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71 Applicant: **INTERLOCK CORPORATION**
1770 Marie Street
Westland Michigan 48185(US)

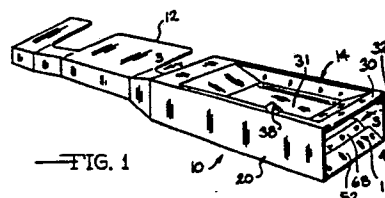
72 Inventor: **Mobley, Dewey Floyd**
1237 Heights Road
Lake Orion Michigan 48035(US)
Inventor: **Peterson, Robert George, Sr.**
50500 Hanford Road
Canton Michigan 48187(US)
Inventor: **Mergless, James Edward**
8756 Honeycomb Circle Apt. 174
Canton Michigan 48187(US)

74 Representative: **Williams, Trevor John et al**
J.A. KEMP & CO. 14 South Square Gray's Inn
London WC1R 5EU(GB)

54 **Tab receptacle with fixed beam contacts.**

57 The tab receptacle terminal fabricated by bending a single sheet of metal comprising a rectangular receptacle box having a closed continuous wall forming an end opening through which a male tab terminal is inserted so as to make contact with a receptacle box. The receptacle box includes a bottom, a top, and sides. Fixed beams formed in the top extend toward the bottom for engagement with one side of the male tab terminal. The fixed beams lie parallel to the axis of male tab terminal insertion. A cantilever supported movable beam member is formed between the top and the bottom by a portion of the sheet of metal folded into the interior of the box for contact with the other side of the male tab terminal. The movable beam member includes a front end portion located adjacent to the end opening, a middle portion, and a rear portion attached to the box. The rear portion of the movable beam is bent upward toward the top of the box, the middle portion is bent substantially parallel to the bottom, and the beam has a first transverse raised ridge protruding toward the fixed beams in the top at the transition between the rear portion and the middle portion. This first ridge is positioned to make contact

with the male tab terminal engaged with the fixed beams in the top. The front end portion of the movable beam is bent toward the bottom and has a second transverse raised ridge at the transition between the middle and the front end portion. The second ridge is also positioned to make contact with the inserted male tab terminal engaged with the fixed beams in the top. The bottom has an integral flap at the end opening which is bent toward and into the opening at an acute angle so as to overlap and limit motion of the movable beam as the male tab is inserted thus making the movable beam fixed when the male tab terminal is inserted within the box. This provides fixed beam contact between the ridges on the movable beam on the underside of the male tab terminal and between the fixed beams in the top and the opposite side of the male tab terminal.



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TAB RECEPTACLE WITH FIXED BEAM CONTACTS

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates generally to electrical terminals and more particularly to a fabricated tab receptacle terminal which is capable of establishing improved electrical contact with a male tab terminal by utilizing fixed beams on both sides of an inserted male tab terminal.

Electrical terminals of the tab receptacle type are in common use in appliances, automobiles, etc. and are an essential component of many products. Tab receptacle terminals in the prior art include springs to grip at least one side of the male tab terminal upon insertion. The spring member limits the amount of current that the tab terminal connection can carry. As current increases through the connector, resistance heating in the spring members causes a weakening in the spring member and limits the ampacity at which the terminals can be used.

Improved ampacity is achieved by providing fixed beam contact between the tab terminal and receptacle terminal. An improved tab receptacle terminal having a closed continuous wall which increases the current carrying capability of the receptacle is disclosed in U.S. patent application Serial No. 916,950, commonly assigned. This terminal utilizes an integral spring formed in the top of the closed continuous wall box and fixed beams in the bottom of the box. The fixed beams are the prime current carrying members. The present invention utilizes fixed beams on both sides of the male tab terminal thus further improving the ampacity of the terminal.

It is an object of the invention to provide an improved tab receptacle terminal having fixed beams on both sides of an inserted male tab terminal allowing increased current carrying capabilities for a given terminal size.

A disadvantage in prior art receptacle terminal designs occurs where contact of the receptacle terminal with the inserted male tab terminal creates a pivot point allowing relative rocking of the terminal components. This condition causes a type of fretting corrosion whereby oxides of tin inhibit contact between terminal elements. This increases contact resistance and creates increased resistance heating.

It is an object of this invention, therefore to provide an improved tab receptacle terminal that eliminates relative rocking of terminal components to thereby eliminate the corrosion which interferes with the conductivity of the terminal.

In addition, prior art structures are such that high tensile strength material must be utilized. These materials are required in order to maintain satisfactory contact forces between terminal elements. High tensile strength materials have the disadvantage that they have lower conductivity than low tensile strength materials. It is an object of this invention to provide an improved tab receptacle terminal that has high conductivity but does not require low tensile strength materials.

The receptacle of this invention may be used in a discrete application, in multiple connectors, or any other fabricated array that might be designed, e.g., a bus bar or lead frame. The tab receptacle terminal of this invention is fabricated by bending a single sheet of metal. Interlocking tabs are formed on the ends of the single sheet of metal from which the tab receptacle is formed to maintain the box in its desired rectangular form. The tab receptacle is a rectangular receptacle box having a closed continuous wall forming an end opening through which a male tab terminal is inserted. The receptacle box has a bottom, a top, and upright sides. There are fixed beams formed in the top that extend toward the bottom which engage one side of an inserted male tab terminal.

Inside the box, a cantilever supported movable beam is formed by folding a portion of the terminal into the interior of the box for contact with the other side of the male tab terminal. This beam member includes a front end portion located adjacent to the end opening, a middle portion, and a rear portion attached to the box. The rear portion of the movable beam is bent upward towards the top of the box, the middle portion is bent almost parallel to the bottom, and the front end portion of the beam is bent downward toward the bottom.

Between the front end portion of the beam and middle portion is a transverse raised ridge positioned to make contact with the under side of an inserted male tab terminal. A similar transverse raised ridge is also provided at the transition between the middle portion and the rear portion of the movable beam. The bottom of the box has an integral flap at the end opening which is bent toward and into the opening at an acute angle, overlapping and limiting the motion of the movable beam and making the beam fixed when the male tab terminal is inserted within the box. This provides fixed beam contact between the ridges on the beam and the under side of the male tab terminal and between the fixed beams in the top and the upper side of the inserted male tab terminal.

This fixed beam contact on both sides of the

male tab terminal enhances the current carrying capability of the connector, increases the rigidity with which the male tab terminal is held inside the receptacle, and minimizes the amount of fretting corrosion that can occur between the contact surfaces. An additional flap in the top of the receptacle box at the end opening which is bent toward and into the box at an acute angle guides insertion of the male tab terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects, features, and advantages of the invention will become apparent from a consideration of the following description and the appended claims when taken in connection with the accompanying drawings in which;

Figure 1 is a perspective view of the tab receptacle terminal with fixed beam contacts showing particularly the fixed beams formed in the top and the end opening through which a male tab terminal is inserted;

Figure 2 is a perspective view of the tab receptacle terminal of this invention, like Figure 1 but turned upside down, showing the interlocking tabs joining the closure side with the bottom of the receptacle box and the portion of the sheet of metal forming the movable beam where it is bent inward into the receptacle box;

Figure 3 is a longitudinal sectional view of the receptacle terminal of this invention taken along the line 3-3 in Figure 1;

Figure 4 is the sectional view of the receptacle shown in Figure 3 showing the fixed beam relationship of the movable beam when a male tab terminal of one thickness is inserted;

Figure 5 is the sectional view of the receptacle shown in Figure 3 showing the fixed beam relationship of the movable beam when a male tab terminal of another thickness is inserted;

Figure 6 is a cross-sectional view of the receptacle terminal of this invention taken along the line 5-5 in Figure 3;

Figure 7 is a plan view of the sheet of metal that is bent to form the receptacle terminal of this invention prior to bending.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawing, the tab receptacle terminal having fixed beam contacts of this invention, indicated generally at 10, is illustrated in perspective in Figures 1 and 2. The tab receptacle terminal 10 includes receptacle box 14 and integral

wire clamping portion 12. Flaps 15 and 13 are used to crimp over and attach a connecting wire (not shown). Flaps 16 and 17 are correspondingly used to crimp onto the insulation on the connecting wire (not shown). The wire connecting section 12 is integral with box side 20 and a portion of the top 30 of receptacle box 14 and a portion of the bottom 50 of receptacle box 14.

The receptacle box 14 is generally comprised of sides 20 and 40 and top 30 and bottom 50. As shown in Figure 1, the top 30 has an indented region 31 generally rectangular in shape. End opening 18 allows for male tab terminal insertion into the tab receptacle box 14. Flap 32 at the end opening portion of top 30 is bent downward and inward into opening 18 at an acute angle. A corresponding flap 52 on the bottom 50 is bent into the receptacle box 14 at an acute angle. The combination of flaps 32 and 52 guide insertion of a male tab terminal 11 as shown in Figure 4.

In Figure 2, the bottom 50 and side 40 are joined by overlapping tabs 56 and 42. These tabs fit into depressions 41 and 51 respectively to provide a flat box exterior surfaces. A cantilever supported movable beam member 60, best shown in the longitudinal section views of Figures 3 and 4, extends inside the receptacle box 14 from the rear portion towards end opening 18. Cantilever beam member 60 is formed by bending a metal portion 62 over the bottom 50 at bend 54 such that the base portion of the beam member 60 lies adjacent and against bottom side 50. The rear portion 64 is bent upward towards the top 30. Middle portion 66 is bent generally in the direction of bottom 50. As can be seen in Figure 3 and 4, a transverse raised ridge 65 projects toward the top 30. Another transverse raised ridge 67 projects toward the top 30 at the transition between middle portion 66 and end portion 68. End portion 68 is bent downward toward bottom 50. Longitudinal ribs 34 and 36 clearly shown in Figures 3 and 5 project downward from the recessed portion 31 of top 30. Cantilever supported beam member 60 is biased toward top 30 and is restrained at end portion 68 by contact with guiding flap 52.

A corresponding guiding flap 32 in the top 30 provides symmetrical guidance as a mating tab terminal is inserted into the receptacle as shown in Figures 4 and 5. As can be seen in Figure 5, as the male tab terminal is inserted, cantilever movable beam member 60 is deflected until end portion 68 contacts bottom 50. Further insertion deflects the end of end portion 68 into corner 53 formed between flap 52 and bottom 50 thus terminating any further deflection of member 60. This results in transverse ridges 65 and 67 becoming transversed fixed beams contacting the underside of male tab terminal 11 while longitudinal fixed beams 34 and

36 contact the upper side of inserted male tab terminal 11.

Figure 6 shows the relationship between transverse cantilevered beam member 65 and longitudinal fixed beams 34 and 36. The tab receptacle in this embodiment therefore presents to the male tab terminal four fixed beam contact surface lines represented by fixed beams 34, 36, 65, and 67. The pairs of fixed beams 34, 36 and 65, 67 thus formed preclude rocking of male tab terminal 11 within receptacle box 14 and provide a distributed firm grip on inserted male tab terminal 11. In addition, because the contact members are fixed beams, increased ampacity is achieved for a tab receptacle of a given size.

The tab receptacle terminal is fabricated by bending a single sheet of metal. A sheet metal stamping prior to bending is shown in Figure 7. It can be seen that cantilever supported movable beam member 60 is integrally attached to bottom 50. As shown in Figure 7 longitudinal fixed beams 34 and 36 are already formed in the top 30. Similarly, depressed portions 41 and 51 for receiving tabs 56 and 42 respectively are preformed in side 40 and bottom 50.

In the use of terminal 10, improved ampacity is achieved by providing rigid continuous contact between an inserted male tab terminal, the fixed beams 34 and 36, and fixed beams 65 and 67 as shown in figure 5. Resistance heating will cause expansion of beam 60 which is rigidly confined between corner 53 and base section 62. This will direct forces to counteract any weakening of spring biasing of beam 60 thus maintaining high ampacity.

Because there are two spaced apart contact lines on each surface of the inserted male tab terminal, there can be no relative rocking between tab and receptacle. This feature eliminates the potential for fretting corrosion on the contact surfaces.

In addition, the receptacle terminal of the present invention may be used with male tab terminals of different thickness as illustrated in Figure 4. A male tab terminal with a thin blade will contact the fixed beams 34 and 36 and the first transverse raised ridge 67 upon insertion. Ridge 67 is positioned interior to the front end of beams 34 and 36 thereby maintaining rigid contact of the tab terminal with the beams. As shown in Figure 4, end portion 68 of beam 60 is not wedged into corner 53 thus limiting the ampacity of this combination to a lesser value than that of figure 5.

Although not shown in figures 4 and 5, short male tab terminals are readily accommodated by the receptacle terminal of the present invention so long as the tab terminal can be inserted past transverse ridge 67.

While the above description constitutes the preferred embodiment of the present invention, it

will be appreciated that the invention is susceptible to modification, variation, and change without departing from the proper scope and fair meaning of the accompanying claims.

Claims

1. A tab receptacle terminal fabricated by bending a single sheet of metal comprising: a rectangular receptacle box having a closed continuous wall forming an end opening through which a male tab terminal is inserted so as to make contact with said receptacle box, said receptacle box including a bottom, a top, and sides; fixed beams formed in said top and extending toward said bottom for engagement with one side of said male tab terminal; and a cantilever supported beam member formed between said top and said bottom by a portion of said sheet of metal folded into the interior of said box for engagement with the other side of said male tab terminal.

2. A tab receptacle terminal according to Claim 1 wherein said beam member includes a front end portion located adjacent said end opening, a middle portion, and a rear portion attached to said box, said front end portion being bent downward toward said bottom of said box and having a transverse raised ridge at the transition between said middle portion and said front end portion, said ridge being positioned to make contact with an inserted male tab terminal engaged with said fixed beams in said top.

3. A tab receptacle terminal according to Claim 2 wherein said bottom has a projecting flap at said end opening, said flap being bent upward and into said end opening over said front end portion of said beam member to facilitate insertion of said male terminal into said end opening.

4. A tab receptacle fabricated by bending a single sheet of metal comprising: a rectangular receptacle box having a closed continuous wall forming an end opening through which a male tab terminal is inserted so as to make contact with said receptacle box, said receptacle box including a bottom, a top, and sides; fixed beams formed in said top extending toward said bottom for engagement with one side of said male tab terminal, said fixed beams lying parallel to the axis of male tab terminal insertion; a cantilever supported movable beam member formed between said top and said bottom by a portion of said sheet of metal folded into the interior of said box for engagement with the other side of said male tab terminal, said beam member including a front end portion located adjacent said end opening, a middle portion, and a rear portion

attached to said box;
 said rear portion being bent upward toward said
 top of said box, said middle portion being bent
 substantially parallel to said bottom, and said front
 end portion being bent downward toward said bot-
 tom;
 said beam having contact with said male tab termi-
 nal at spaced points along said beam when said
 male tab terminal is inserted into said box; and
 said front end portion of said beam coacting with
 said bottom when said male tab terminal is inserted
 so as to fix said beam in opposition to said fixed
 beams in said top.

5. The tab receptacle terminal according to
 Claim 4 wherein said top and bottom at said end
 opening have integral flaps bent toward and into
 said box at acute angles to said top and bottom to
 guide insertion of said male tab terminal.

6. The tab receptacle terminal according to
 Claim 5 wherein said bottom flap overlaps said
 movable beam limiting movement of said beam.

7. A tab receptacle fabricated by bending a
 single sheet of metal comprising:

a rectangular receptacle box having a closed con-
 tinuous wall forming an end opening through which
 a male tab terminal is inserted so as to make
 contact with said receptacle box, said receptacle
 box including a bottom, a top, and sides;

fixed beams formed in said top extending toward
 said bottom for engagement with one side of said
 male tab terminal, said fixed beams lying parallel to
 the axis of male tab terminal insertion;

a cantilever supported movable beam member
 formed between said top and said bottom by a
 portion of said sheet of metal folded into the inte-
 rior of said box with the other side of said male tab
 terminal, said beam member including a front end
 portion located adjacent said end opening, a mid-
 dle portion, and a rear portion attached to said box;
 said rear portion being bent upward toward said
 top of said box, said middle portion being bent
 substantially parallel to said bottom;

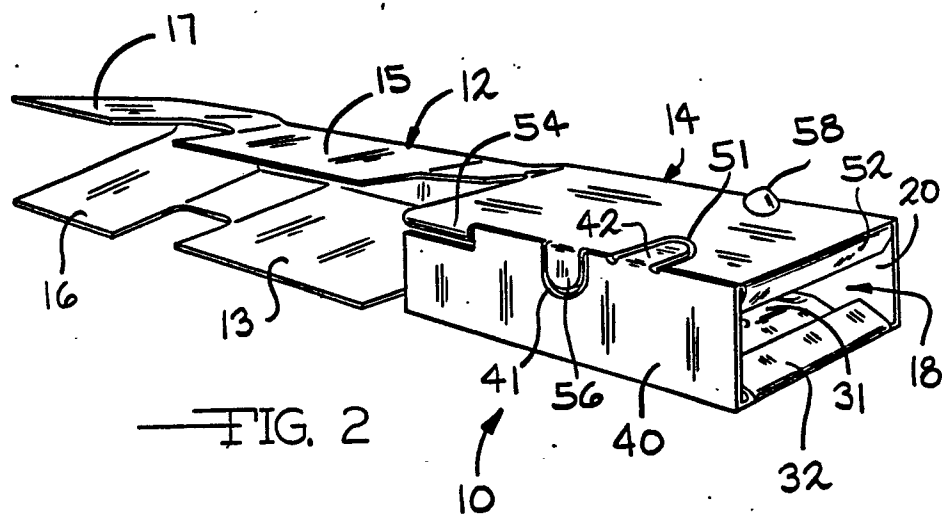
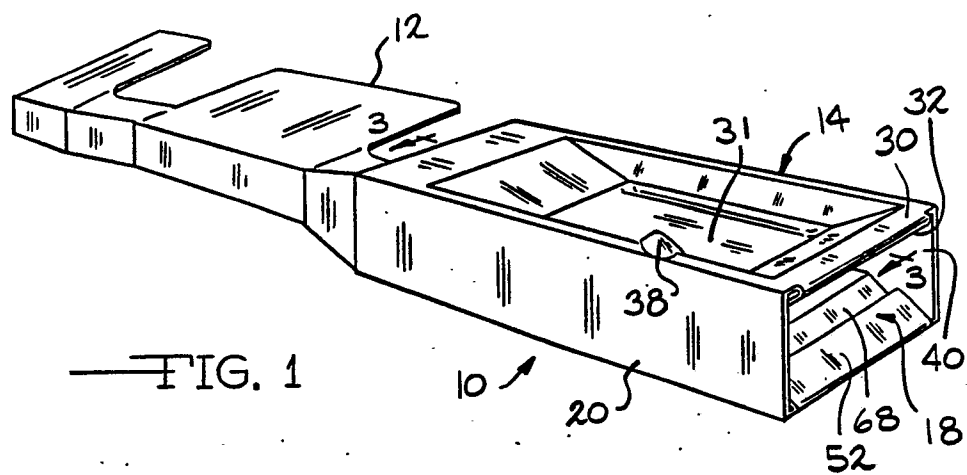
said beam having a first transverse raised ridge
 protruding toward said fixed beams at the transition
 between said rear portion and said middle portion,
 said first ridge being positioned to make contact
 with said male tab terminal engaged with said fixed
 beams in said top;

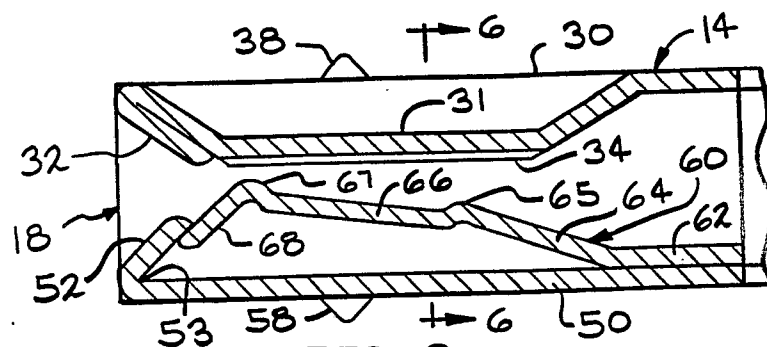
said front end portion of said beam being bent
 downward toward said bottom and having a second
 transverse raised ridge at the transition between
 said middle portion and said front end portion, said
 second ridge being positioned to make contact with
 an inserted male tab terminal engaged with said
 fixed beams in said top; and

said bottom having an integral flap at said end
 opening, said flap being bent toward and into said
 opening at an acute angle so as to overlap and

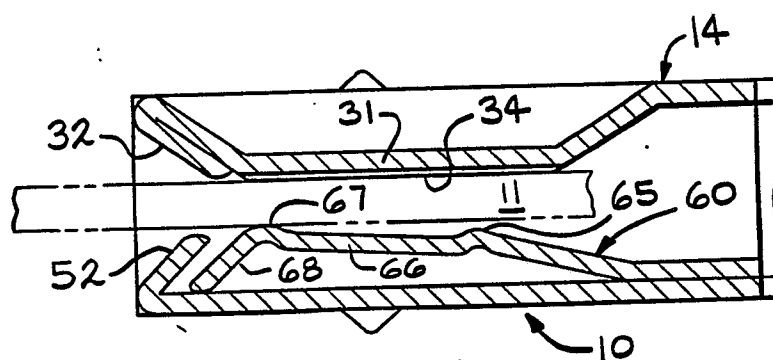
limit motion of said movable beam thus making
 said movable beam fixed when said male tab ter-
 minal is inserted within said box providing fixed
 beam contact between said ridges on said beam
 and the underside of the male tab terminal and
 between said fixed beams in said top and the
 opposite side of said male tab terminal.

8. A tab receptacle according to Claim 7
 wherein said top includes an integral flap at said
 end opening, said flap being bent toward and into
 said opening at an acute angle to guide insertion of
 said male tab terminal.





—FIG. 3



—FIG. 4

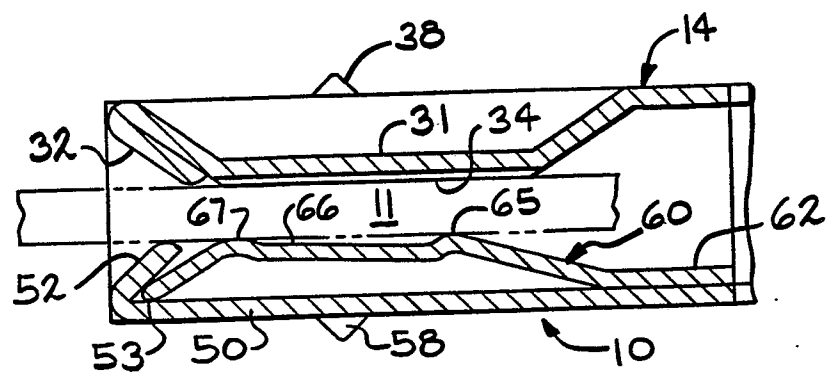


FIG. 5

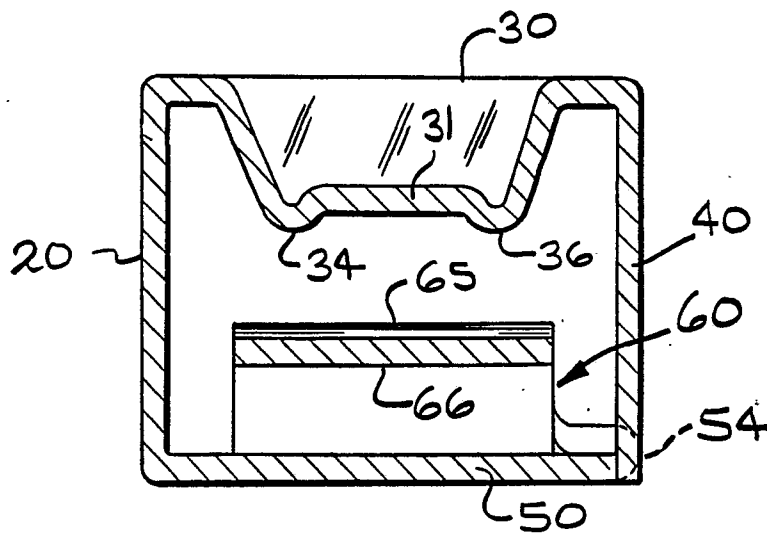


FIG. 6

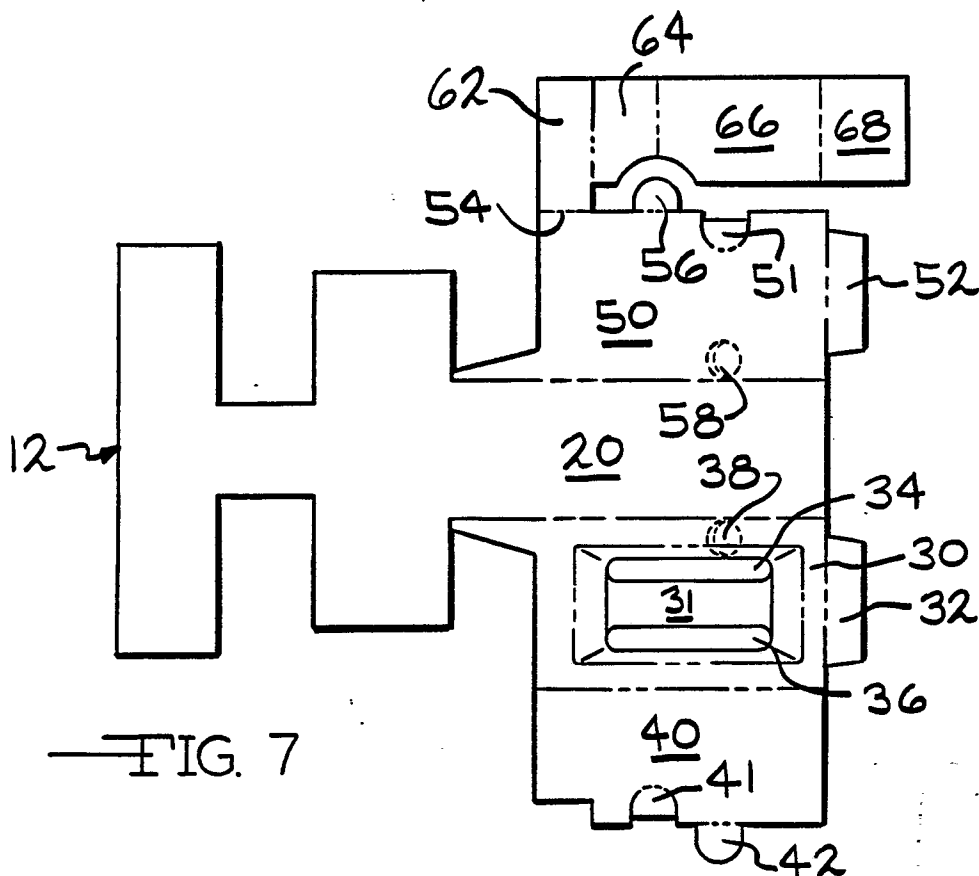


FIG. 7