half million circular mills). Manually operated tools capable of crimping large sized connectors are heavy, bulky, expensive, and require considerable stamina. Furthermore they are not practical for use on connectors larger than 4/0. Even on connectors of the range No. 8 through 4/0 they are difficult to operate and require a large amount of exertion to make a crimp.

Tools powered by electricity are bulky and expensive. Additionally, power is not always available at the situs where the crimped connection is desired, e.g. a utility line.

Applicant provides a crimping tool operated by an explosive charge. A tool of this type permits development of a high thrust in a small, light, inexpensive assembly.

Explosive tools known to the prior art discharge the explosive gases into a barrel which is part of the assembly. The discharge of these gases at firing temperature quickly results in erosion of the barrel. Applicants' invention contemplates discharging these gases into a closed plastic chamber which is a part of a disposable cartridge. The gases quickly cool to a temperature range at which they are relatively harmless and are permitted to bleed gradually from the chamber. Furthermore the plastic expands slightly during the firing cycle whereby it operates as a gas-tight seal. This also serves to reduce to a minimum the noise caused by the explosion.

Thus it is an object of this invention to provide a means for crimping electrical connectors which is capable of crimping a large range of sizes up to extremely large connectors, quickly, easily, inexpensively with a self contained explosive device which is safe, noiseless and emits very little noise.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 is a perspective view of a device in prefired condition illustrating principles of this invention;

FIGURE 2 is a sectional view taken through plane 2—2 of FIGURE 1;

FIGURE 3 is a view similar to FIGURE 2 illustrating the device after firing;

FIGURE 4 is a partially cut away perspective view of the cartridge shown in FIGURES 2 and 3; and

FIGURE 5 is a fragmentary view of the detonating head.

A tool as shown in FIGURE 1, constituting a preferred embodiment of the invention, comprises a body member 10, with a detonating head 12 located thereon.

The particular body member illustrated in the drawings includes a C-shaped frame 14 with a fixed die 16 located

within the frame. The fixed die has a die surface 18 capable of retaining a ferrule type connector "20" with a conductor "22" inside of it. An opening 24 in the frame 14 contains a rod 26 slidably mounted therein and carries a die member 28 on one end so that it cooperates with the fixed die 16.

The detonating head 12 is affixed to the body member coaxially of the opening 24. The head 12 is comprised of a cylindrical member 30 with a central aperture 32 adapted to retain a cartridge 34.

The cartridge (FIGURE 4) includes a plastic cylindrical tube 36 having a plug 38 fitted therein with an interference fit. One end of the tube is closed by a wall-like member 39. A primer 40 is located in the wall member 39 so that it is adapted to detonate a supply of explosive powder 41 contained in the cartridge 34 between the plug 38 and the wall member 39. The wall member 39 has a diameter slightly larger than the diameter of the cylinder 34 to form a rim 44 for seating the cartridge in the tool. Polyethylene is highly satisfactory as a material for fashioning the cartridge and plug although other plastics are suitable.

The rim of the cartridge seats on a shoulder 46 at the outer end of the aperture 32. As shown in FIGURE 2 a cap 48 containing a spring-loaded firing pin aligned with the primer 40 is fitted over the cylindrical member 30. The cap 48 may be threaded or otherwise locked to the cartridge retaining portion of the detonating head, whereby it operates to lock the cartridge in firing positions as well as providing means for detonating the powder charge 41.

A spring loaded holding means generally designated H (FIGURE 1) locates the conductor "22" with the connector "20" while the crimped connection is being made.

Operation

A connector D is positioned in the fixed die 16 with the bare end of the conductor C therein and held in place by a locating means H.

A cartridge 34 is seated in the opening 32 of the detonating head with the rim of the cartridge 44 resting on the shoulder 46. It is noted that the rod 26 of the movable die is located centrally within the bore of the cartridge. The outside diameter of the rod 26 is slightly smaller than the inside diameter of the cartridge.

The detonating cap is locked in place so that the firing pin 50 is aligned with the primer cap 40. The firing pin 50 is then impacted against the primer cap 40 to detonate it. The primer cap in turn detonates the powder charge 41 to drive the plug 38 and the rod 26 toward the connector. The die 28 on the free end of the rod 26 is driven against the connector and conductor with sufficient thrust to crimp the connector and conductor into an intimate metallic mass forming a secure and efficient electrical connection.

The tool illustrated in the drawings is designed so that regulation of the size of the powder charge to the size of the connector controls the crimp depth or degree of compaction. Obviously this could also be by the provision of regulated stops on the dies to control the die travel.

As shown in the drawings (FIGURE 2) the ram piston 26 is disposed so that one end of the ram abuts the plug 38. This relationship causes the crimping die 28 to penetrate deeply into the connector. A lesser penetration may be accomplished (e.g. for smaller connectors) by spacing the end of the ram from the plug. Since part of the energy is expended prior to the accomplishment of useful work, the total useful work performed is less which results in a shallower crimp. The crimp depth may thus be varied according to spacing between the ram and the plug.

The phenomenon occurring with the cartridge during the firing cycle is particularly interesting. The explosive

gases generated by the burning of powder 41 cause the plastic cartridge to expand thus forming a gas tight seal with the opening 32 and cap 48. The plug 38 is driven toward the open end of the barrel 34. The combustion flame and hot gas are contained entirely within the closed barrel 34 while the powder is burning. When the die 28 has compacted the connector and conductor to a degree whereby the resistance of the metal to further crimping is equal to the pressure in the barrel 34, the die travel ceases. The plastic plug 38 being softer than the metal of the piston rod 26 is slightly extruded around the end of the rod. This extrusion pressure in conjunction with a softening of the plastic plug 38 and softening of the plastic inner wall of the chamber 36 due to the heat generated by the hot gases and burning of the powder causes fusion between the plug 38 and the cartridge wall 36 when the plug 38 is in its final position. This contains the hot gases within the cartridge and prevents them from being expelled from the open end of the cartridge. Of course the action is practically instantaneous so that the crimp is made within microseconds after the detonation of the primer 40. Exploding the powder within the closed plastic chamber also serves to muffle the noise of the explosion so that at most only a slight report is heard.

After the charge is fired the gases cool very quickly (again within microseconds) and the plastic tends to return to its original shape. The plastic in its expanded position is fitted very tightly about the primer cap to prevent the escape of combustion gases. Relaxation of the plastic cause the primer to fit loosely within the cartridge thus permitting the combustion gases to escape. However at the lower temperature the gases are sufficiently cool so as to be innocuous and the combustion flame is extinguished. The reduction in temperature results in a corresponding reduction in pressure so that the exhaust gases are bled out slowly under a very low pressure. In fact if the gases were cooled sufficiently in the cartridge, a vacuum would form.

After the crimp is completed the cap 48 is unlocked, the locator mechanism released, and the connector and conductor removed from the fixed die. The action of lifting the connector out of the tool causes the die 28 and the rod 26 to be pried upwardly. The rod 26 bears upon the plug 38 which is now fused to the cartridge. The resultant is that the entire cartridge is forced upwardly so that the rim 44 is raised from the surface 46. This permits the operator to get a grip on the spent cartridge to extract it from the tool quite easily.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

We claim:

1. A device of the type described including a body member, a fixed die in said body member, a movable die in said body member which cooperates with the fixed die, means for actuating said movable die including a piston rod fixed to the movable die, a cartridge having a plastic chamber, one end of said chamber being closed, a plastic plug in said chamber, explosive powder in said chamber between the plug and the closed end of the chamber, said piston rod disposed in the open end of the plastic chamber and means for detonating said powder to drive the piston rod within the chamber whereby the dies are brought into cooperative engagement.

2. A tool of the type described including, a body member, a pair of relatively movable dies, one of said dies having a piston rod thereon, a plastic cartridge having an explosive charge therein and having one end open, said cartridge disposed in said tool with the free end of the piston rod disposed in said cartridge, means for detonating said cartridge and means disposed within the cartridge for containing the combustion gases completely within the cartridge while permitting said gases to actuate the piston rod.

3. The device of claim 2 wherein the last named means comprises a plastic plug in the cartridge between the explosive charge and the piston rod.

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