April 18, 1950 R. MacLATCHIE, JR 2,504,338

ELECTRIC POWER APPLICATOR

Filed June 30, 1945

Fig. 1.

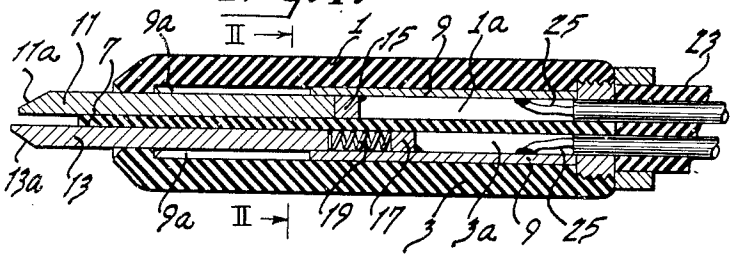


Fig. 2.

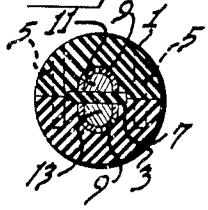


Fig. 3.

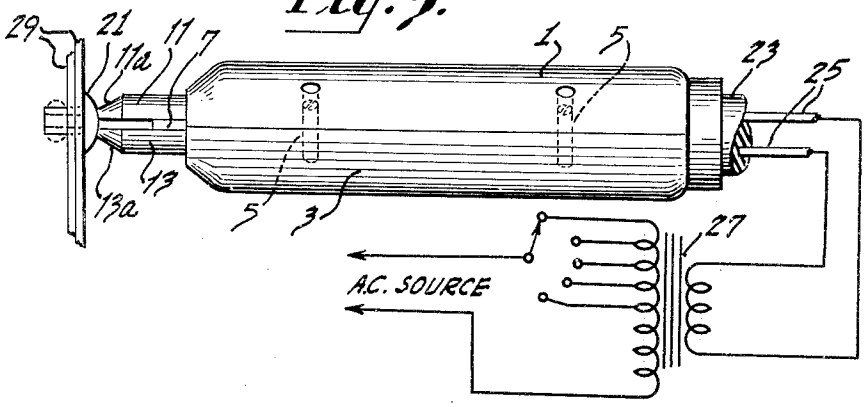
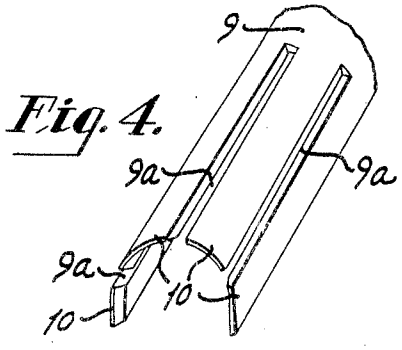


Fig. 4.



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ELECTRIC POWER APPLICATOR

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2 Claims. (Cl. 219—21)

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This invention relates to an electric power applicator, and more particularly to an applicator or tool for applying heating current to workpieces such as the so-called explosive rivets.

Rivets of this type are provided with a hollow shank in the bore or cavity of which a small charge of explosive is placed. When the rivet is heated, the charge explodes and causes the shank of the rivet to expand, thereby firmly uniting two or more parts through which the rivet extends.

For heating such rivets by means of an electric current, various tools have been provided heretofore. For example, heating irons similar to conventional soldering irons have been utilized for this purpose, as have also induction heating devices employing radio frequency current. These and similar devices of the prior art are subject to certain disadvantages. Thus, such devices are generally extremely bulky and heavy to hold in the hand. Operators using such tools tire quickly. Another common objection to prior art tools of this sort is that they consume a relatively large amount of power and are, at best, relatively inefficient devices. In the case of tools operating with radio frequency current, the cost of operation is an important item.

The primary object of my present invention is to provide an improved electric power applicator which is free from the above mentioned and other disadvantages characteristic of prior art applicators.

More particularly, it is an object of my present invention to provide an improved electric power applicator or tool which is particularly useful for detonating explosive rivets and which is rapid, economical, and highly efficient in operation.

Another object of my present invention is to provide an improved power applicator as above set forth which is simple in construction and light in weight.

Still another object of my present invention is to provide an improved power applicator as aforesaid which can be used successfully even by one unskilled in the art and which will not tire the operator even after continued or prolonged use.

In accordance with one form of my invention, I provide a hollow, tubular casing of a material which has good heat and electrical insulating properties, and divide the casing into two parts by means of a longitudinally and diametrically extending partition of electrical insulating material. In each of the casing parts, there is disposed a separate electrode, each of the electrodes having a portion which protrudes from one end of the casing for engagement with the rivet head

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or other suitable workpiece. The electrodes may both be made of carbon or graphite, or one of them may be made of metal, such as copper. However, at least one of the electrodes or the portion thereof which engages the workpiece should be made of carbon or graphite. When one metal electrode is used and several rivets are to be detonated in a large, contiguous metal surface, the metal electrode may be attached to the body of the metal surface, in which event the metal being riveted forms a part of the electric circuit. Whether one or two carbon electrodes be used, it is essential that the carbon be in contact with some portion of the rivet surface, preferably the head, in order to include the rivet in the electric circuit whereby to cause the rivet to be heated when current is passed therethrough.

Either an alternating current or direct current electric circuit may be employed. Operating voltage may range from a fraction of a volt up to ten volts or more, and current may range from a few amperes to one hundred or more amperes, both voltage and current being dependent upon the mass of the rivet and the time interval desired for detonating. Heating of the rivets is both primary and secondary. Primary heating is caused by the high current density flowing through the rivet, and the secondary heating by radiation and conduction from the carbon contact. Various carbon and graphite compositions may be used to afford variation in control of electrical resistance and heating effects.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description of one embodiment thereof, when read in connection with the accompanying drawing, in which

Figure 1 is a central, longitudinal, sectional view of one form of tool or applicator according to my present invention,

Figure 2 is a sectional view taken on the line II—II of Figure 1,

Figure 3 is a side elevation of the tool shown applied to a rivet head, and

Figure 4 is a fragmentary, perspective view of one form of clamping device for the electrodes.

Referring more particularly to the drawing, wherein similar reference characters designate corresponding parts throughout, there is shown a tool or applicator constituted by a tubular casing formed of two hollow, semi-cylindrical casing

parts 1 and 3 made of a material which has good heat insulating and electrical insulating properties. One such material, for example, is hard asbestos. The casing 1, 3 serves as a handle by means of which the tool may be manipulated by an operator. The casing parts 1 and 3 may be held together by any suitable means, such as the screws 5.

A partition 7 of electrical insulating material extends longitudinally along and diametrically across the tubular casing 1, 3 to divide it into two parts having chambers 1*a* and 3*a*. Within each chamber is a resilient, electrode clamping member 9, shown in detail in Figure 4. The clamping members 9 may be constituted by tubing or channelling of berillium-copper alloy or any other suitable, resilient metal and are formed with one or more longitudinally extending slots or cuts 9*a* to provide tabs 10 which may be bent inwardly slightly. Also within the chambers 1*a* and 3*a*, are a pair of cooperating electrodes 11 and 13, the electrodes being electrically insulated from each other by the partition 7 and being clamped or gripped within their respective compartments by the inwardly sprung gripping tabs 10.

The electrode 11 is disposed against a copper or other suitable block 15 which may be brazed or soldered to the upper clamping member 9 and acts as a stop which fixes the position of the electrode 11 within the casing so that its work engaging tip 11*a* will protrude or extend from the casing a short distance at all times. The lower clamp 9 is also provided with a similar stop block 17, and a coil spring 19 is interposed between the block 17 and the inner end of the electrode 13. The spring 19 normally forces the electrode 13 outwardly to a position where its work engaging tip 13*a* will protrude from the casing somewhat in advance of the tip 11*a*, as best seen in Figure 1. However, when the electrode tip 13*a* is placed against a workpiece, such as the head of a metallic rivet 21, and pressure is applied, the spring 19 will yield and the electrode 13 will be forced farther into the casing until the electrode tip 11*a* also comes into contact with the conductive workpiece which then bridges the two electrodes.

Current may be supplied to the electrodes 11 and 13 through a two conductor cable 23 having leads 25 which are soldered at one end to the clamps 9 and are connected at the other end to a suitable source of alternating current through a transformer 27. If desired, a direct current source may be employed, in which case, of course, the transformer 27 may be dispensed with. When the electrode tips 11*a* and 13*a* are brought into engagement with the conductive rivet head, the circuit is completed and the current passing through the rivet quickly heats it to explode a charge of explosive within the hollow shank thereof. The shank then expands to cause a pair of sheets 29 through which it extends to be firmly united in known manner.

The electrodes 11 and 13 are preferably both made of carbon or graphite, although one may be made of copper or other suitable metal, if found desirable in certain cases. Various grades of carbon or graphite welding rods of about $\frac{5}{16}$'' diameter are readily obtainable. These may be cut or ground to the desired shapes and may be electrodeposited with copper, if desired. In the latter case, the contact surfaces (the tips 11*a* and 13*a* in the modification described above) must be shielded during plating, or else the plating must be removed therefrom. The copper coating may be found desirable since it functions to reduce the electrical resistance at the points of contact between the carbon electrodes and the clamps 9, but if it is not, of course, absolutely essential. The important thing is to have the work engaging portions of carbon, graphite or the like to minimize the possibility of arcing or corona discharge with consequent undue wearing of the electrodes and marring of the work.

A carbon electrode applicator such as described above utilizes the electric energy in a very efficient manner because, among other things, it consumes power only during the actual heating process while the electrodes are in contact with the work and it converts a very large proportion of the input energy to useful heat in the work. This is in marked contrast to prior art applicators many of which require preheating and otherwise needlessly dissipate heat. Moreover, an applicator according to my invention is small in size and very light in weight (only several ounces) as a result of which and the further fact that it generates heat only when in engagement with the work (so that it does not itself heat up much) operator fatigue is minimized. Its small size also makes it easier to manipulate, and by backing the electrode 13 up with the spring 19, the electrodes can be applied to the work effectively at any angle. In addition, it may be pointed out that the carbon electrodes are very inexpensive and require little or no care.

Although I have shown and described but one embodiment of my invention, it will be undoubtedly be apparent to those skilled in the art that many modifications thereof are possible. Hence, I desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. An electric power applicator for feeding current to a workpiece, said applicator comprising a tubular casing of insulating material constituting a handle, an insulating member within said casing extending diametrically across and longitudinally along said casing and dividing said casing into two hollow parts, a pair of electrodes within said casing one in each of said parts, said insulating member maintaining said electrodes in electrically insulated relation to each other, said electrodes having work engageable portions extending out of one end of said casing and adapted to be bridged by the workpiece when applied thereto, one of said electrodes being mounted for longitudinal movement within said casing relative to the other of said electrodes, means associated with said electrodes for coupling said electrodes to a source of electric energy, and yieldable means for projecting said movably mounted electrode a greater distance out of said casing than said other electrode whereby the work engageable portion of said movably mounted electrode normally occupies a position in advance of the work engageable portion of said other electrode.

2. An electric power applicator for feeding current to a workpiece, said applicator comprising a tubular casing of insulating material constituting a handle, an insulating member within said casing extending diametrically across and longitudinally along said casing and dividing said casing into two hollow parts, a pair of conductive clamping members within said casing one in each of said hollow parts, a pair of electrodes within said casing one also within each of said parts, said clamping members having resilient

elements arranged to engage and grip their respectively associated electrodes for holding said electrodes in place within said casing and for providing electrical contact between said electrodes and said members, said insulating member maintaining said electrodes in electrically insulated relation to each other, said electrodes having work engageable portions extending out of one end of said casing and adapted to be bridged by the workpiece when applied thereto, stop means in each of said casing parts associated with the inner ends of said electrodes for determining the extent to which said electrodes will extend out of said casing, and means connected to said conductive clamping members for coupling said electrodes to a source of electric energy.

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