This invention relates to means for applying fasteners, more especially fasteners having dissimilar fastening portions.

Certain kinds of fastening devices are provided with dissimilar fastening portions for holding differently shaped portions of one or more elements in a definite relation, and the object of this invention is to provide means for simultaneously clenching the dissimilar fastening or holding portions of such a fastening device.

For example, the terminal portions of electrical conductors for certain purposes are commonly provided with so-called "terminal clips" to facilitate connection with binding posts, to insure satisfactory electrical contact and to reinforce the conductors in a way to guard against weakening or rupturing the connections as a result of tightening the binding nuts or of strains tending to pull the conductors from the binding posts. A known form of terminal clip for this purpose consists of a piece of ductile sheet metal having a grommet portion and other portions adapted to be bent or curled around the conductor. The approved mode of applying such a clip is to bend the terminal portion of the conductor to form an eye, to insert the grommet portion of the clip through said eye and clench it to reinforce the latter and to secure the two permanently to each other, and to bend or curl the other portions of the clip around the body of the conductor adjacent to the eye to supplement the holding effect of the grommet portion and to guard against rupturing the conductor at the bend where the eye portion joins the body portion.

It has heretofore been necessary, in applying a clip of the character stated, to perform two separate and successive operations, one to secure the grommet portion of the clip to the eye portion of the conductor and the other to secure the other portion of the clip to the body portion of the conductor. To avoid the inconvenience of having to perform two separate operations and to eliminate the labor cost incidental to one of them, particularly when it is undertaken to apply such clips in large quantities for the trade, a purpose of the invention, stated more specifically, is to provide an improved combination of dies adapted to function simultaneously to clench or otherwise impart final holding shape to a plurality of dissimilar holding portions of a device of the character above described.

Accordingly a feature of the invention consists in a novel construction and organization of means for clenching a holding portion of a metallic fastening device and means for simultaneously clenching another kind of a holding portion of said device. In the broader aspect of the invention the means for clenching one holding portion may comprise a pair of cooperative mated dies while the means for simultaneously clenching the other holding portion of the device may comprise another pair of cooperative mated dies, and so long as one die of each pair is arranged to execute its working movement simultaneously with the corresponding movement of a die of the other pair it is not necessary to form the unmated die elements as integral portions of a single piece or part. Nevertheless I prefer the integral construction for two unmated dies and a non-integral construction for the other two and have therefore disclosed the invention in that form.

Other features of the invention are hereinafter described and claimed and are illustrated by the accompanying drawing.

Fig. 1 is a perspective view of a suitable die-press equipped with compound dies embodying this invention in a preferred form; Fig. 2 is a side elevation of the operating tools at an intermediate stage of closing, the reinforcing clip being in its initial condition but about to undergo the first stages of transformation;

Fig. 3 is a perspective view, partly in section, of the operating tools and between them a portion of a conductor with a terminal clip assembled therewith ready to be transformed and clenched;

Fig. 4 is a vertical section in which the forming tools are closed on the work, the terminal clip having been transformed and clenched; and

Fig. 5 is a perspective view of a portion of an electrical conductor to which a terminal clip has been applied and clenched.

The conductor 10 shown by the drawings comprises a plurality of strands of fine wire and it is encased in a cover 11 of insulating material. The terminal portion 12 of the conductor is bared and bent to form...
an eye for attachment to a binding post (not shown).

The illustrated form of terminal clip for reinforcing the conductor is made of a single piece of ductile sheet metal such as brass, and is preliminarily formed to provide a gromet portion, including a barrel portion 13 and a substantially annular flange portion 14, and an outlying holding portion including cooperative ears 15, 15. The holding portion comprising said ears is initially U-shaped in cross-section and adjoins the flange 14.

When the conductor and the reinforcing clip are assembled as shown by Fig. 2 the body portion of the conductor lies in the channel formed by the ears 15, 15 while the eye portion 12 surrounds the barrel portion 13 and lies on the flange 14. To secure the clip to the conductor it is necessary to burst the barrel portion 13 into a plurality of outwardly projecting prongs 16 and to clench these prongs on the eye portion 12 as shown by Fig. 4. It is also necessary to bend or curl the ears 15, 15 toward each other so that they will embrace tightly the covering 11 of insulating material as shown by Fig. 4. The gromet portion of the clip then reinforces the eye portion 12 of the conductor and confines the strands in contact relation, at the same time effecting a tight connection between the conductor and the clip to prevent the conductor from being pulled away from its anchorage. The ears 15, 15, when closed or clenched to embrace the insulating material tightly, nearly meet and form a substantially tubular holding portion which prevents the insulating material from slipping away from the eye portion and prevents the conductor from breaking at the point where the eye portion begins.

The illustrated means for applying the clip to the conductor comprises a die member 20, a die member 21 and a clenching tool 22 rigidly but adjustably related to the latter and having an annular die portion for acting on the barrel 13. A set-screw 23 is arranged to maintain the members 21 and 22 in the desired position of adjustment. The die member 20 is preferably arranged to support a partially formed reinforcing clip in a convenient position for assembling the electric conductor therewith, and is therefore formed with a depression adapted to conform to that side of the reinforcing clip which requires no further shaping, the annular die portion 24 of said depression conforming to the flange 14 while the U-shaped trough portion 25 conforms to the part intended to embrace the insulating material 11. A spring-pressed spindle 26 projects normally from the center of the portion 24 to register the barrel portion 13 relatively to the clenching tool 22. The member 20 is formed to be seated on a supporting element such as the base or bed 27 of a die-press and is provided with a hollow stem 28 adapted to enter a socket in the base 27 and to contain a compression spring 29 for normally projecting the spindle 26. This die member may turn to any desired position about the axis of the stem 28 and may be fastened by a set-screw 30. For a right-handed workman it is most convenient to have the outlying portion of the conductor 10 at the left and accordingly the die member 20 is so adjusted in the die press that the trough portion 25 extends toward the left from the spindle 26.

The clenching tool 22 comprises not only the screw-threaded portion 31 for holding the die member 21 but comprises also an extension or stem 32 by which to secure it to a moveable pressure-applying holder such as a plunger 33. The plunger, as shown, is divided into segments to form a chuck, the latter being indicated as a whole at 34. The smooth stem 32 may therefore be clamped by the chuck in any position according to the position of the die member 20. The plunger 33 is arranged to slide up and down in an overhanging head 34, the upper end of the plunger being above the head and underlying an operating lever 36. This lever is connected with the chuck by a fulcrum pin 37 and extends to the rear for connection with an operating rod 38. If the die-press is mounted on a bench the rod 38 would commonly extend to a treadle (not shown). When the treadle is operated to depress the lever 36 the latter will move the clenching tool 22, and with it the die member 21, toward the die member 20, and the die press will impart to the reinforcing clip the final holding shape shown by Figs. 3 and 4. A compression spring 39 is arranged in the head 35 to raise the plunger 33 when the operating mechanism is released. A clench tool 40 extends through a slot 41 in the head and is carried by the plunger to prevent the latter from turning about its axis.

The die member 21 is provided with converging surfaces 42, 42 connected by a semicylindric surface 43 for curling the ears 15 inwardly and for closing them tightly upon the insulating material 11. In practice the die member 21 will be so adjusted relatively to the clenching tool 22 as to act on the ears 15, 15 while the clenching tool is acting on the barrel portion 13. The clenching tool is provided with a pilot portion 44 which enters the barrel portion 13 before the bursting of the barrel portion begins, and this pilot portion is preferably long enough to enter the barrel portion before the surfaces 42, 42 touch the ears 15, 15. The portion 44 therefore prevents the gromet portion from being displaced by the initial bending action of the surfaces 42 on the ears. The relative adjustment of the die member
21 and clenching tool 22 afforded by the screw-thread 31 is sufficient to compensate for variations in the thickness of the insulating material 11 and for variations in the size of the conductor 10, and in case it is found that the ears 15 are not being closed tightly enough upon the insulating material when the prongs 16 of the grommet portion are tightly clouched, it is only necessary to loosen the set-screw 23 and turn the die member 21 one or more turns about the clenching tool to obtain a tight embrace by the ears. On the other hand, if the prongs 16 do not clench the eye portion 12 tightly when the ears are tightly curled about the insulating material the desired correction may be obtained by turning the die member 21 in the opposite direction about the clenching tool.

Although, for quantity production, the compound dies would preferably be associated with a bench machine of the general character illustrated, they may also be mounted in a hand tool of well-known construction comprising relatively movable handles pivotally connected and having relatively movable jaws operated thereby to carry the dies. This type of hand tool is more convenient for individual jobs such as repair work on automobiles, in which case it is preferable to take the tool to the job than to take the conductors from the job to a bench machine.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A fastener-applying device comprising two relatively movable pressure-applying members, and two dissimilar pairs of fastener-engaging dies carried by said members, one of said pairs of dies being formed and arranged to clench a holding portion of a fastener and the other one of said pairs being otherwise formed and arranged to transform another portion of said fastener while said clenching dies are functioning.

2. A fastener-applying device comprising two relatively movable pressure-applying members, and two dissimilar pairs of fastener-engaging dies carried by said members, the dies of one of said pairs being annular and arranged to impart an outward clench to a-g-barrel portion of a compound fastener and the other one of said pairs being otherwise formed and arranged to impart an inward clench to another holding portion of said fastener while the pair first specified is functioning.

3. A fastener-applying device comprising two relatively movable units having mated portions adapted to clench a grommet portion of a fastener element in position to reinforce an eye of an electric conductor and having other mated portions formed and arranged to transform an initially trough-shaped portion of said fastener into a tubular shape while the first said mated portions are clenching said grommet portion as aforesaid.

4. A fastener-applying device comprising two relatively movable units having two mating couples of operating dies for simultaneously applying dissimilar holding portions of a compound fastener, one of the dies of one of said units being carried by and adjustable relatively to the other die of that unit.

5. A fastener-applying device comprising means adapted to hold a compound fastener having a grommet portion and another holding portion of a different type, an externally threaded tool having a die surface at one end for clenching said grommet portion and a die member carried by the threaded portion of said tool for transforming said other holding portion, said tool and said die member being relatively adjustable by reason of their screw-threaded connection.

6. A fastener-applying machine comprising two pairs of dies arranged to operate simultaneously upon two individual holding portions of a single fastener member, one of said pairs of dies being formed to transform one of said holding portions from a partially developed to a fully developed tubular formation, and the other one of said pairs being formed to impart a clenching formation to the other one of said holding portions.

7. A machine of the character described comprising means for supporting and registering an electric terminal clip having a grommet portion and an initially U-shaped holding portion, a tool formed and arranged to clench said grommet portion, means for holding said clenching tool, means for relatively moving said supporting and said holding means to effect clenching action of said tool, and means rigidly related to said clenching tool for transforming said U-shaped portion to a substantially tubular shape while said clenching tool is clenching said grommet portion.

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

WILLIAM HUGHES.