

July 13, 1937.

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2,086,998

ASSEMBLING MACHINE FOR ELECTRICAL CONNECTERS

Filed June 11, 1936

4 Sheets-Sheet 1

Fig. 1

Fig. 11

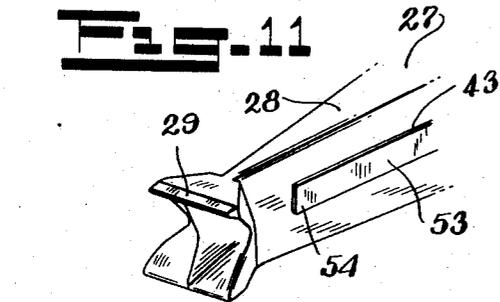
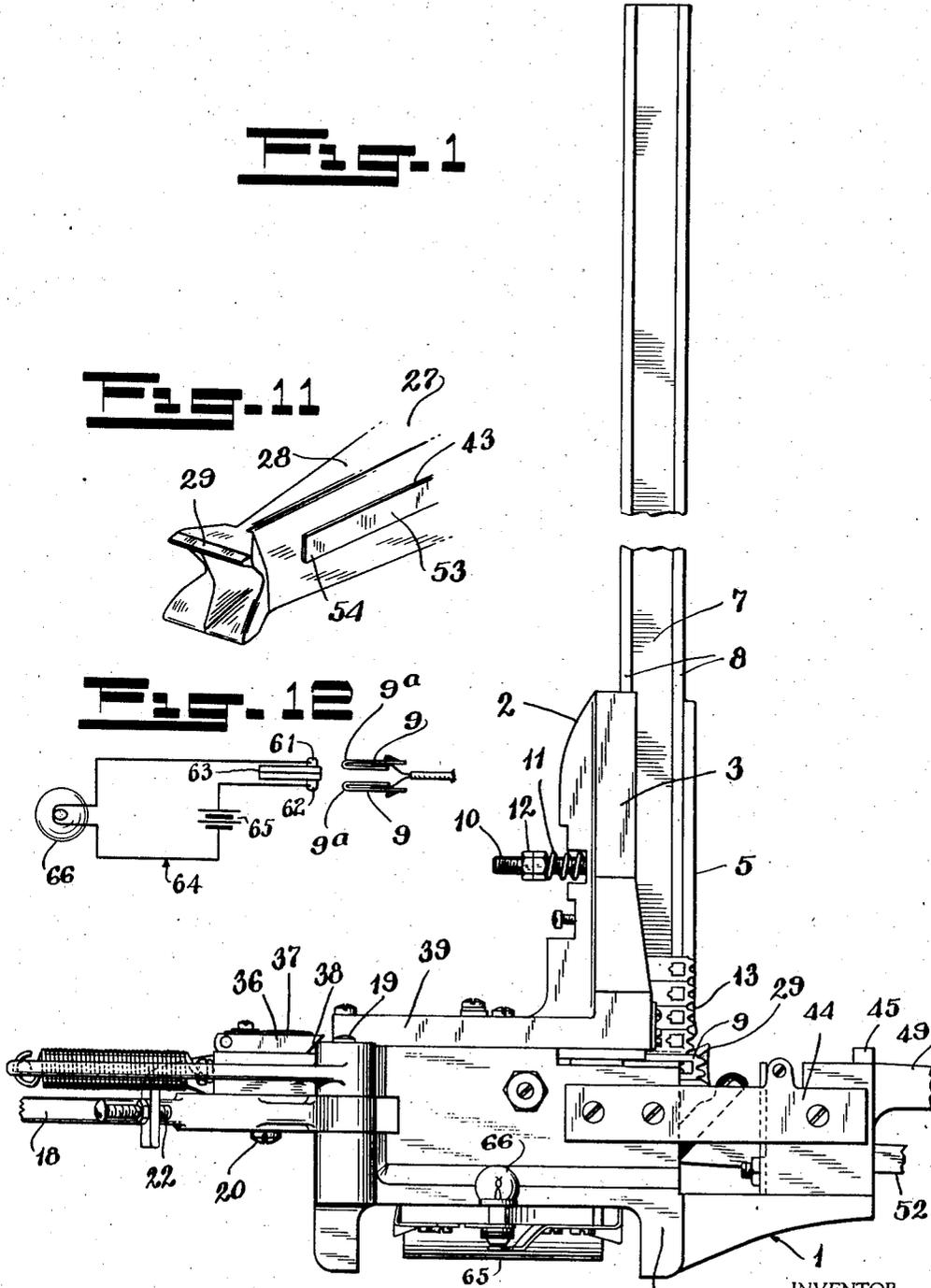
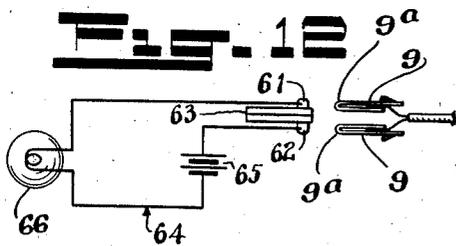


Fig. 12



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Fig. 2

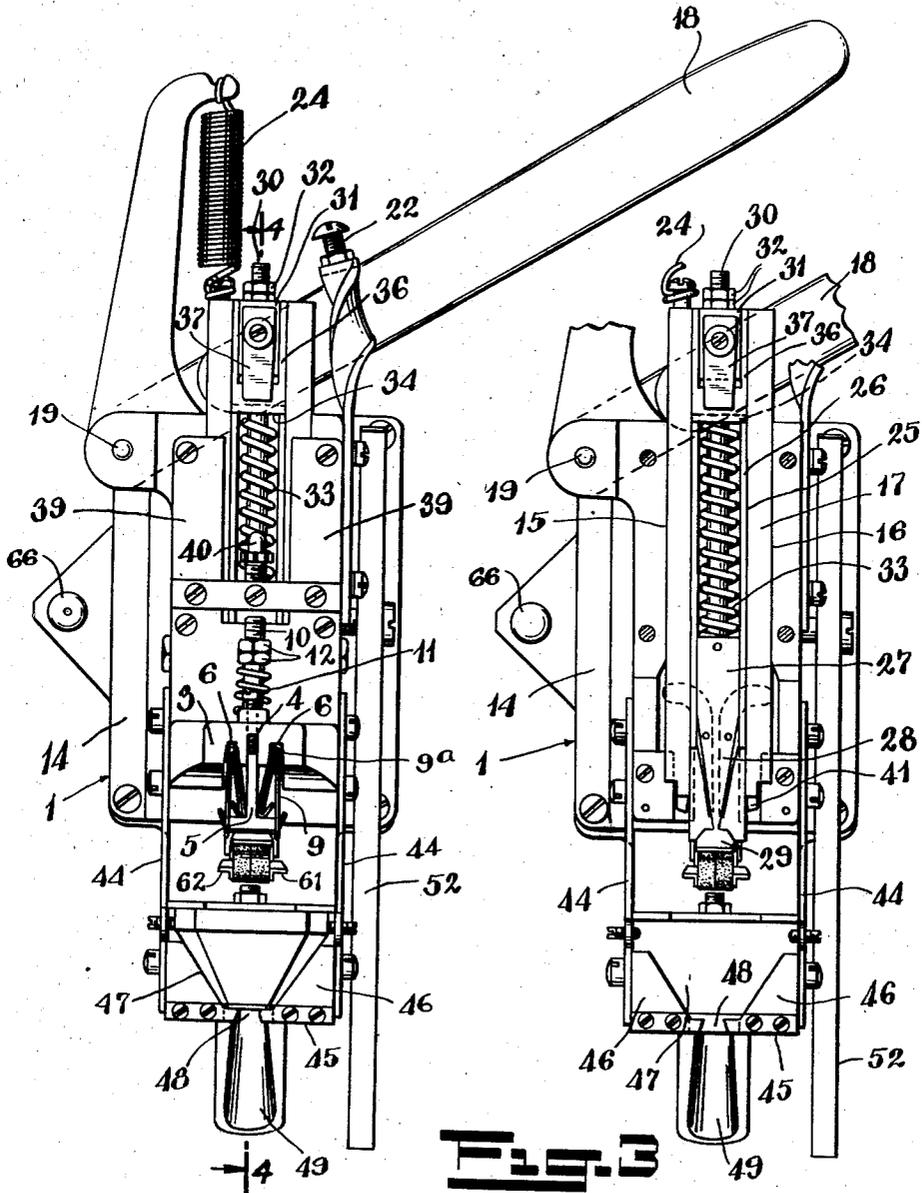


Fig. 3

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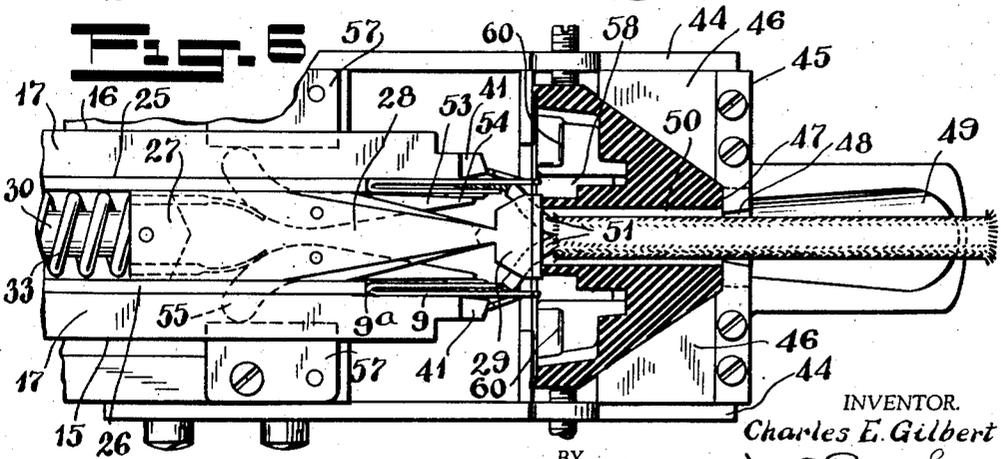
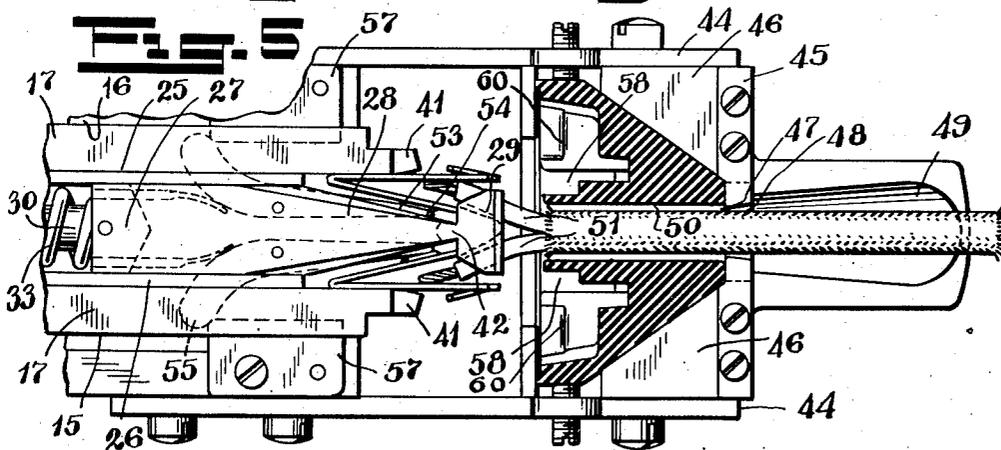
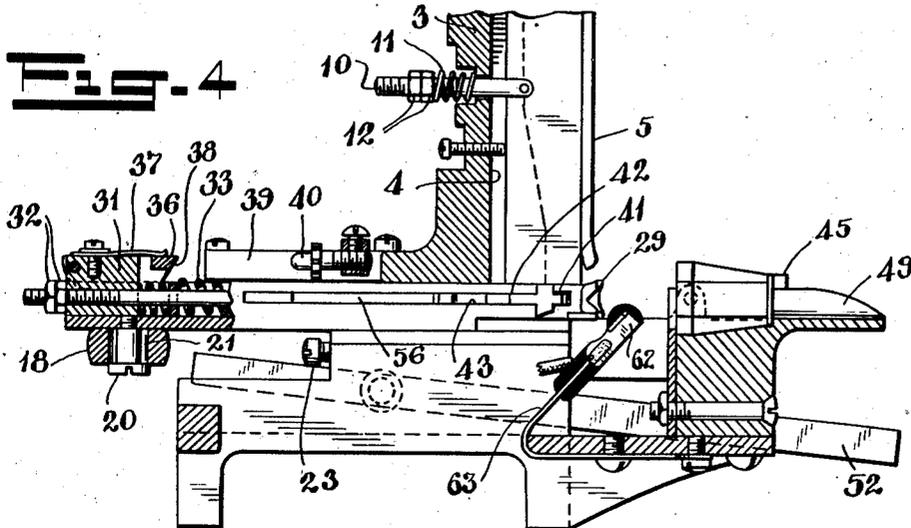
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ASSEMBLING MACHINE FOR ELECTRICAL CONNECTERS

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4 Sheets-Sheet 3



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ASSEMBLING MACHINE FOR ELECTRICAL CONNECTORS

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Fig. 9

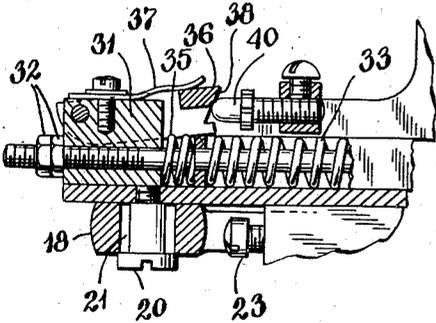


Fig. 10

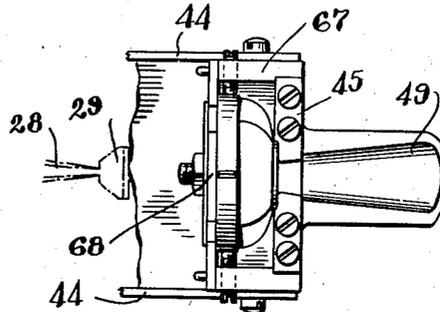


Fig. 7

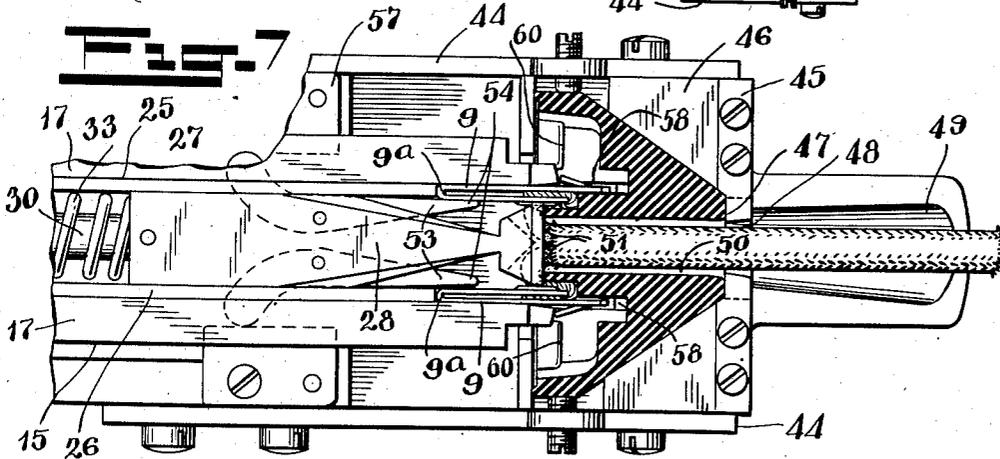
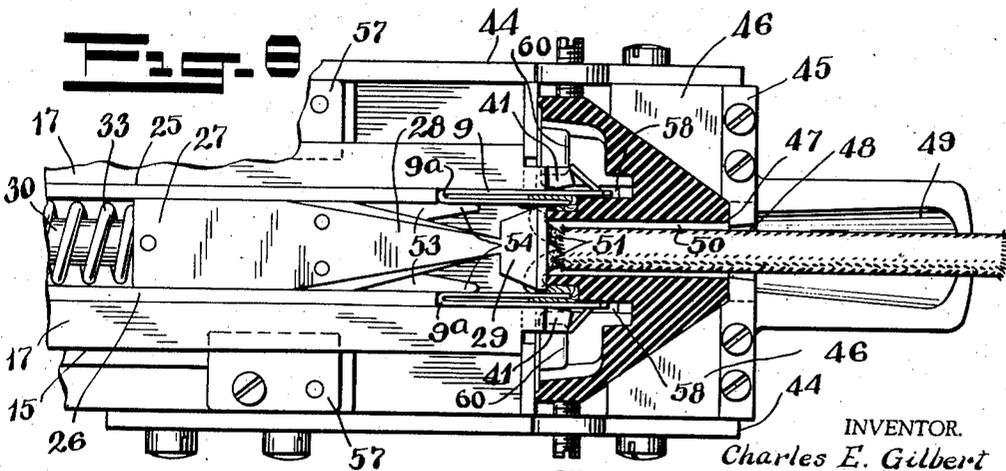


Fig. 8



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2,086,998

ASSEMBLING MACHINE FOR ELECTRICAL CONNECTERS

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Application June 11, 1936, Serial No. 84,635

13 Claims. (Cl. 29—84)

This invention covers a new and useful improvement in assembling machines for electrical connectors.

In my application No. 2,168 filed January 17, 1935, I disclose a type of electrical connector composed of a one piece moulded body and two contact elements. No assembling is necessary until the electrical conductor is to be connected at which time this connection is made by the mere act of pushing the contact elements into body recesses provided for them, and in which the contact elements become locked through the engagement of outwardly projecting resilient tongues with shoulders adjacent the open ends of the recesses. Thus the usual preliminary assembly of the connector parts is eliminated and the entire assembly of the parts and making connection to a conductor is effected by a single operation very quickly and simply performed.

Since the machine of this invention was designed primarily for use in assembling and connecting this particular type of connector, a form suitable for that purpose has been selected for illustration and description. This, however, is not to be taken as showing any intention of correspondingly limiting the scope of the invention.

The form selected is shown in the accompanying drawings of which

Figure 1 is a side elevation of the machine;

Fig. 2 is a plan view of the machine;

Fig. 3 is a plan view of the machine with the magazine removed;

Fig. 4 is a vertical sectional view along the line 4—4 of Fig. 2 viewed as indicated by the arrows;

Figs. 5-9 are detail views illustrating several stages in the operation of the machine;

Fig. 10 is a detail view of one form of holder for the connector bodies;

Fig. 11 is an enlarged view of the end of one of the plungers and the conductor guiding foot thereof; and

Fig. 12 is a diagrammatic view of the short circuit detector and the electrical circuit thereof.

As shown in Fig. 1 this machine consists of a base generally indicated by 1 surmounted by a contact element magazine holder and magazines generally indicated by 2.

The magazine holder is a vertically positioned casting 3 provided with a recess 4 along its longitudinal axis to receive the leg of T-shaped clamp 5 and also two other recesses 6 symmetrically positioned on either side of recess 4, each adapted to receive an edge of a magazine 7.

The magazine, of which there are two since the form of connector shown calls for two con-

tact elements, may consist of a strip of thin metal bent over at its long edges as at 8 to form a shallow channel in which a stack of contact elements 9 may be held edge to edge as shown in Fig. 1. Clamp 5 is provided with a stem 10 projecting through casing 3. A spring 11 upon stem 10 held in compression by a nut 12 urges the T-shaped clamp 5 towards casing 3 but also permits it to be moved forward so that one edge of each magazine may be seated in a recess 6 and the other edge brought under the cross arm of clamp 5 whereby it will be securely held in vertical position against holder 3. Its lower end may rest upon a suitable stop 13 so formed and positioned adjacent the lower end of the holder that it will permit the lowermost contact element in the magazine to pass downwardly out of the magazine and subsequently in a horizontal direction without interference.

The magazine holder described permits of the quick substitution of filled for exhausted magazines. If desired the magazines may be built into the machine in which case clamp 5 would be unnecessary. However, such a construction would, obviously, be less convenient.

The base 1 consists of a casting 14 by which all of the parts of the machine, including the magazine holder, are supported.

The interior of casting 14 is cut away vertically and its upper portion is fashioned into slide ways 15 and 16 between which is mounted a slide 17 having a free sliding fit so that it may be reciprocated by any suitable means, manual or mechanical. That shown is the hand lever 18 pivoted to the body casting 4 at 19 and connected to slide way 17 by pin 20 on the slideway which engages elongated slot 21 in lever 18. The swing of lever 18 is regulated by adjustable stop nuts 22 and 23. By this means the extent and limits of movement of slide 17 are determined. Normally slide 17 is held in its rearward position against stop 22 by a spring 24.

Slide 17 is provided with a longitudinal channel 25 in which a contact element driving plunger 26 is slidably mounted. This is channel-shaped also and within it, adjacent its forward end, is slidably fitted another plunger 27 which tapers towards its forward end as shown at 28 where it expands into a foot 29.

From the rear end of plunger 27 a rod 30 extends through channel-shaped plunger 26 and through a block 31 fixed to the rear end of slide 17. The projecting end of rod 30 is provided with adjusting nuts 32 which are normally maintained in contact with block 31 by a spring 33 compressed

between the rear end of plunger 27 and the rear end 34 of plunger 26. Another spring 35 surrounds rod 31 and is compressed between the rear end of plunger 26 and the front end of block 31.

5 In this way plungers 26 and 27 are normally maintained in definite positions upon slide 17 and are caused to move as a unit with slide 17 unless the resistance of one or both of the springs is overcome. When plunger 27 meets with sufficient resistance spring 33 enables it to stop without interfering with the forward unitary movement of plunger 26 and slide 17. Similarly spring 35 enables plunger 26 to come to rest if it meets with sufficient resistance during the forward movement of slide 17.

At certain times it is necessary that a greater force be applied through plunger 26 that might be possible through spring 35. Therefore, a positive driving means is provided which consists of a latch 36 hinged upon block 31 on slide 17 and normally held in down position by a spring 37. The lower edge of the latch drops behind the rear end 34 of plunger 26 and thus provides a positive driving connection for plunger 26 through slide 17. Plunger 26 may be released by raising latch 36. To effect this the front end of latch 36 is bevelled as shown at 38. On the foot 29 of magazine holder 3, which acts as a top guide for slide 17 and extends rearwardly in the form of two arms 39, is positioned a rearwardly projecting adjustable trip 40 adapted to engage with the bevelled end 38 of latch 36 when it is nearing the end of its forward movement and to lift the latch, as best shown in Figs. 2 and 9.

Returning to slide 17 it is provided at its front end with two projections 41 which are bevelled outwardly as shown in Fig. 3. Foot 29 of plunger 27 has the duty, among others, of separating and guiding the conductors of an electric cord into the two contact elements. Consequently its front face is undercut slightly along its main vertical axis 42 and to a progressively increasing amount outwardly from this axis so that two rearwardly sloping guiding channels are formed as shown in Fig. 11 at 43.

Opposing the forward ends of slide 17 and plungers 26 and 27 a holder 45 for the body of the connector is mounted by means of arms 44. That shown in Figs. 2 and 3 consists of a block 46 provided with a depression 47 of suitable shape to receive a connector body of the type described in my application for Design Patent No. 61,257 filed February 20, 1936, and to hold it in proper position to receive its contact elements i. e. with its open end facing the plungers and in alignment therewith. In the end of depression 47 is an opening 48 which will register with the central opening of the connector body so that the end of an electric cord can be inserted through both of them. To facilitate this a trough-shaped guide 49 is provided.

The remaining details of this device can best be described in connection with a description of its method of operation.

55 The first step in the assembly of the connector and the attachment thereto of a conducting cord is to place the connector body 49 in depression 47 of holder 45 so that its open end points rearwardly, as shown in Fig. 1. Central opening 50 of the connector body will then register with opening 48. The magazines 7 have been previously filled with contact elements and fastened in holder 3. Consequently a pair of the contact elements 9, one from each magazine, have

dropped down into the space between the forward end of slide 17 and the tapered portion 28 of plunger 27 with their bends 9^a directly in front of the front end of plunger 26, as shown in Figs. 1 and 4.

Lever 18 is then swung forward a little moving slide 17, plungers 26 and 27, and the contact elements forward into the position shown in Fig. 5. This positions the contact elements for the reception of the ends of the conductors 51. The conductors, the ends of which have been stripped, are then pushed through opening 48 and the central opening in the connector body into the position shown in Fig. 5 with the stripped ends between the blades of the contact elements. This positioning is facilitated by foot 29 of plunger 27 which, as previously discussed and as shown in Fig. 11 is shaped so as to guide the conductors to the right and left. The forward movement of the contact elements may be limited to that required for positioning them to receive the conductors by a lever 52 pivotally attached to the machine, the rear end of which is normally positioned so as to stop the forward swing of lever 18 when the required movement has been made.

Additional forward movement of lever 18 produces a corresponding additional advance of slide 17, plungers 26 and 27 and contact elements 9. During this advance the two legs of each contact element are brought together to squeeze the conductor between them as shown in Fig. 6. For this purpose tapered section 28 of plunger 27 is horizontally slotted and in these slots two fingers 53 (Figs. 2, 5 and 6) are pivotally mounted. Normally the forward ends 54 of fingers 53 do not project beyond the surface of tapered position 28 of plunger 27. The rear ends 55, however, project not only from plunger 27 but through plunger 26 and into slide 17 (Fig. 5) which are suitably slotted to receive these ends. The slots in slide 17 are shown at 56 in Fig. 4.

Cam pieces 57 attached to the body casting project into slots 56 sufficiently to engage the rear ends 55 of fingers 53 to swing them inwardly, thus causing the front ends 54 of fingers 53 to swing outwardly beyond the sides of tapered position 28 of plunger 27, as shown in Fig. 6. Cam pieces 56 are so positioned that this action occurs while the contact element is moving from the position shown in Fig. 5 to that of Fig. 6. By these fingers 53 the two legs of each contact element are brought together and the conductor firmly squeezed between them. During this operation the forward motion of plunger 27 has also brought its foot 29 in contact with the face of the connector body 49 so that the body is firmly held in depression 47. During the remaining steps plunger 27 remains in this position without interfering with the action of slide 17 or plunger 26 because of the compressibility of its driving spring 33.

The following step produced by a further advance of slide 17 and plunger 27 drives the contact elements into their recesses 58 in the connector body, as shown in Fig. 7, the compression of the legs against the conductor originated by fingers 53 now being maintained by the sides of foot 29 and the sides of slide 17. At the end of this step the contact elements will have been fully seated in their recesses and their locking tongues 59 will have engaged with shoulders 60 in the recesses. The conductors have, of course, been carried into the recesses also and are permanently

and firmly held between the legs of the contact elements.

At this point trip 40 has passed latch 31 so that plunger 26 is no longer positively driven by slide 17. Consequently slide 17 may be advanced slightly without causing a similar advance of plunger 26 to cause its end projections 41 to engage with tongues 59 and to press them outwardly as shown in Fig. 8 to insure that they are securely locked under shoulders 60. Thereafter lever 18 is swung back causing the slide 17 and plungers 26 and 27 to return to their original retracted positions shown in Fig. 2 and the connector completely assembled with the electric cord removed from the machine. Another pair of contact elements will then drop into position and the machine is ready for action upon another connector.

Means is also provided for detecting short circuits in the cord or the connector. As shown in Figs. 1, 2, 4 and 12 two contacts 61 and 62 insulated from each other are positioned directly in front of foot 20 and so that the contact elements will engage with them as they are driven forward. To insure the engagement each contact 61 and 62 is mounted upon an individual spring 63 adapted to urge it upward against its contact element. Contacts 61 and 62 are connected by a circuit 64 in which is a source of electricity shown as a battery 65, and a signal lamp 66. If there is a short circuit between the contact elements or in the conductor the signal light circuit will be completed and the fact indicated by the illumination of the lamps.

The machine is, of course, capable of assembling connectors of other external shapes by providing a suitable holder therefor. For example, in Fig. 10 is shown a holder 67 for the familiar round connector body. This differs only in shape from the holder shown in the other figures although, for convenience, it is advisable to provide means for correctly positioning the connector body so that the recesses thereof will be correctly aligned with the contact element, such, for example, as a tongue 68 which projects slightly into some particular depression in the body so that the body can be inserted into the holder in only the correct position.

What I claim is:

1. A machine for assembling an electrical connector having a body provided with a shoulder and a contact element provided with a locking tongue which comprises a holder for the connector body, a holder for a contact element, means for causing one of said holders to approach the other until said contact element is inserted in said body, said contact element holder having means for locking a tongue on said contact element under a shoulder on said connector body when said contact element has been inserted in the body.

2. A machine for assembling an electrical connector having a body and a contact element which comprises a holder for the connector body, means for seating a contact element in said body comprising a reciprocable slide for supporting a contact element, means for moving said slide towards said body holder, a second slide reciprocable with said first slide, a third slide also reciprocable with said other slides, means for enabling said first and second slides to continue to move towards said body holder when the movement of said third slide is arrested, and means to enable said first slide to continue to move towards said

body holder when the movement of said second slide is arrested.

3. A machine for assembling an electrical connector consisting of a body and a folded contact element provided with a locking tongue which comprises a holder for the body, means for inserting the free ends of the legs of the contact element in said body which consists of a reciprocable slide for supporting the contact element so that the free ends of its legs are directed towards said body, means for moving said slide towards said holder to cause said contact element to approach said body, a second slide reciprocable with said first slide for inserting said contact element in said body, a third slide reciprocable with said other two slides and adapted to engage said body to hold it firmly in said holder while said contact element is being inserted, said first slide being provided with means for locking a tongue on a leg of the contact element under a shoulder in said body when said contact element has been inserted in said body.

4. A machine for assembling an electrical conductor and an electrical connector having a body and a contact element provided with a locking tongue which comprises a holder for the connector body, a holder for a contact element, means for causing said holders to approach each other until said contact is inserted in said body, said contact element holder having means for locking a tongue on said contact element under a shoulder on said connector body when said contact element has been inserted in the body, and also means for guiding an electrical conductor into contact with the contact element before it is inserted in said body.

5. A machine for assembling electrical connector bodies and contact elements which comprises a holder for a body, a magazine for a plurality of contact elements, means to receive a contact element from said magazine and to insert it in said body consisting of a reciprocable slide, means for moving said slide towards said holder, a second slide carried by said first slide and reciprocable therewith, a third slide also reciprocable with said other slides, means for enabling said first and second slides to continue to move towards said body holder when the movement of said third slide is arrested, and means to enable said first slide to continue to move towards said body holder when the movement of said second slide is arrested.

6. A machine for assembling an electrical connector consisting of a body and a folded contact element having a locking tongue which comprises a holder for the body, a magazine for a plurality of contact elements, means for inserting the free ends of the legs of a contact element in said body which consists of a reciprocable slide for receiving and supporting a contact element so that the free ends of its legs are directed towards said body, means for moving said slide towards said holder to cause said contact element to approach said body, a second slide reciprocable with said first slide for inserting said contact element in said body, a third slide reciprocable with said other two slides and adapted to engage said body to hold it firmly in position in said holder while said contact element is being inserted, said first slide being provided with means for locking a tongue on a leg of the contact element under a shoulder in said body when said contact element has been inserted in said body.

7. A machine for assembling an electrical con-

necter having a body and a contact element which comprises a holder for the connector body, means for inserting a contact element in said body comprising a reciprocable slide for supporting a contact element, means for moving said slide towards said body holder, a second slide reciprocable with said first slide, a third slide also reciprocable with said other slides, resilient means for maintaining said third slide in a fixed relation to said first and second slides during the simultaneous reciprocation of all three slides and for enabling said first and said second slides to continue to move towards said body holder when the movement of said third slide is arrested, means on said first slide for unyieldingly holding said second slide in a fixed position with respect thereto while said first and second slides are being simultaneously reciprocated, and means for automatically releasing said holding means to permit said first slide to move independently of said second slide.

8. A machine for assembling an electrical connector consisting of a body and folded contact elements and for connecting an electrical conductor to each of said elements which comprises a holder for the connector body, and means for inserting the contact elements in said body comprising a reciprocable slide for supporting the contact elements, means for moving said slide towards said body holder, means for guiding an electrical conductor into position between the legs of each contact element, a second slide reciprocable with said first slide for driving said contact elements into said body, a third slide also reciprocable with said other slides, means for enabling said first and said second slides to continue to move towards said body holder when the movement of said third slide is arrested by contact with the connector body in said holder, and means to enable said first slide to continue to move towards said body holder when the contact elements are fully inserted in said body and the movement of said second slide arrested.

9. A machine for assembling an electrical connector consisting of a body and folded contact elements and for connecting an electrical conductor to each of said elements according to claim 8 in which the means for guiding the conductors into position between the legs of the contact elements is carried by the third slide.

10. A machine for assembling an electrical connector consisting of a body and folded contact elements and for connecting an electrical conductor to each of said elements which comprises a holder for the connector body, means for inserting the contact elements in said body comprising a reciprocable slide for supporting the contact elements, means for moving said slide

towards said body holder, means for guiding the electrical conductors into position between the legs of each contact element, a second slide reciprocable with said first slide for driving said contact elements in said body, a third slide also reciprocable with said other slides, means for enabling said first and said second slides to continue to move towards said body holder when the movement of said third slide is arrested by contact with the connector body in said holder, means to enable said first slide to continue to move towards said body holder when the contact elements are fully inserted in said body and the movement of said second slide arrested, and means for automatically indicating any short circuit between the contact elements or the conductors connected thereto when the assembly has been completed.

11. A machine for assembling an electrical connector consisting of a body and folded contact elements and for connecting an electrical conductor to each of said elements according to claim 10 in which the short circuit indicating means consists of two contacts insulated from each other, one engageable respectively with each contact element while the body of said assembled connector is still positioned in said body holder, said contacts being included in a circuit having a source of electrical energy and a signalling device.

12. A machine for assembling an electrical connector having a body and a contact element which comprises a holder for the connector body, means for inserting a contact element in said body comprising a holder for a contact element, means for moving said contact element holder towards said body holder, additional means movable with said contact element holder for forcing said contact element into said body.

13. A machine for assembling an electrical connector consisting of a body and a folded contact element provided with a locking tongue which comprises a holder for the body, means for inserting the free ends of the legs of the contact element in said body which consists of a reciprocable slide for supporting the contact element so that the free ends of its legs are directed towards said body, means for moving said slide towards said holder to cause said contact element to approach said body, a second slide reciprocable with said first slide for inserting said contact element in said body, said first slide being provided with means for locking a tongue on a leg of the contact element under a shoulder in said body when said contact element has been inserted in said body.

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