

March 28, 1961

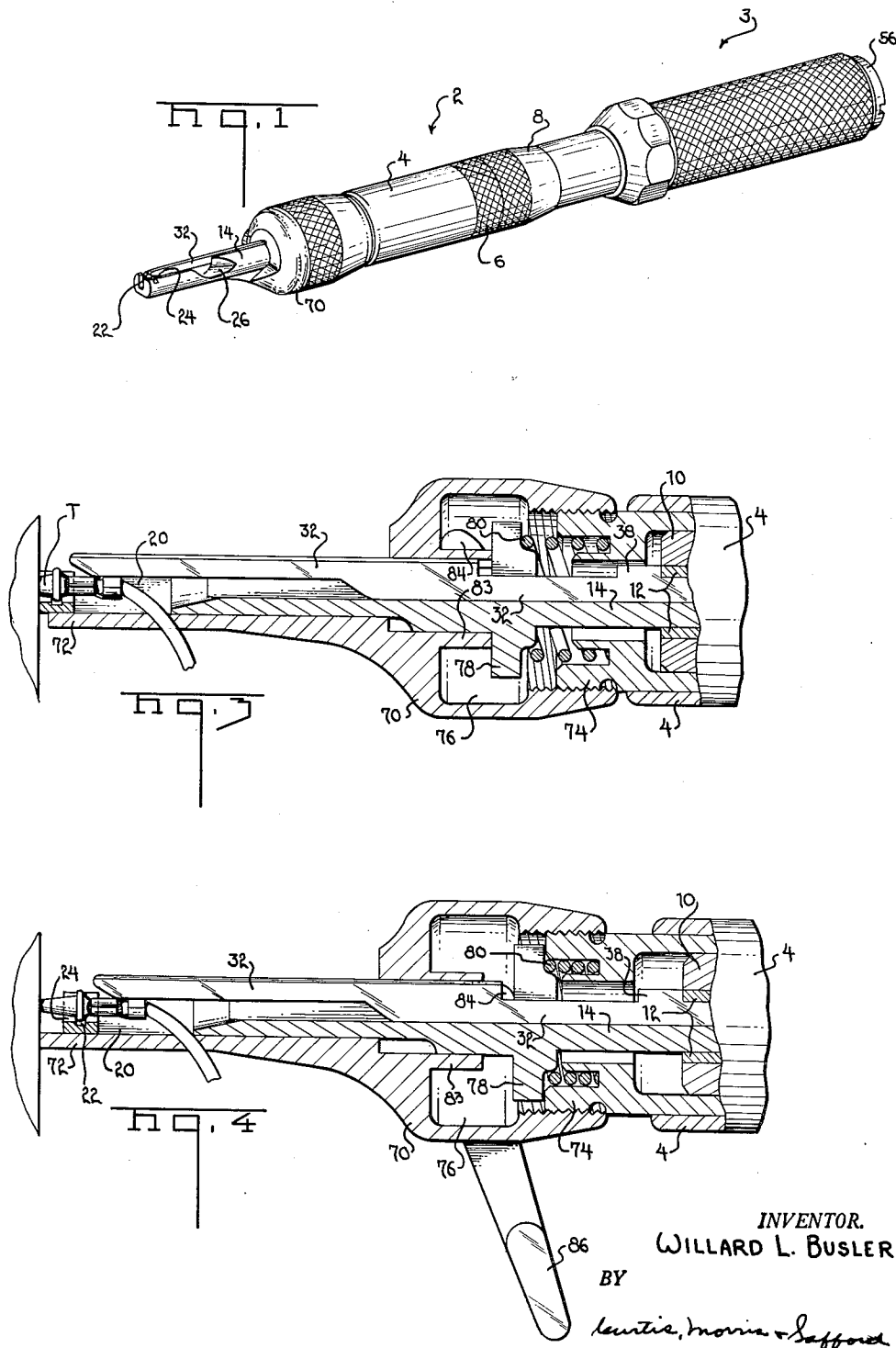
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TAPER PIN EXTRACTING TOOL

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2 Sheets-Sheet 1



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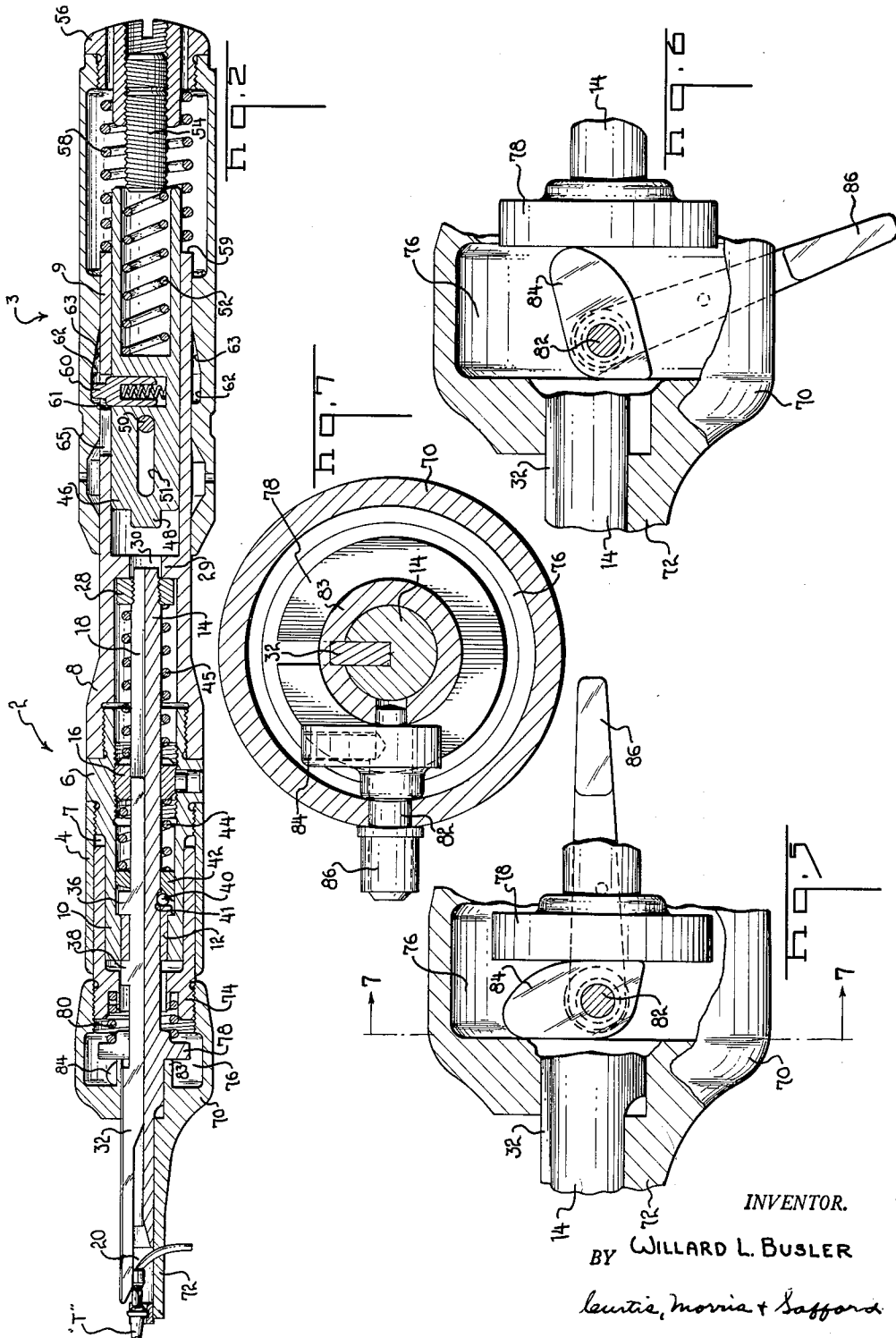
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TAPER PIN EXTRACTING TOOL

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3 Claims. (Cl. 29—254)

This invention relates to hand tools for inserting and extracting taper pin electrical connectors from receptacles.

Taper pin connectors are widely used for making permanent and semi-permanent electrical connections and are particularly useful for connecting relatively small wires. It has been found that for best results, connectors of this type should be inserted by the application of an impact blow of predetermined magnitude and that if a pin has been properly inserted, the integrity of the connection can be determined by applying a pull test to the pin. For example, it has been found that one type of taper pin requires a force of 25 to 30 pounds for extraction if the pin is properly inserted into its receptacle. With this particular pin, the effectiveness of the insertion can be established by applying a pull test of about 10 pounds to the pin. If the pin withstands this 10 pound pull test, it will withstand additional pull testing to the level of about 25 pounds but if it was improperly inserted, the pin will be extracted by the 10 pound pull test. Tools are known to the art which combine an impact type hammer for inserting taper pin electrical connectors with a pull test device so that at the time a pin is inserted the operator can perform a pull test in order to establish the integrity of the electrical connection.

It is a desideratum in this art to provide also a means for purposely extracting taper pins from their receptacles when it is desired to make circuit changes requiring modifications of wiring. As noted above, some relatively small taper pins require a pull of about 25 pounds for extraction. If the pin is extracted from its receptacle by merely grasping the wire to which the pin is attached and pulling, the entire strain of the extracting operation is transmitted through the connection (which may be crimped or soldered) between the end of the wire and the pin. Obviously it would be preferable to apply the extracting force directly to the pin in order to avoid the possibility of damage to this connection between the wire and the pin.

It is, accordingly, an object of the present invention to provide a tool for extracting taper pin electrical connectors from their receptacles. It is a further object to provide a single tool having means for inserting taper pins into receptacles, means for extracting taper pins from receptacles, and embodying a compulsory pull test feature so that each pin inserted with the tool must be pull tested by the operator.

These and other objects are achieved in a preferred embodiment comprising a rod, a spring loadable hammer for delivering an inserting blow to the end of the rod, means for gripping the pin on the end of the rod and a detent means for maintaining the gripping means in contact with the pin. The preferred embodiment provides also a pin extracting device comprising a collet in surrounding relationship to the rod and having an extension which projects to a point adjacent the rod tip. This collet is normally maintained in a retracted position

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by a spring so that it does not interfere with the use of the tool during a pin inserting operation. A cam is provided on the collet which acts between the rod and the collet so that upon actuation of this cam, the collet extension is moved relatively beyond the tip of the rod. When it is desired to extract a pin then it is gripped by the tip of the rod and the cam is thereafter actuated to cause the extension to move relatively beyond the rod tip. As it does so, it comes to rest against the receptacle in which the taper pin is positioned and upon further movement of the cam, the rod itself moves relatively away from the receptacle and carries with it the taper pin.

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 drawing;

Figure 1 is a perspective view of a preferred embodiment;

Figure 2 is a sectional view of the embodiment of Figure 1;

Figure 3 is a sectional view of the end of the tool showing details of the pin extracting features of the tool;

Figure 4 is a view similar to Figure 3 showing the relative positions of the parts during a pin extracting operation;

Figures 5 and 6 are views similar to Figures 3 and 4 respectively but with parts broken away; and

Figure 7 is a view taken along the line 7—7 of Figure 5.

The preferred embodiment comprises a tool barrel 2 and a handle 3, the barrel 2 being composed of three separate sections, 4, 6 and 8. The center section 6 has a reduced diameter cylindrical extension 10 and threadedly receives the lower end section 4 and the upper end section 8. End section 4 comprises a simple cylindrical sleeve which is in concentric relationship to extension 10 so that a recess 7 left between the outer surface of section 10 and the inner surface of end section 4. The upper end section 8 projects upwardly for a substantial distance into handle 3 as shown at 9 and is axially hollow for substantially all of its length.

The lower end of extension 10 is provided with a bushing 12 which slidably supports a rod 14, this rod being supported additionally by a nut 16 threaded into the bore of the central section 6. Rod 14 has an axial slot 18 extending for substantially its entire length and has a cavity 20 at its lower end for the accommodation of the taper pin. The taper pin T is held by means of a slot or groove 22 at the tip of the rod and a transverse groove 24 into which the collar of the taper pin extends. As shown best in Figure 1, an oblique recess or opening 26 is provided in the rod 14 adjacent cavity 20 for the accommodation of the wire to which the pin is attached. The upper end of rod 14 has a stop nut 28 threaded thereon which bears against the surface of an internal constriction or wall 29 in the bore of end section 8. The upper end of the rod projects partly into a reduced diameter opening 30 in this wall to permit delivery of an impact blow as described below.

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A key 32 is slidably received in groove 18 and provides ears 36, 38 intermediate its ends. Ear 36 extends into the bore of barrel section 6 between the upper end of bushing 12 and the lower face of a slidable bushing 42. This slidable bushing is normally biased downwardly by a coil spring 44 which acts between the lower surface of nut 16 and the upper face of the bushing 42. The lower face of the bushing is bevelled as shown and bears against a plurality of ball bearings 40 (only one of these ball bearings being shown in the drawing). These bearings extend into a relatively shallow circumferential groove 41 in rod 14 and are urged against bushing 12 by spring 44 so that relative movement between the rod and the barrel 2 is not possible until these bearings are cammed outwardly. The end of key 32 extends over cavity 20 and holds the taper pin in this cavity when the parts are in the positions shown in Figure 2.

The tool handle 3 and the portion 9 of end section 8 may contain any suitable type of spring-loadable impact hammer. In the disclosed embodiment the hammer 46 is received within the bore of the cylindrical portion 9 of the tool barrel and has a projection 48 on its lower face which is adapted to enter reduced diameter bore 30. A pin 50 extends through a slot 51 in the hammer and also through an oversized slot in the upper portion 9 of the tool barrel and is mounted at its ends in the handle 3 thereby to permit relative motion between the hammer, the handle, and the end 9 of the barrel. The upper end of the hammer is axially bored for the reception of a coil spring 52 which bears against the face of a screw 54 in the cap piece 56 on the upper end of the tool handle. An additional spring 58 surrounds the hammer and is imposed between the upper end 59 of barrel portion 9 and the face of the cap piece. A spring biased detent 60 in the hammer projects through a circular opening in the tool barrel extension and into a circumferential groove 62 on the inside surface of the tool handle. This groove tapers inwardly as shown at 63 to cam the detent inwardly as the handle is moved downwardly in the drawing. In order to permit relative motion between the hammer 46 and the barrel extension 9, there is provided a slot 65 in the barrel extension which slot opens into circular opening 61 and which is sufficiently wide to receive the reduced diameter end of the detent.

The features of the tool which have been described thus far are disclosed and claimed in the application of Harold E. Cootes et al., Serial No. 724,352 filed March 27, 1958 for Hand Tool and a lengthy description of these features is therefore deemed unnecessary. It is sufficient to say that in use and with the parts in the positions shown in Figure 2, the operator aligns the pin with the opening in the receptacle and pushes on the handle portion of the tool. As he does so, this handle moves relatively downwardly as viewed in the drawing and the spring 52 is compressed. At the same time, detent 60 is cammed inwardly until its larger diameter portion is disengaged from barrel extension 9. Upon such disengagement, the hammer is propelled against rod 14 and its kinetic energy is transmitted to the rod when the projection 48 of the hammer strikes the upper end of the rod. The impact blow thus delivered to the taper pin through the rod completes the insertion operation and the tool can thereafter be removed from the pin. It should be noted that downward movement of the hammer is permitted by virtue of slot 65 which permits downward travel of the detent when the detent is depressed.

The operator cannot, however, release the taper pin from the tool until the key 32 is moved relatively rightwardly as viewed in Figure 2 with respect to the rod 14. This can be accomplished by applying a pulling force to the tool handle which pulling force is transmitted through bushing 12 to the ball bearings 40. The reaction force in the rod is also transmitted to the ball bearings and they are, as a result, cammed outwardly against the force of spring 44. When these ball bear-

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ings are cammed outwardly, the tool barrel is free to move relative to the rod and the key moves with the tool barrel. Thus the barrel and key move relatively upwardly while the rod remains stationary and the taper pin is released from confinement by the key. Advantageously a coil spring 45 is provided between the faces of the nuts 16, 28 to cushion the movement of the barrel after the ball bearings have been cammed out of groove 41.

The taper pin extracting device on the tool comprises collet 70 which surrounds the rod and has an extension 72 projecting therefrom along the rod. When the parts are in the positions shown in Figure 2, the end of this projection is located to the right of the tip of the tool so that it does not interfere with the use of the tool for an inserting operation. The collet is biased upwardly by means of a spring 80 which acts between a collar 78 integral with rod 14 and an extension 74 on the collet. This extension, which comprises a cylindrical sleeve, is received in the circumferential recess defined by the sleeve 4 and the lower end 10 of the intermediate section of the tool barrel. When it is desired to remove or extract a taper pin it is necessary to move the collet and extension 72 downwardly relative to the rod and such motion is accomplished by means of a cam 84 secured by a set screw to a pin 82 in the hollow interior 76 of the collet. Pin 82 is rotatably mounted in the wall of the collet and in a circular flange 83 in the collet, and has a handle 86 on its end. Upon turning of this handle, the cam causes the rod 14 to move relatively rightwardly as viewed in Figures 5 and 6 and the collet itself to move relatively leftwardly. Since the collet extension can not move beyond the surface of the taper pin receptacle, the rod moves upwardly during the final stages of the operation and the pin is extracted.

A salient advantage of the invention is that the technician can be provided with a single tool capable of performing all of the necessary operations for the making of taper pin connections and the extraction device on the end of the tool in no way effects the normal usage of the tool for insertion and pull testing although this extraction device is immediately available when needed.

I claim:

1. A tool for taper pin electrical connectors comprising, a rod, means on one end of said rod for holding a taper pin, a tool barrel in surrounding relationship to said rod, with said one end extending beyond said tool barrel, means within said tool barrel for delivering an impact blow to the opposite end of said rod, a collet in surrounding relationship to said rod adjacent said one end, an extension on said collet extending along said rod, resilient means acting between said rod and said collet and normally urging said collet towards said barrel, and means in said collet for moving said collet relatively away from said tool barrel against the force of said resilient means thereby to move said extension beyond said one end and to permit removal of a taper pin from a receptacle by relative movement of said rod away from the receptacle.

2. A tool for taper pin electrical connectors comprising, a rod, means on one end of said rod for holding a taper pin, a tool barrel in surrounding relationship to said rod, said one end extending beyond said tool barrel, means within said tool barrel for delivering an impact blow to the opposite end of said rod, a hollow collet in surrounding relationship to said rod and disposed adjacent said one end, an extension on said collet extending along said rod towards said one end, a collar integral with said rod disposed within the hollow interior of said collet, resilient means acting between said collet and said collar normally to urge said collet away from said one end, and cam means within said hollow interior of said collet to displace said collet relatively towards said one end thereby to move said extension beyond said one end and to permit removal of a taper pin from a receptacle by relative movement of said rod away from said one end.

3. A tool for taper pin electrical connectors comprising, a rod, holding means on one end of said rod for holding a taper pin, a tool barrel in surrounding relationship to said rod, said one end extending beyond said tool barrel, means within said tool barrel for delivering an impact blow to the opposite end of said rod, a locking key on said rod and extending towards said one end, means acting between said rod, said locking key, and said tool barrel for releasably maintaining said locking key in a position with its end extending over said holding means thereby to lock a taper pin in said holding means, an internally hollow collet in surrounding relationship to said rod and said locking key, a collar on said rod within the hollow interior of said collet, an extension on said collet extending along said rods towards said one end a spring acting between said collet and said collar and normally

urging said collet away from said one end, and cam means within said collet for moving said collet and said collar relatively away from each other thereby to move said extension beyond said one end and to permit removal of the taper pin from a receptacle by relative movement of said rod away from said one end.

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