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Miller et al.

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[54] CONNECTION FORMING APPARATUS

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[21] Appl. No.: **117,665**

Related U.S. Application Data

[62] Division of Ser. No. 786,285, Dec. 23, 1968, abandoned.

[30] **Foreign Application Priority Data**

Dec. 22, 1969	Belgium	83100
Sept. 15, 1969	Canada	061963
Dec. 16, 1969	France	6943606
Dec. 22, 1969	Germany	P 19 64 262.7
Dec. 20, 1969	Italy	26110 A/69
Dec. 19, 1969	Luxembourg	29124
Dec. 22, 1969	Netherlands	6919236

[52] **U.S. Cl.** **29/204**

[51] **Int. Cl.** **H01m 35/18**

[58] **Field of Search** ..... 29/204, 243.54, 204 D, 29/208 D, 200 B, 628; 136/134

[56] **References Cited**

UNITED STATES PATENTS

1,430,292	9/1922	Dicks	29/243.54
2,387,449	10/1945	Kaman	29/243.54
3,336,164	8/1967	Miller	136/134
3,508,318	4/1970	Clingenpeel et al.	29/204

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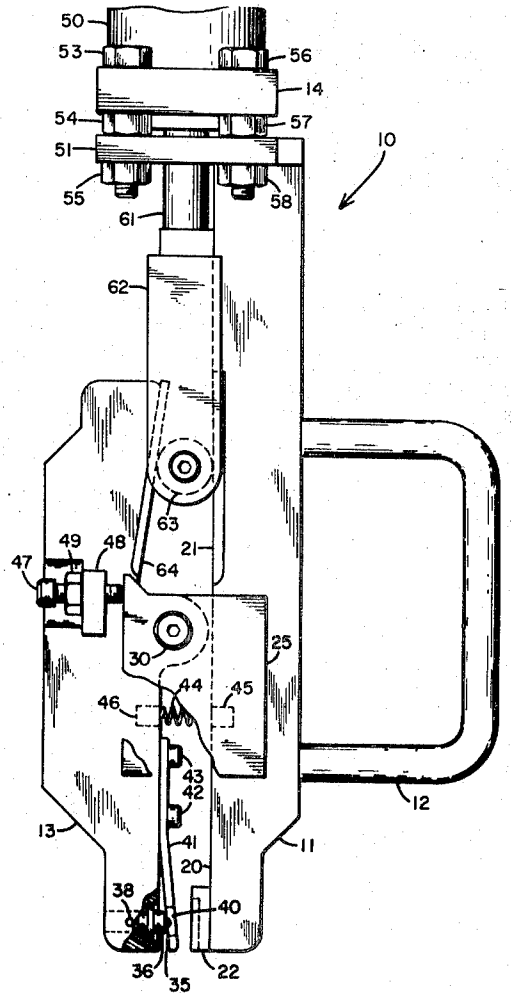
[57] **ABSTRACT**

An apparatus for forming a tight sealing relation between intercell connector lugs of a storage battery. The apparatus comprises a pair of jaw members that squeeze the intercell connector lugs of a storage battery together and a flaring member that expands the intercell connector lugs to form a tight sealing relation.

7 Claims, 4 Drawing Figures



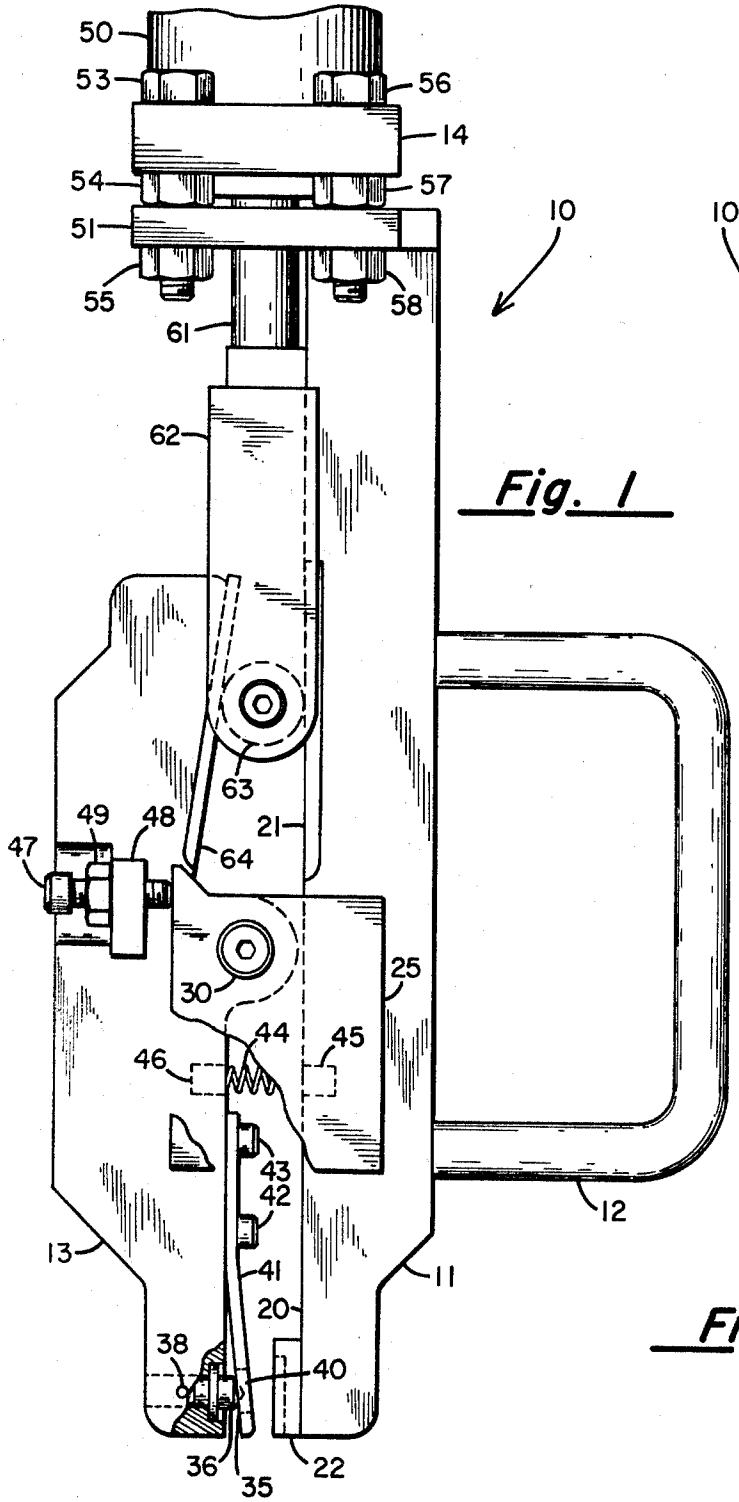


Fig. 1

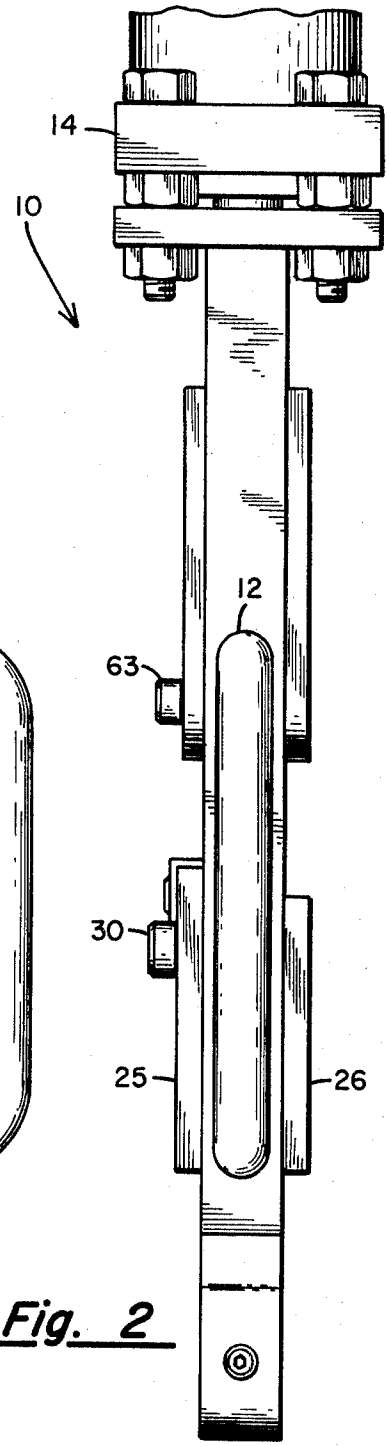


Fig. 2

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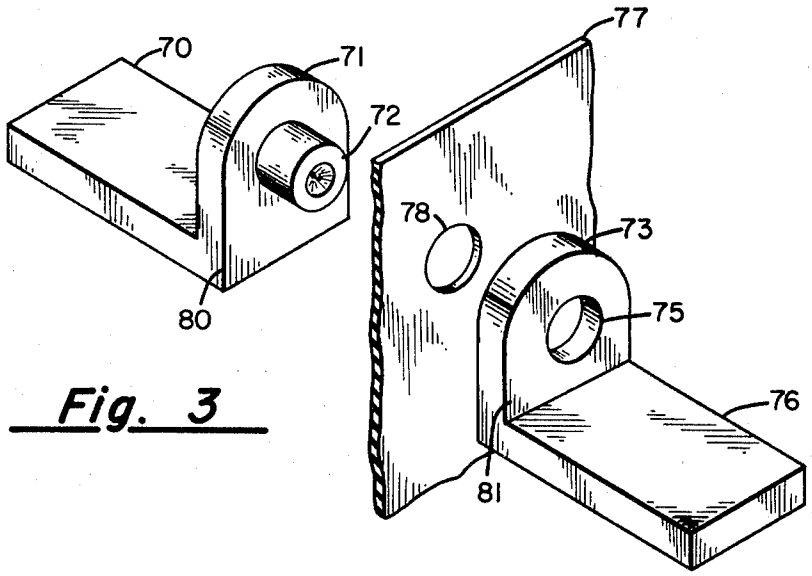

Fig. 3

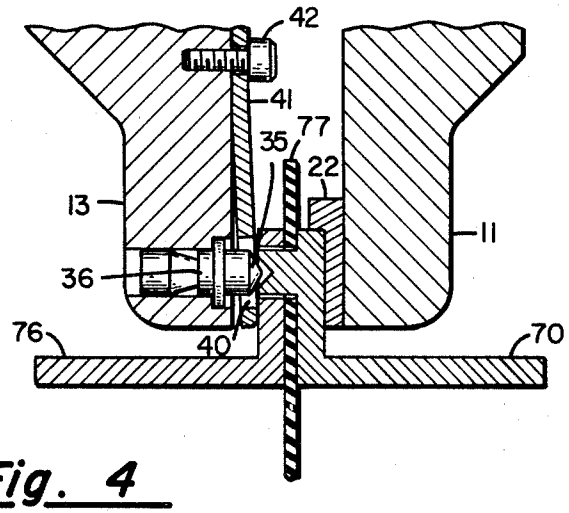

Fig. 4

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CONNECTION FORMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of our abandoned application filed Dec. 23, 1968, Ser. No. 786,285, and accordingly, priority is claimed from Dec. 23, 1968.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to connection forming apparatus and, more specifically, to storage battery intercell connection forming apparatus.

2. Description of the Prior Art

With the advent of storage battery intercell connector lugs, such as shown in Miller U.S. Pat. No. 3,336,164, it became necessary to have a reliable method and apparatus for ensuring a tight sealing relation between the connector lugs. These prior art connector lugs have a male lug with an extension thereon for extending through a partition between the battery cells and into an opening in a female lug. Flaring the end of the extension on the male lug produces an interference fit between the male lug and the female lug. To obtain a good electrical connection between the male lug and the female lug, it is necessary to uniformly flare the end of the extension in the male lug around the opening in the female lug. It is also necessary to ensure that the face of the male lug and the face of the female lug are securely located in a tight sealing relation around the intercell partition to prevent leakage of electrolyte between the battery cells. Because batteries having intercell connector lugs are often assembled by a human operator, they consequently require means for quickly and accurately positioning the connection forming apparatus against the intercell connector lugs.

We have invented such apparatus that quickly aligns and holds the face of the male lug and the face of the female lug securely against the intercell partition while flaring the end of the extension of the male lug around the opening of the female lug.

SUMMARY

An apparatus for producing a tight sealing relation between storage battery intercell connector lugs having a resilient member for holding a male connector lug and a female connector lug in a sealing relation against an intercell partition while a second member flares an end of an extension on the male lug into an opening in the female lug.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front view of our connection forming apparatus;

FIG. 2 is a side view of our connection forming apparatus;

FIG. 3 is a pictorial view showing an extension of a male lug aligned for assembly with the opening in the intercell partition in the opening of the female lug; and

FIG. 4 is a central vertical sectional view showing the intercell connector lugs and the connection forming apparatus prior to flaring the end of the extension of a male lug around the opening in a female lug.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, reference numeral 10 denotes our connection forming apparatus comprising a jaw member 11 having a handle 12, a movable jaw member 13 and power actuated means 14. Power actuated means 14 may be any suitable type of device; however, a hydraulic actuated device is preferred because of the flexibility of the hoses that connect the power source to the connection forming apparatus. Obviously, with a hand held connection forming tool, this is a desirable feature because an operator can quickly and easily move the tool from one position to another.

Jaw member 11 comprises an elongated section having a first working face 20 located on the lower portion of jaw member 11 and a second working face 21 located on the top portion of jaw member 11. Attached to first working face 20 is a lug holding and locating means 22. Attached to the front side of jaw member 11 is a first flat plate 25 and attached to the back side of jaw member 11 is a second flat plate 26. Plates 25 and 26 extend outward from jaw member 11 forming a recess that fits around movable member 13. Plates 25, and 26 also have a bolt 30 extending therethrough that pivotally support movable member 13 in the recess between plates 25 and 26.

A set screw 38 fastens a flaring member 36 to the lower portion of movable jaw member 13. Flaring member 36 has a cylindrical ridge that rigidly supports flaring member 36 in a cylindrical recess in movable jaw member 13. Flaring member 36 is shown having a conical shaped point 35 for pressure flaring the end of the extension of the male lug. Although a conical shaped point is shown, it is apparent other configurations could be used also and no limitation thereto is intended. Conical shaped point 35 extends through an opening 40 in a spring member 41 which is attached to jaw member 11 by a bolt 42 and a bolt 43. During the flaring process spring member 41 on moveable jaw 11 and means 22 on jaw 13 co-act to securely hold the face of the connector lugs against the intercell partition while flaring member 36 flares the connection between the two connections.

Prior to forming a connection between the two connector lugs, the lower ends of jaw member 11 and jaw member 13 are held in a spaced relation by a compression spring 44 that fits into a cylindrical recess 45 in jaw member 11 and into a cylindrical recess 46 in jaw member 13. Obviously, the spaced relation between jaw 11 and jaw 13 is determined by the size of the intercell connector lugs the jaws must fit around. Knowing the size of the connectors the operator sets the jaws so they pass freely over the connector lugs. An operator adjusts this spaced relation between jaw 11 and jaw 13 by turning a bolt 47 which is threaded through an extension 48 located on movable jaw member 13. When an operator determines the proper or desired distance between the lower end of jaw member 11 and jaw member 13, he tightens a nut 49 against extension 48 thereby securing bolt 47 in extension 48. Thus there is provided means for adjusting the distance between jaws 11 and 13 as well as means for maintaining the spaced relation between the two jaws in the open position.

Fastened on the top portion of jaw member 11 is a support plate 51 for a hydraulic cylinder 50. Four bolts (only two which are shown in FIG. 1) fastens hydraulic

cylinder 50 to plate 51. FIG. 1 shows a bolt 53 and a nut 54, a nut 55 thereon and a bolt 56 having a nut 57 and a nut 58 thereon for holding hydraulic cylinder 50 in rigid spaced support against plate 51. Extending downward from hydraulic cylinder 50 is a shaft 61 having a yoke shaped member 62 containing a hardened cylindrical forcing member 63 located in the yoke shaped portion of member 62. Forcing member 63 slides vertically along hardened working face 21 or jaw member 11 and along a hardened working face 64 on jaw member 13. Upward movement of forcing member 63 causes jaw member 13 to pivot counter-clockwise about bolt 30 thereby bringing the lower portion of jaw member 13 into working relation with jaw member 11.

FIG. 3 shows an intercell connector of the aforementioned Miller type comprising a first connector strap 70, a male lug 71, having an extension 72 located thereon and a second connector strap 76, female lug 73 having an opening 75 located therein. Located between male lug 71 and female lug 73 is a partition 77 that is normally found between the cells of a storage battery. An opening 78 in partition 77 allows extension 72 on male lug 71 to be pressed through the opening 78 into the opening 75 in female lug 73. Male lug 71 has a face 80 that normally abuts against partition 77 in a fluid-tight sealing relation and a back 81 opposite from the face.

FIG. 4 shows a cross-sectional view taken through the intercell connector and the lower portion of jaw member 11 and jaw member 13 during the forming of an intercell connection. Because the parts in FIG. 4 are identicial to parts previously described they have identical reference numerals. The purpose of FIG. 4 is to more clearly show the position of the jaws of connection forming apparatus 10 in pressure contact with male lug 71 and female lug 73. Briefly, jaw member 11 and jaw member 13 are shown in the closed position prior to expanding the end of the extension on male lug 71. In this position, spring member 41 and locating means 22 hold the face of male lug 71 and the face of female lug 73 in a sealing relation against partition 77. From this position additional force is exerted on jaws 11 and 13 causing conical point 35 on flaring member 36 to radially flare the end of extension 72 on male lug 71.

In order to more fully understand the connection forming process the steps will now be described in more detail. The steps are as follows:

First, extending the end of extension 72 on male lug 71 through opening 77 in a cell partition and through an opening 75 in female lug 74.

Second, placing the jaw member 11 and locating means 22 which is attached to the working face 21, around male lug 71. This serves a dual purpose in that it provides a support for flaring the male lug and also because of the contoured recess shape in means 22 it produces proper alignment of male lug 71 with respect to jaw member 11.

Third, actuating the hydraulic means through a hydraulic supply (not shown) which starts upward movement of forcing member 63 attached to shaft 61. As forcing member 63 moves upward it pushes the top portion of jaw member 13 away from jaw member 11 thus bringing spring member 40 in contact with the face of female lug 73. Note, spring member 40 contacts the face of female lug 73 prior to flaring member 36 contacting the end of the extension 72 of male lug 71. Thus, as jaw member 11 and jaw member 13 close, spring member 40 forces face 80 of lug 71 and the face of lug 73 firmly against partition wall 77. The force necessary to firmly place the connecting lugs against partition 77 is controlled by the spring member 40. An example of a typical force used has been found to range from 200 to 600 pounds. This is by way of illustration only and should not be intended as a limitation for all size connecting lugs.

Fourth, increasing the hydraulic pressure thus closing jaw member 13 and the member 11 which allows conical shaped point 35 on flaring member 36 to strike the center of the end of extension 72.

Fifth, applying additional hydraulic pressure to cylinder 50 causes further upward movement of forcing member 63 thereby exerting a greater compressive force between jaw member 13 and jaw member 11. This greater compressive force pushes spring 40 against jaw member 13 thus allowing conical shaped point 35 to radially flare the end of the extension 72 into a tight sealing relation in the opening 75 of female lug 74. In the process of flaring the end of the extension, it has been found that a force ranging from 1,000 to 13,000 pounds produces a force capable of ensuring a tight sealing relation between the two connector lugs. It will be apparent that different sized lugs and different sized connectors could be used and consequently different forces would be desirable. Therefore, the range of 1,000 to 13,000 pounds is by way of illustration and is not meant as limiting for all size connections.

Sixth, maintaining the hydraulic pressure in the cylinder for a short period of time thus ensuring that flaring member 36 forms a tight sealing relation between the two connector lugs. After this predetermined time has elapsed hydraulic cylinder 50 is deactivated allowing shaft 61 to extend downward thereby bringing forcing member 63 downward which allows jaw member 11 and jaw member 13 to open. When the jaw members 11 and 13 open the operator can remove jaw member from connector lug by raising the handle attached to jaw member 11.

We claim:

1. Apparatus for forming a storage battery intercell connection between a first lug and a second lug, said apparatus comprising:
   - a first jaw member adaptable to be hand held by an operator;
   - locating means attached to said first jaw member, said locating means operable to align said first jaw member with one of the lugs;
   - a second jaw member located in a spaced relation from said locating means and adaptable to engage the other of the lugs;
   - a resilient member attached to said second jaw member for bringing the lugs of the battery into a flaring position; and
   - a flaring member located in said second jaw member for pressure expanding the lugs of the battery into a sealing relation when said second jaw member is brought into an operable relation with respect to said first jaw member.

2. The apparatus of claim 1 including power actuated means for bringing said first jaw member into an operable relation with said second jaw member.

3. The apparatus of claim 1 including means for adjusting the spaced relation between said first jaw member and said second jaw member.

4. The apparatus of claim 1 wherein one of said jaw members is pivotally mounted.

5. The apparatus of claim 2 including first means located on said first jaw member for slidable engaging said power actuated means; second means located in an opposite disposed manner in said second jaw member for slidable engaging said power actuated means; said first means and said second means positioned at an acute angle with respect to one another so that actuation of said power actuated means causes said second jaw member to be pivoted into a working relation with said first jaw member.

6. The apparatus of claim 5 wherein said first means located on said first jaw member and said second means located on said second jaw member comprise a hardened material.

7. The apparatus of claim 6 including spring means for holding said first jaw member in a spaced relation from said second jaw member when said apparatus is in a pre-operative condition.

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