June 2, 1964 C. R. CURTIS ETAL 3,135,147

CAPTIVE TAPER PIN INSERTION TOOL

Filed March 27, 1958

Fig. 1

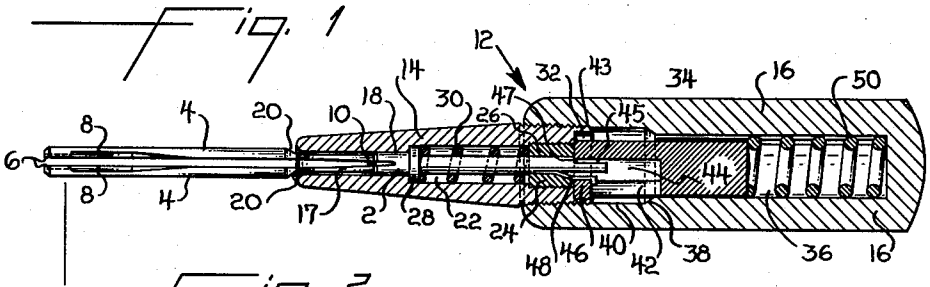


Fig. 2

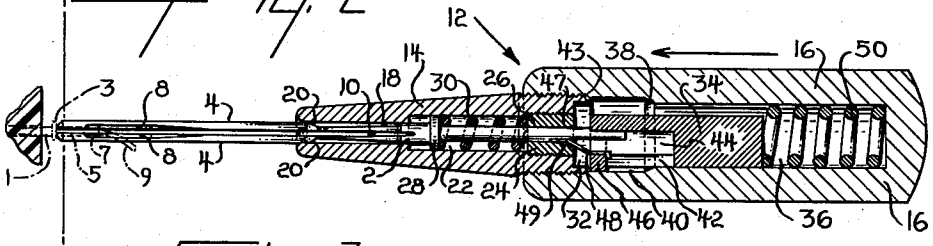


Fig. 3

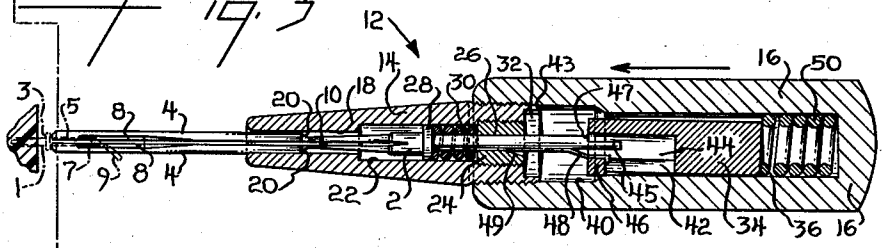


Fig. 4

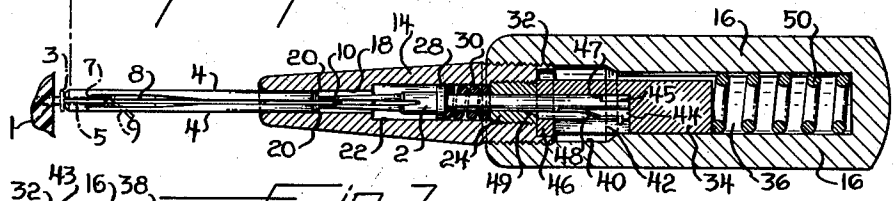


Fig. 7

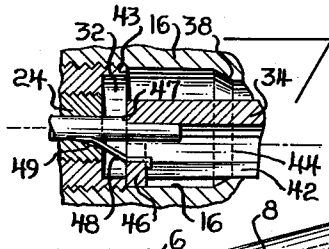


Fig. 5

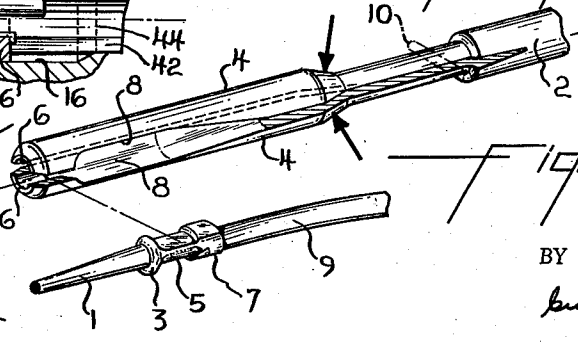
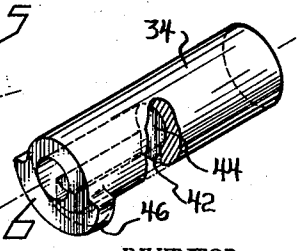


Fig. 6



INVENTOR.
Charles R. Curtis
Ralph R. Lau

BY

Curtis, Morris & Safford

ATTORNEY

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CAPTIVE TAPER PIN INSERTION TOOL

Charles R. Curtis, Camp Hill, and Ralph R. Lau, Harrisburg, Pa., assignors to AMP Incorporated, Harrisburg, Pa.

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This invention relates to tools for inserting pins or the like into receptacles or other bodies. The invention is disclosed herein in an embodiment adapted for the insertion of taper pin electrical connectors into complementary receptacles, however, it will be apparent that the invention is amenable to other uses.

Taper pin electrical connectors have been widely accepted in the electrical arts and are used in vast numbers, particularly in the construction of complex circuits in computers and other electronic devices where large numbers of connections are required and relatively small diameter wires are involved. Electrical connections are made with taper pin connectors by merely inserting the pin into a receptacle which may provide several tapered openings for several pins, so that multiple conductors can be connected at a common junction. Advantageously, the pins are inserted by means of an automatic impact type hand tool of the type in which the inserting blow is delivered by a spring loaded hammer which is actuated when the tool, having the pin in its shank, is pushed into the receptacle. One tool of this type which has received widespread acceptance is disclosed in United States Patent No. 2,774,133 issued December 18, 1956, to G. C. Sitz.

An object of the present invention is to provide an improved impact type hand tool for inserting pins or the like into receptacles having means to lock the pin to the tool so that the tool can be used in any desired orientation, for example, so that the tool can be used to drive a taper pin electrical connector into a receptacle which is disposed on an overhead panel. A further object is to provide a tool for inserting taper pin electrical connectors having means to lock the pin to the tool to facilitate the inserting operation and also having means to release the pin from locked engagement to the tool after the inserting operation is completed. A further object is to provide a percussion type impact tool for inserting taper pin electrical connectors which is constructed in such manner that the technician using the tool will be encouraged to actuate the triggerable impact hammer when a pin is inserted and will be discouraged from merely lightly inserting the pin into the receptacle without actuating this triggerable impact hammer.

These and other objects of the invention are achieved in one embodiment which provides a rod and a barrel in surrounding relationship to the rod. The rod is slotted to provide a pair of resilient fingers at its end and is telescopically movable into the barrel in such manner that the two fingers are resiliently biased towards each other to grip a taper pin.

By virtue of the fact that two fingers are provided, the conductor extending from the taper pin can be accommodated between these fingers. After the rod has been partially telescoped into the barrel, and the taper pin is gripped between the fingers, the rod is locked in position by means of a detent so that the taper pin is retained and cannot drop out. Upon actuation of the triggerable impact means which is contained within the barrel, an impact blow is delivered to the end of the rod to insert the pin into the receptacle. An additional feature of the preferred embodiment is that after delivery of the impact blow, the rod can move telescopically out of the barrel thereby to release the pin from locked engagement.

For a more thorough understanding of the invention reference is had to the following description of a preferred embodiment and to the accompanying drawings in which:

FIGURE 1 is a cross-sectional view of a preferred embodiment showing the normal positions of the parts before a pin has been locked within the tool preparatory to an inserting operation:

FIGURES 2, 3 and 4 are views similar to FIGURE 1 but showing the relative positions of the parts at various stages of an inserting operation. FIGURE 2 shows the relative positions after the pin has been locked to the tool, FIGURE 3 shows the relative positions of the parts after the triggerable impact hammer has been loaded, and FIGURE 4 shows the relative positions of the parts after delivery of the impact blow;

FIGURE 5 is an enlarged view of the tip of the rod which forms part of the tool showing a taper pin electrical connector in alignment for positioning within this tip;

FIGURE 6 is a perspective view of the impact hammer which forms part of the preferred embodiment;

FIGURE 7 is an enlarged view in cross-section showing the relative position of the hammer and the rod when the rod is locked in its partially telescoped position.

A commonly used type of taper pin electrical connector is shown in FIGURE 5 to comprise a tapered nose portion **1** having a circumferential bead or collar **3** at its inner end and a crimped portion **5** by means of which a connector is crimped to the conducting core of the wire. A second crimped portion **7** by means of which the connector is crimped onto the insulation covering of the conductor or wire **9** may be provided for strain relief as shown. In the use of such connectors, the tapered nose portion **1** is merely inserted into a receptacle having an aperture with a complementary taper. Advantageously the pin is inserted by an impact blow of predetermined force to ensure consistency among a large number of such connections and good quality electrical and mechanical properties.

A preferred embodiment of the invention for inserting pins of the type shown in FIGURE 5 comprises a rod **2** having a slot extending from its end to form a pair of fingers **4** which are flexible towards and away from each other to grip a taper pin. Adjacent their ends, these fingers have recesses **8** on their opposing faces and these recesses in turn communicate with semi-cylindrical recesses **6** which extend to the end of the rod. Semi-cylindrical recesses **6** are advantageously of a diameter such that when the two fingers are flexed against each other, the crimped portion **5** is securely locked between these fingers with crimped portion **7** and the end portion of the wire disposed in the space between recesses **8**.

Rod **2** is surrounded by a barrel **12** which is formed by a generally conical nose portion **14** threaded into the end of a cylindrical handle portion **16**. Nose **14** has an axial bore **18** extending inwardly from its end which bore receives the central portions of rod **2**. The section of the rod in the vicinity of the base or end of the slot is of a diameter substantially equal to, but slightly less than, the diameter of bore **18**. An adjacent section of the rod at **17** is of a slightly reduced diameter while the end of rod **2** is again of substantially the same diameter as that of bore **18**. Conical camming surfaces **20** are formed between reduced diameter portion **17** and the end section of the rod so that when the rod is telescoped into barrel **12** from the position of FIGURE 1, the fingers **4** are flexed towards each other as camming surfaces **20** enter bore **18**. A pin **10** extends transversely through nose portion **14**, through axial bore **18** and between fingers **4**. This pin serves to wedge the fingers apart, when the parts are

in the position of FIGURE 1, and to key the rod against rotation. The slot is of a width slightly greater than the diameter of the pin so that the fingers can be flexed towards each other upon inward telescopic movement of the rod as explained above. As shown in the drawing, the sides of the slot converge near its base so that the wedging effect of the pin takes place when the rod is in its extended position relative to the barrel.

Bore 18 communicates with a somewhat larger bore 22 through which the rod extends and a threaded plug 24 having an axial bore 26 closes the end of this second bore 22. Axial bore 26 of plug 24 should be such that the inner end of rod 2 is freely slidable relative to this bore although the dimensions should also be such that the rod is accurately guided in an axial direction. A collar 28 integral with rod 2 intermediate its ends functions to guide the rod within bore 22 and also functions as a stop or abutment for a helical spring 30 interposed between collar 28 and the face of plug 24.

The inner end of nose 14 is provided with an enlarged counterbore 32 of a diameter sufficient to receive the end of an impact hammer 34 reciprocally mounted within a bore in handle portion 16. Bore 36 is somewhat oversized relative to the diameter of hammer 34 so that the hammer can be cocked from an axially aligned position in this bore as shown best in FIGURE 3. A bevelled camming surface 38 extends from the end of bore 36 to a counterbore 40 which normally receives the end of hammer 34. It will be noted particularly in FIGURE 7 that the diameter of counterbore 40 and the inner diameter of the counterbore 32 in nose portion 14 are such that a shoulder 43 is formed between the inner end of the nose and the counterbore 40.

Hammer 34 provides a slot 42 extending axially adjacent its left hand end as shown in the drawing and this slot communicates within axial bore 44 of a diameter somewhat larger than the diameter of the inner end of rod 2. A lip 46 provided on the end of the hammer extends beyond the normal diameter of the hammer and partially around its circumference. Rod 2 provides a flat surface 45 on its inner end where it is cut away and this flat surface extends within bore 44 so that the shoulder 47 formed by this flat surface engages the face of the hammer. A light spring 48 having a hook formed on its end is secured near the inner end of the rod and in the position of FIGURE 1 extends into bore 44 in slot 42, plug 24 being cut away at 49 to accommodate this spring. This spring would normally bias the hammer downwardly as viewed in FIGURE 1; however, in that position the lip is seated within counterbore 32. A spring 50 disposed between the end of bore 36 and the end of hammer 34 normally urges the hammer leftwardly when the tool is in the position shown.

In use, the parts will be in the relative position of FIGURE 1 at the beginning of an inserting operation with the face of hammer 34 seated in counterbore 32 and with shoulder 47 abutting the face of the hammer. The operator first positions the taper pin within the end of rod 2 with crimped portion 7 and the end portion of the conductor received within recesses 8. Thereafter the rod is telescoped relatively inwardly of barrel 12 until hammer 34 is pushed by the flat surface at shoulder 47 beyond the limits of counterbore 32. At that point spring 48 cocks hammer lip until lip 46 is lodged against shoulder 43 as shown in FIGURES 2 and 7. During such inward movement coil spring 30 of course is lightly compressed and tends to urge the rod leftwardly, however, by virtue of the fact that the end of spring 48 is lodged behind lip 46 and this lip itself abuts shoulder 43, the rod cannot be moved leftwardly and the taper pin is retained in the end of the rod between the fingers.

Thereafter the technician aligns the pin with the receptacle into which it is to be inserted and applies a pushing force on handle 16 to move this handle relatively leftwardly as viewed in the drawing. As barrel 12 moves

leftwardly, camming surface 38 engages lip portion 46 of the hammer and moves the hammer upwardly as shown in FIGURE 3 until the face of the hammer is cammed out of engagement with the shoulder 47. Thereafter, the hammer is projected leftwardly by spring 50 until it delivers an impact blow to the end of the rod. This blow is of course delivered when the hammer at the base of recess 44 strikes the rod. During leftward movement of the hammer it is guided by rod 2 so that at the conclusion of this travel of the hammer it is positioned within counterbore 43 as shown in FIGURE 4. The impact blow will then have been delivered to the taper pin and it only remains for the operator to release the pushing force on the handle which will result in the entire barrel 12 being projected relatively rightwardly from the position shown in FIGURE 4 to the position of FIGURE 1. As this is done, the barrel portion will move relative to the rod, the camming surfaces 20 will be returned to their relative positions of FIGURE 1, the fingers will automatically spring apart, and the taper pin will be released from locked engagement.

It will thus be apparent that the taper pin is held securely while the inserting operation is being carried out. Furthermore, the technician using the tool is encouraged to deliver the proper inserting force to the pin since by doing so the pin will be automatically released from locked engagement with the tool. This is a distinct advantage in that with previously known tools it is sometimes possible to insert a pin without delivering an impact blow and such pins inserted without impact do not have the desirable electrical or mechanical properties.

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. In an insertion tool of the type utilized to insert a pin type electrical conductor through impact forces transmitted by a rod member from a hammer disposed within said tool, the improvement comprising triggerable impact means including a hammer of a lesser diameter than a bore within the tool barrel, the hammer being counter-bored at one end to define an interior face and including an external flange extending radially from the same end, the counter-bore of the hammer being of a length greater than the impact stroke of the hammer, a compression spring disposed within said bore forcing said hammer axially along said bore, a rod member interconnected to connector carrying fingers extending from said bore and adapted to transmit the impact forces to the connector imparted to the rod member from said hammer, the rod member including, at the other end, a relieved shoulder portion defining a face engaging the said interior face of said hammer, said shoulder portion itself having a face engaging an end face of the hammer, the said rod member including, affixed thereto, a spring member having a radial spring moment adapted to bias the hammer flange portion outwardly against said bore to hold said faces in bearing relationship, the said bore including a cam surface adapted to engage said hammer flange during axial travel thereof and release said hammer whereby said rod and hammer faces are disengaged, with said hammer being driven by said compression spring to strike the end of said rod and impart said impact forces.

2. An insertion tool for inserting a pin type electrical connector into a connector receptacle comprising a barrel having a closed end and including an axial recess formed of a first bore of a given diameter, a second bore of a slightly greater diameter than the said given diam-

eter joining said first bore through a tapered bore forming a cam surface, a third bore of said given diameter and a fourth bore of a different diameter, a hammer member of a diameter less than the given diameter fitted for sliding movement within said axial recess, a compression spring fitted within said first bore and adapted to force said hammer along said recess toward said fourth bore, the said hammer member including a counter-bore defining an internal face and including a radial flange adapted to release said hammer upon engagement with said cam surface, a rod member secured within said fourth bore with a close-fitting relationship adapted to restrict sliding movement of said rod member to travel along the longitudinal axis of said barrel coaxial with said bores, the rod member including at one end, resilient finger members adapted to grip said connector and including an outer cam surface adapted to force said resilient fingers together to grip said connector as said rod is displaced along said fourth bore, the rod member including at the other end, a relieved shoulder portion defining a transverse face directly engaging the said face of said hammer member, said shoulder portion itself having a face engaging an end face of the hammer, a spring member affixed to said rod adjacent said transverse face, the spring member extending radially to bias said flange member against the walls of the second and third bores; the movement of said rod and said hammer along said axial recess operating at a point of substantial compression of said compression spring through the release of said hammer by the flange thereof engaging the said cam surface to disengage the faces of said rod and hammer, whereby the hammer is released to travel over said rod face to a point wherein the end of said counter-bore strikes the end of said rod to deliver impact forces thereto and insert said connector within a connector receptacle.

3. An improved connector insertion tool comprising a barrel member, a rod member and a hammer member

having a radial flange thereon, a compression spring driving said hammer within a bore of said barrel member, the rod member including resilient fingers extending from said barrel and adapted to hold a connector pin therebetween, an external surface of said rod member including a cam surface adapted to coact with a bore of said barrel member to force said fingers together and captivate the connector therebetween as the rod member is moved within the barrel member to compress said compression spring, a pin member secured to said barrel member located between the fingers of said rod to bias said fingers open when said rod member is fully extended from said barrel member, the end of said rod member opposite said finger members including a face directly engaging an interior end of said hammer formed by a counter-bore therein, a shoulder portion adjacent said face, said shoulder portion itself having a face engaging an end face of the hammer, a spring member secured to said rod adapted to bias said hammer member against a face of said barrel bore in a radial sense, the movement of said tool to insert a connector being such as to drive said rod member inwardly and thereby through the rod face compress said hammer against said spring to a point wherein said flange engages a cam surface of said bore driving said hammer to disengage the faces of the said rod and said hammer, whereby said hammer travels along said bore to strike said rod and drive the connector held within the resilient fingers thereof.

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