

Dec. 29, 1925.

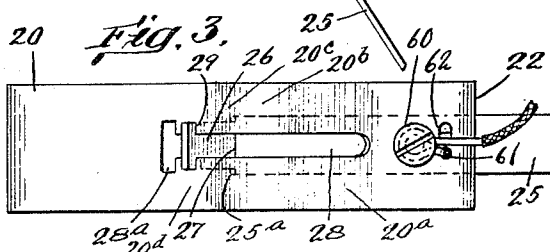
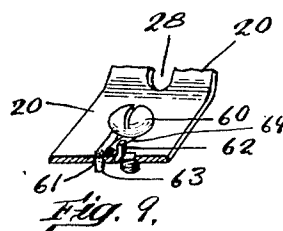
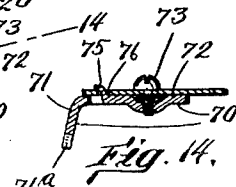
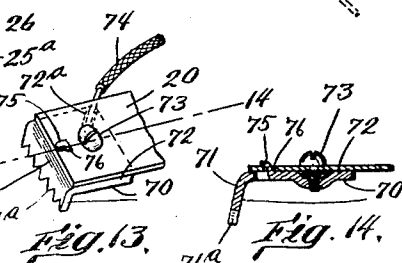
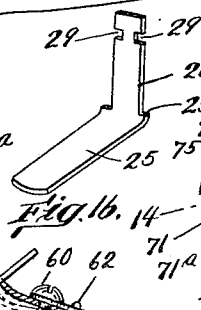
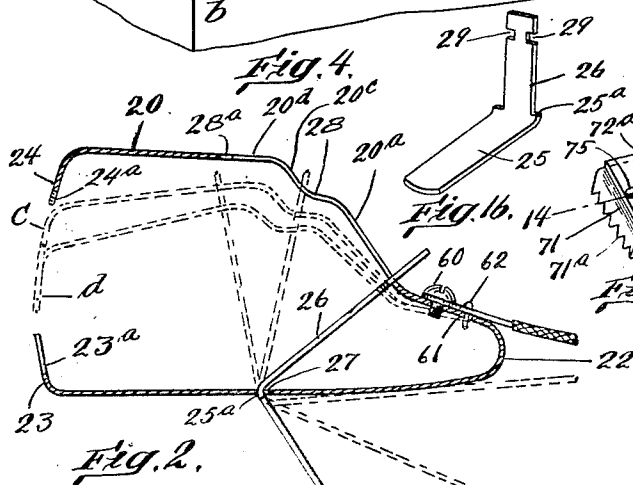
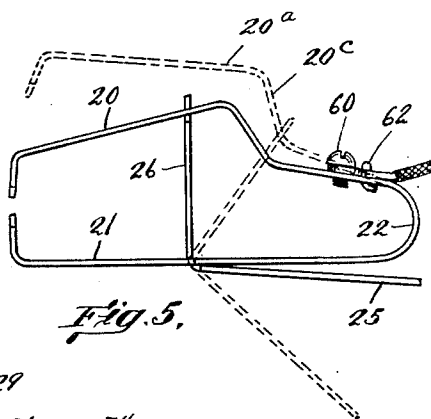
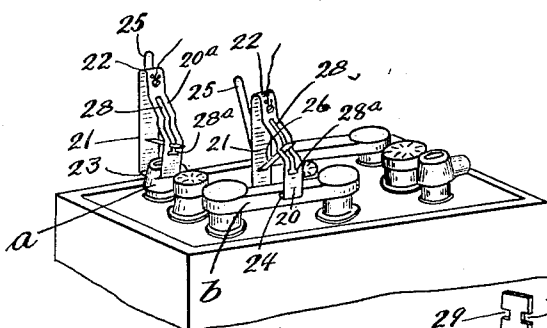
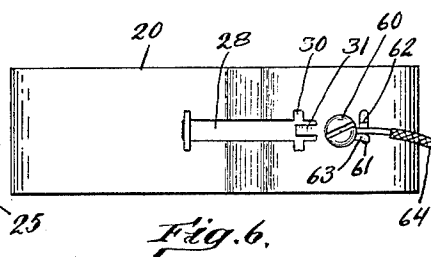
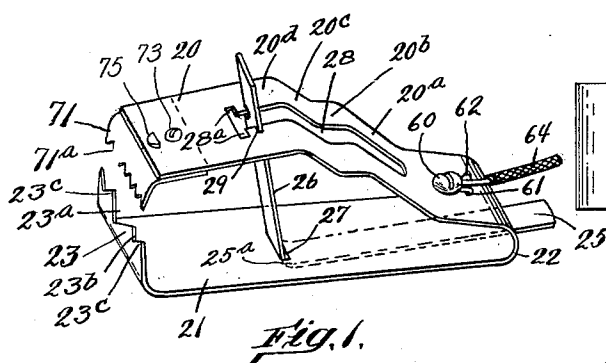
1,567,155

I. W. LITCHFIELD

ELECTRIC CONNECTER

Filed May 7, 1921

2 Sheets-Sheet 1



Inventor.
Isaac W. Litchfield
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Dec. 29, 1925.

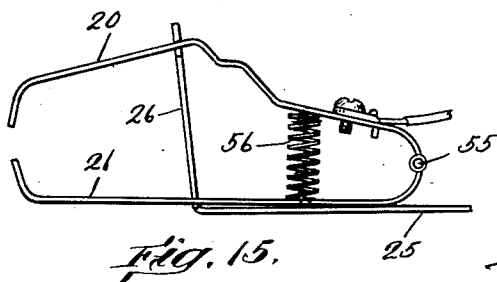
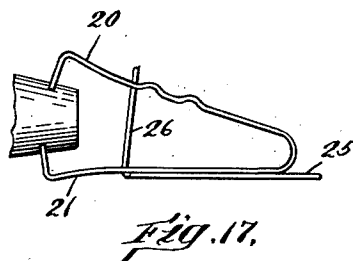
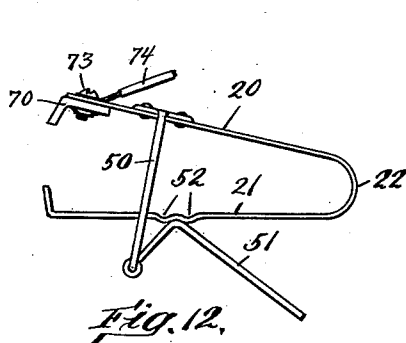
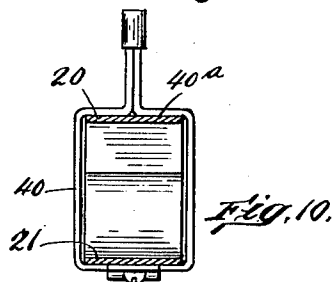
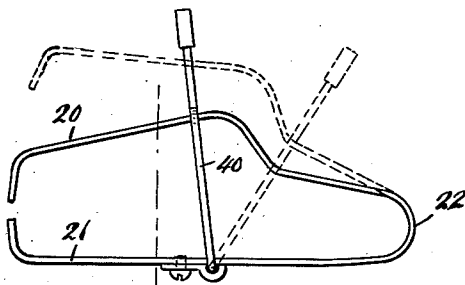
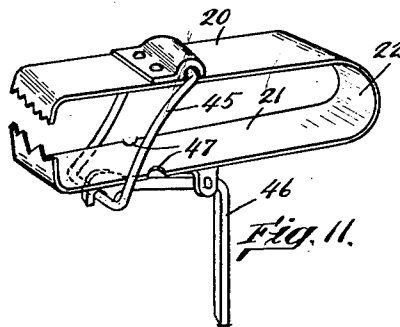
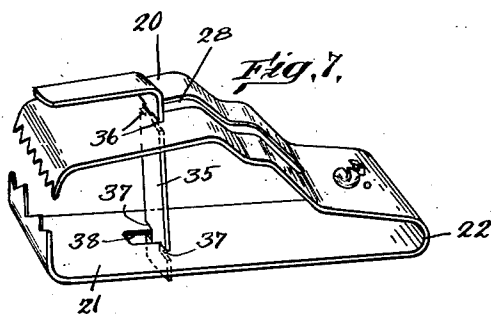
1,567,155

I. W. LITCHFIELD

ELECTRIC CONNECTER

Filed May 7, 1921

2 Sheets-Sheet 2



Inventor,
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UNITED STATES PATENT OFFICE.

ISAAC W. LITCHFIELD, OF NEWTONVILLE, MASSACHUSETTS.

ELECTRIC CONNECTER.

Application filed May 7, 1921. Serial No. 467,659.

To all whom it may concern:

Be it known that I, ISAAC W. LITCHFIELD, a citizen of the United States, residing at Newtonville, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Electric Connecters, of which the following is a specification.

This invention relates to electric connectors and has particular reference to connectors adapted to engage the terminal posts or lugs of storage batteries to connect them electrically with a charging circuit.

The usual type of connector has a pair of clamping jaws and a spring or equivalent adapted to press the jaws into engagement with the battery terminal. The usual difficulty experienced with this type of connector is that it does not grip the terminal with sufficient pressure to secure and maintain good electrical and firm mechanical contact therewith unless the spring tension is made so great as to render difficult the manipulation of the connector; and also increase its cost.

An object of this invention is the provision of a connector having a lever or equivalent power-increasing device by which to force the clamping jaws into good electrical and firm mechanical contact with the terminal with the application of but little effort on the lever or power-increasing device.

A further object is to provide a connector adapted firmly to engage terminal posts and the equivalent of varying dimensions and shapes.

The connector embodying the invention may comprise a pair of spring arms terminating in opposed clamping jaws adapted to be pressed into engagement with the battery terminal. Said spring arms may be so arranged that, in a non-clamping position, the jaws are resiliently held separated or open. A lever may be pivoted to one of said arms intermediate its length and engage the other arm intermediate its length

to force said jaws toward each other and lock said jaws in clamping engagement; and said lever and arms may be arranged to provide several jaw-locking positions.

A further object is generally to improve the construction and operation of an electric connector.

Fig. 1 is a perspective view of an electric connector embodying the invention.

Fig. 2 is a sectional view of a modified connector.

Fig. 3 is a plan view of the connector of Fig. 2.

Fig. 4 illustrates the manner of attaching the connector to the terminals of a storage battery.

Fig. 5 is a side view of a modified form of the connector of Fig. 1.

Fig. 6 is a plan view of the connector of Fig. 5 and illustrating more particularly a modified method of securing the operating lever in the upper arm.

Fig. 7 is a perspective view of the connector of Fig. 2 provided with a modified form of operating lever.

Fig. 9 is a sectional detail illustrating means for clamping the circuit wire to the connector.

Figs. 8 and 10 are side and end views respectively of a connector having a modified form of clamping lever.

Fig. 11 illustrates in perspective a further modified form of connector.

Fig. 12 is a side view of a connector having further modified clamping-jaw operating means and particularly a construction wherein the circuit wire is connected directly to a separable clamping jaw.

Fig. 13 is a detail of the separable clamping jaw of Fig. 12.

Fig. 14 is a section along line 14—14 of Fig. 13.

Fig. 15 is a modified form of connector wherein a separate spring is employed to open the clamping jaws.

Fig. 16 is a perspective view of the operating lever of Fig. 1.

Fig. 17 illustrates more particularly the yielding of the arms of the connector when clamped to a terminal.

As here shown, the connector embodying the invention is formed of suitable strip spring material reflexed to form the upper arm 20 spaced over the lower arm 21; and the intermediate connecting portion 22. The end portions of said arms are reflexed to form the lower upwardly extended clamping jaw 23 and the upper downwardly extended clamping jaw 24; and said latter jaw is disposed above said lower jaw 23. Said connector is so formed that said arms normally tend to separate due to the inherent resiliency of the arms and connecting portion 22 of the connector, and said arms may assume some such position as that illustrated in Fig. 2 when not operatively engaged by the clamping lever, or equivalent, hereinafter to be described. Said arms are adapted to be forced toward each other to cause the clamping jaws to engage a battery terminal. The proximate edges of said clamping jaws are formed with notches and projections to assist in obtaining good electrical contact and firm mechanical engagement with the battery terminal. Preferably said upper jaw 24 is formed with the uniform row of projections or teeth 24^a while the lower jaw 23 is formed with the relatively large notch 23^a therein and the smaller notches 23^b with the corresponding projections 23^c on each side of said notch. With this arrangement round terminals, as the terminal *a*, may be received in the large notch 23^a and flat terminals, as the lug *b* may be engaged by the projections on each side of said notch. With this arrangement the spread or extent of opening of the jaws is reduced.

The jaws of the connector are arranged to be positively forced into and held in clamping engagement with a terminal and also may be and preferably is arranged to be held in one or more definite clamping positions as will be hereinafter set forth.

The clamping or pressure applying and power-increasing lever illustrated in Figs. 1 and 5 is formed of strip material of suitable dimensions and has the handle portion 25 and the reduced portion 26 reflexed to stand at approximately right angles to the handle portion. The lower arm 21 of the connector is formed with the perforation 27 therein through which the portion 26 of the operating lever is extended and the shoulder 25^a at the junction of the handle and reduced portions of the lever is adapted to bear against the arm 21 and serve as a fulcrum for the lever. The upper arm 20 of the connector is formed with the slot 28 therein extended along the length of the arm and which terminates, at that end

nearest the clamping jaw, in an enlarged portion 28^a through which the end of the reduced portion 26 of the lever is adapted to be initially inserted. Said reduced portion is formed with opposed notches 29 in its upper end adapted to receive the opposite side walls of the slot 28 whereby the upper arms will be moved toward or away from the lower arm upon a movement of said lever. Preferably said slot 28 and lever are so arranged that in the upright position of the portion 26 of said lever the enlarged portion 28^a of said slot is beyond the lever whereby the lever will normally be restrained in the slot but may be removed therefrom by springing the lever forward to enter said enlarged portion 28 and subsequently withdrawing it from the perforation 27 in the lower arm.

The upper arm 21 of the connector illustrated in Fig. 1 is formed with the upwardly inclined cam face 20^a which terminates in the step-portion 20^b, and the second upwardly inclined cam face 20^c which extends from said step portion to the forward portion of the arm which forms a second step-portion 20^d; and said slot 28 extends through said cam and step portions. With this arrangement the clamping jaws may be locked in two different clamping positions. It is obvious that as said lever 25 is moved from say, its full line position, Fig. 2 to the intermediate dotted position, the notched end portion will move over the first cam-face 20^a and depress the clamping jaw 24, and when said lever arrives at the first step-portion 20^b said jaw will be held locked releasably in the clamping position indicated at *c*. As the clamping lever is moved further about its fulcrum in the lower arm 21 the upper notched portion thereof will travel over the second cam-face 20^c of the upper arm and further depress the clamping jaw 24, and when the notched portion of said lever arrives at the second step-portion of said arm 20 the clamping jaw will be moved into its lowest clamping position *d*. The dimensions of the terminals adapted to be engaged by the connector may vary considerably and yet the connector will firmly engage the terminals with the operating lever held in one of the step-portions of the arm 20 and variations in dimensions of the terminals will be taken care of by the springing of the arms 20 and 21 between the clamping jaws and the operating lever as indicated in Fig. 17.

While it is preferable to provide a plurality of cam faces and step portions for connectors adapted to engage terminals of greatly varying dimensions, for connectors of a lesser range of capacity it may be sufficient to provide but one cam face and step-portion, as illustrated in Fig. 5.

While the method of securing the operating lever 25 in the slot 28 as illustrated in Fig. 1 is preferable for certain purposes yet other means may be employed. For instance, in Fig. 6, the slot 28 is provided with an enlargement 30 at the rear end thereof through which the operating lever is initially inserted and said enlargement is subsequently closed by the projection 31 which is struck out from the body of the arm 20 and reflexed into said enlargement 30 after the lever is inserted in the slot.

Various forms of operating levers or means for applying pressure to the clamping jaws may be provided. In Fig. 7 one arm of the operating lever 35 is formed with the opposed notches 36 intermediate its end and the notches 37 near its end. The lower arm 21 of the connector is formed with the narrow slot 38 therein so that its longest length lies along the length of said arm and parallel to the slot 28 in the upper arm. The lever is inserted in said slot by first engaging it at right angles to the arms and then rotating it to a position as illustrated with the notches therein engaging the upper and lower arms.

In Fig. 8 the operating lever 40 is in the form of a loop which is pivoted to the lower arm 21 and extends over the opposite sides of the upper arm and has the top 40^a of the loop adapted for engagement with the cam face of the upper arm.

In Fig. 11 a toggle arrangement is illustrated wherein the link 45 in the form of a loop enclosing both arms of the connector is pivoted to the upper arm 20 and is pivotally connected to one arm of the bell crank operating lever 46 which is pivoted to the lower arm of the connector. The lower arm may have the opposed notches 47 in its opposite edges into which the link 45 may fit and be resiliently retained thereby to lock the connector releasably in engagement with a terminal.

In Fig. 12 a rigid arm 50 is fixed to the upper arm 20 of the connector and is pivotally engaged by an arm of the bell crank lever 51 the elbow of which is fulcrumed on the lower arm 21 of the connector between the two transverse projections 52 thereof.

While I prefer to form the connector from a single strip of metal with the two integral arms 20 and 21, and having inherent resiliency, yet the connector may be otherwise arranged.

In Fig. 15 the two arms 20 and 21 are pivotally connected at 55 and the compression spring 56 is arranged in engagement with said arms between their pivotal connection and the operating lever and serves to spread the arms and the clamping jaws.

For some connectors, I may prefer to arrange binding means for connection with a

circuit lead at the rear of the connector, as illustrated in Fig. 1 and more specifically in Fig. 9. The binding means may include the binding screw 60 which is threaded in the arm 20, the aperture 61 adjacent said screw, and the projection 62 which is struck out of said arm adjacent said screw and aperture. The end 63 of the circuit lead or wire 64 is adapted to be bent at an angle with the body of the wire and inserted in the aperture 61 by which said end is adapted to be held. The wire is then wrapped about the screw 60 and the body of said wire is arranged on the side of said projection 62 adjacent the aperture 61 and as shown in Fig. 9.

This arrangement serves to hold the wire securely in position on both sides of the binding screw 60 when said screw is tightened on the wire.

For connectors adapted for use on circuits adapted to carry a relatively heavy current the construction of clamping jaw illustrated in Figs. 12, 13 and 14 may be preferable.

As shown in these figures, the upper clamping jaw is separable from the upper arm 20 of the connector. Said jaw comprises the relatively massive L-shaped member 70 having one leg 71 formed with the teeth or projections 71^a. The other leg 72 is formed with an indentation or recess 72^a extended from its middle portion to one side edge. Said indented portion is provided with a threaded aperture therein adapted to receive the clamping screw 73 by which the clamping jaw is secured to the upper arm 20. The circuit lead 74 is adapted to be received in the indented portion 72^a of said jaw and will be electrically and mechanically connected with said jaw by said screw 73. Said jaw may be formed with the struck out lip 75 which is adapted to enter a perforation 76 in the arm 20 and be reflexed over said arm whereby to cooperate with said screw 73 to secure said jaw to said arm. It will be noted that, in the construction above set forth, the current will flow directly from the circuit lead through the clamping jaw to the terminal and without traversing the arms 20 and 21.

It is obvious that the invention may be embodied in modified structures without departing from the spirit thereof.

I claim:

1. An electric connector having a pair of arms terminating in clamping jaws, means including a lever arranged forcibly to move said jaws toward each other, and means removably to receive a circuit lead.

2. An electric connector having a pair of clamping jaws normally spring-pressed away from each other, means including a lever arranged forcibly to move said jaws toward each other, and attaching means

electrically to connect a circuit lead directly to one of said jaws.

3. An electric connector having a pair of connected arms terminating in clamping jaws, means detachably securing one of said jaws to its arm, means including a lever arranged to apply pressure to said arms between said jaws and the connection between said arms, whereby to move said jaws forcibly toward each other, and means removably to receive a circuit lead.

4. An electric connector having a pair of resilient and spaced-apart connected arms normally spring-pressed away from each other, and having clamping jaws at the ends thereof, means detachably securing one of said jaws to its arm, means connecting said arms intermediate their ends and including a lever arranged forcibly to move said arms and jaws toward each other, and means electrically to connect a circuit lead directly to said detachable jaw.

5. An electric connector having a pair of spaced-apart connected arms terminating in opposed clamping jaws, means including a lever pivotally carried by one of said arms and extended through said other arm and arranged to move said arms and jaws forcibly toward each other, and hold said jaws in a predetermined clamping position and means removably to receive a circuit lead.

6. An electric connector having a pair of spaced-apart connected arms terminating in opposed clamping jaws, one of said arms having a cam face, a lever pivoted to said other arm and extended through said first arm and the cam face thereof and arranged to engage the cam face and press said arm and its clamping jaw toward the clamping jaw of said second arm, and means removably to receive a circuit lead.

7. An electric connector having a pair of spaced-apart connected arms terminating in opposed clamping jaws, one of said arms formed with a plurality of cam faces and steps arranged in alternate succession, a lever pivoted to said other arm arranged to engage the cam faces of said first arm and press its clamping jaw toward said other clamping jaw, and engage said steps to hold said jaws in clamping position, and means removably to receive a circuit lead.

8. An electric connector having a pair of spaced connected arms terminating in opposed clamping jaws, one of said arms having lever-locking means, means including a lever pivoted to said other arm arranged in sliding engagement with said first arm to move said jaws toward each other, and also arranged to engage said lever-locking means, whereby to hold said jaws in set position and binding means for a circuit lead.

9. An electric connector having a pair of

spaced connected arms terminating in opposed clamping jaws, means including a lever pivoted to one of said arms arranged in sliding engagement with said other arm to move said jaws forcibly toward and away from each other, and binding means for a circuit lead.

10. An electric connector having a pair of resilient spaced-apart connected arms terminating in opposed clamping jaws, means including a lever pivoted in one of said arms intermediate its length and extended through and arranged in sliding engagement with said other arm intermediate its length to move said jaws toward each other, and binding means for a circuit lead.

11. An electric connector having a pair of integral spaced-apart resilient arms terminating in opposed clamping jaws, one of said arms formed with a cam face and a slot in said cam face disposed along the length of the arm, a lever pivoted to said other arm having an end-portion received in said slot in sliding engagement with said cam face to press said clamping jaws toward each other, and binding means for a circuit lead.

12. An electric connector having a pair of spaced-apart connected arms terminating in opposed clamping jaws, manually-operable power-increasing means including a power-increasing lever operably connected with said arms and arranged forcibly to move said jaws toward and away from each other, and binding means for a circuit lead connected with one of said arms.

13. An electric connector having a pair of integral spaced-apart resilient arms terminating in opposed clamping jaws, one of said arms formed with a cam face and a slot extended along the length of the arm through said cam face, said other arm having a perforation, an operating lever having a reduced portion pivotally received in said perforation and formed with a notched upper end portion which is received in said slot with the side walls of the slot received in the notches, whereby said lever is arranged to engage said cam face and move said jaws forcibly toward each other and binding means for a circuit lead.

14. An electric connector having a pair of spaced-apart connected arms terminating in opposed clamping jaws, one of said arms formed with a plurality of cam faces and steps arranged in alternate succession and a slot extended along the length of said arm through said cam faces and steps, said other arm having a perforation, an operating lever having a reduced portion pivotally received in said perforation and formed with a notched upper end received in said slot with the side walls of the slot received in the notches whereby said lever is arranged to engage said cam faces and move

said jaws forcibly toward each other, and is arranged also to engage said steps and hold said jaws in clamping position, and binding means for a circuit lead.

- 5 15. An electric connecter having a pair of spaced apart connected arms terminating in opposed clamping jaws, means including a lever pivoted to one of said arms to move said jaws forcibly toward each other and
10 hold said jaws in a plurality of predetermined clamping positions, and hold said lever in a corresponding plurality of posi-

tions, and binding means for a circuit lead.

16. An electric connecter having a pair of spaced-apart connected arms, one of said 15 arms terminating in a clamping jaw and a clamping jaw removably connected with said other arm having means arranged directly to receive and be electrically connected with a circuit lead. 20

In testimony whereof, I have signed my name to this specification.

ISAAC W. LITCHFIELD.