Nov. 5, 1929. R. S. PIPER 1,734,145

ELECTRICAL CONNECTER

Filed April 3, 1925

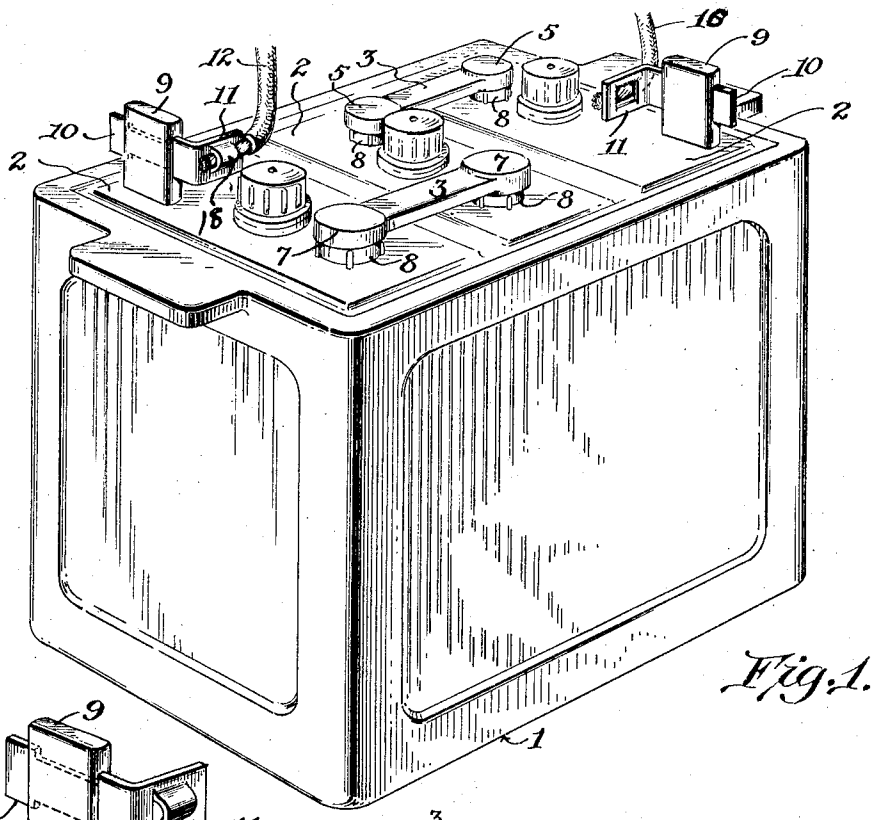


Fig. 1.

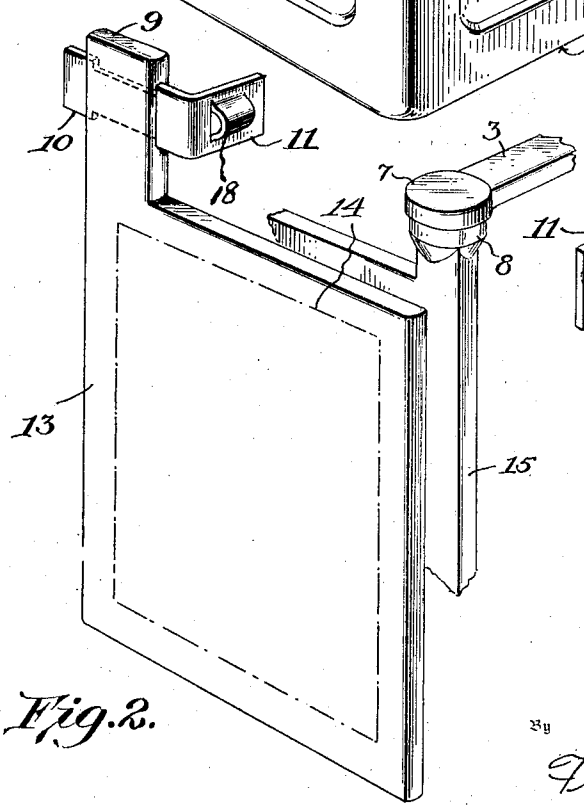


Fig. 2.

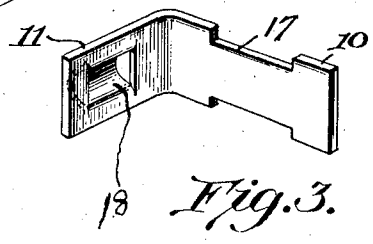


Fig. 3.

Inventor

Ralph S. Piper

By Todd Stanton Attorney

Patented Nov. 5, 1929 1,734,145

UNITED STATES PATENT OFFICE

RALPH S. PIPER, OF CHICAGO, ILLINOIS

ELECTRICAL CONNECTER

Application filed April 3, 1925. Serial No. 20,511.

My invention relates to an electrical connecter of a type adapted to serve particularly as a terminal for the free end element of a lead storage battery.

One object of my invention is to avoid the use of purely mechanical joints in electical connections of this character and yet provide a connection that may be readily made and easily opened and remade.

Another object of my invention is to provide a connection of the character indicated which combines a mechanical interlock, between the parts connected, which is so designed that it greatly facilitates soldering, or spot welding, i. e., autogenous joining of these parts as a final step in effecting a perfect electrical joint.

Another object of my invention is to provide an electrical connection which is economical of material and proof against corrosion and danger of shaking loose.

Other objects and advantages will appear as the description proceeds. I will describe my invention more particularly in connection with the accompanying drawings which form part of this specification, and in which:—

Fig. 1 is a perspective view of a battery provided with my connecter in a form that is especially serviceable for use in radio and automobile work.

Fig. 2 is a perspective elevation, showing parts in detail, of a connecter of my invention as adapted for use as a battery terminal.

Fig. 3 is a detail perspective view of a connecter element used in my invention, as designed for automobile batteries.

In all kinds of electrical work there exists a constant demand for devices adapted to readily connect the end of a wire to a battery terminal. These devices may be roughly divided into two general classes, viz, those in which the engagement with the wire is purely mechanical and those in which the wire is united to the connecter by solder, or by an autogenous welding operation. My invention combines many of the desirable features of each of the above classes of joints with great economy of manufacture.

Referring to Fig. 1, the connecter of my invention is designated by 11. This connecter consists of a sheet metal plate preferably of copper which may be of various shapes and sizes, but in Fig. 1 is shown as a flat metal strap. This flat piece of metal 11 carries a stirrup 18, formed from the metal of the section which carries it by a stamping operation. It will be seen that the stirrup so formed remains integrally connected to the piece of metal from which it projects at each of its ends, and the curvature of the stirrup is such that the end of a wire 12 may be readily inserted between the stirrup and the flat side portions of the section as shown in Fig. 1. When so inserted a slight pressure of a pair of tweezers upon the top of the stirrup, or a light blow of a hammer, will bring the wire into close metallic engagement with the inner face of the stirrup and the flat portions of the section on each side of the stirrup. A drop of solder run into the concave side of the stirrup, can then be applied to rigidly fix the wire in place, and owing to the conformation of the parts described, the solder will flow along the wire to seal it hermetically to the flats of the section on each side of the stirrup 18.

While I have indicated that the stirrup may be large enough with respect to the wire to take the latter freely, and require a setting of the stirrup to the wire, after the wire has been placed in position, obviously the stirrup can be formed initially, as part of the punching, or stamping operation, by which it is struck out of the section of the connecter, of such shape and size that the wire will fit snugly and even tightly in the stirrup. This size and shape of the stirrup can be so graduated by given die parts that a certain size connecter can be made up for each size of wire, and the only operation needed to make a perfect electrical joint will be to flow solder over the wire back of its engagement with the stirrup. This design of connecter is particularly efficacious in making joints in heavy wire connections, because the stirrup may be made to conform closely through a considerable arc of contact with the wire, giving a good electrical contact even before any solder is applied.

Electricians are generally agreed that a

soldered, or welded joint, between electrical conductors is superior to any form of mechanical joint, particularly when the conductors are constituted of light materials. No matter how perfect a mechanical joint may be initially, it is always subject to deterioration, due to corrosive effects and possible loosening of the mechanical bond. A soldered, or welded joint, on the other hand when properly designed as to current carrying capacity is free from these defects and will last indefinitely, but owing to the inconvenience and difficulty of making soldered joints heretofore there has been a tendency to put up with electrical joints in which the connection is purely mechanical.

Figs. 1 and 2 show my invention as applied to a battery terminal. Probably no more exacting use can be found for a connecter than when used for the purpose of making a good electrical joint between a battery terminal and its leads, or line wires. Such a connection is subjected to all kinds of strains, constant vibration and the corrosive action of the fluids and fumes inseparable from batteries. Even with the well known drawbacks of mechanical joints, and the severe requirements of battery use the mechanical joint remains the universal favorite for end terminal connections, but it is bound to be displaced by an electrical joint that provides soldered, sweated, or welded contacts, which can be quickly and certainly put together and taken apart again to be reused.

In Figs. 1 and 2 a battery lug, or post, 9 is shown used as an end terminal connection, and provided with a line connecter of my invention, marked 11. These two parts may be permanently united as a detail of the plate manufacture, by casting them together. To facilitate illustration of the invention the connecter plate 11 is shown bent at right angles to the plane of the battery plate, and it may be used in that position, but the particular conformation of the connecter piece, the material of which it is made, and its fabrication may be varied, without departing from my invention which takes a connecter piece, similar to that shown in Fig. 3, and bodily incorporates it as part of the structure of a battery plate, and as a detail of the manufacture of the plate by a casting operation. The electrical and mechanical properties of a good connecter element are well known.

All storage batteries, as now constructed, have a lug, or post, similar to the one shown at 9 in Figs. 1 and 2 cast integral with the plates, or grids. The lugs of the inside, or intermediate, plates of a battery are universally electrically connected together, as shown at 3, in Fig. 1. The part 3 is called in the art a jumper, it is made of battery metal and is burned to the lugs of the plates it connects, according to well known practice in lead burned joints. The lead jumpers across the cells 2 of a battery aggregate represent standard practice for inside plate connections, but a satisfactory connecter for joining the first and last plates of a battery to the power wires has never been designed. Such connecters are known as—end terminal connecters—, because they are used to connect the end plates of a battery to the line wires.

The usual form of end terminal connecter found in practice is a brass clamp, soldered to the power wire, and mechanically joined to the lug, or post, of the battery plate by a bolt compressing the clamp on the lug. Since this lug is nothing but weak battery metal it cannot withstand the crushing and wrenching strains imposed by these devices, even when made much larger than they need, or should be, simply to serve as an electrical connection between the plate and its supply and discharge wires. At best the joint between the lug and the brass clamp is a mechanical one, and the weak metal of the lug soon crushes together causing a loose joint which becomes rapidly useless due to filling up with insulating salts and deposits from the battery.

Originally all storage battery plates were made as solid plates of pure lead. That metal has one incomparable advantage for acid battery work. It is not chemically attacked by the electrolyte. It has other advantages for the purpose, which need not be explained, but it is about the poorest metal which could be selected to clamp a much harder metal to for the purposes of a high duty, permanent, electrical connection.

This invention enables the shape and dimensions of the lug 9, Figs. 1 and 2, to be restricted to the most favorable and economical design of that part consistent with ability to carry heavy currents, to and from the battery plate. As shown in these figures it is a plain rectangular lug, of the same thickness as the plate itself, and compared to the usual battery lug, built up to witstand compression by powerful clamp terminal pieces, requires only about half as much metal.

Much less metal is required in the connecter element also, as compared to clamp terminals. It is shown as considerably less in thickness than the lug it is heremetically sealed into during the plate casting operation. Aside from economy of metal in these parts of the terminal a considerable economy of space results in use. These advantages, while important, are only incidental to the very basic and reconstructive improvement which follows from the conception of making plate and connecter a single unitary electrical and mechanical entity, permanently locked together in an inseparable, hermetically sealed union.

It will be understood from the above description that this invention reconciles the unavoidable use of battery metal, consisting mostly of lead, as plate metal, with provisions for getting current into and out of the

plate made of a metal especially suited to serve as an excellent connecter for a wire, both mechanically, or through the agency of soldering, sweating or welding. In all cases the joint between the lug 9 and the connecter 11 will be an autogenous one, permanent and indestructible, always of high conductivity, and, if desired, the wire 12, Fig. 1, can be either tightly twisted into its stirrup in piece 11 as described earlier in this specification, or it can be soldered or spot welded therein, resulting in another autogenous joint.

Modern battery plates are seldom made solid throughout, usually nearly the entire area of a battery plate is made up of an open work grid. In the plate 13, Fig. 2, all within the broken line 14 would be of grid formation filled with paste pellets of active material. The name plate however has persisted when grid or grid-plate would be better, but, it will be understood, that in most instances these terms are interchangeable and mean the same thing. For the purposes of this invention, however, a distinction should be observed between the end plates of a battery and its inside plates. The problem of interconnecting the inside plates has been satisfactorily solved for years, but this invention is the first that presents a device for connecting a battery to its circuit, through its terminal, or end plates, which can and does make as good an electrical connection as it is possible to make, under the most favorable circumstances.

As explained above, either pure lead or battery metal, which is 90 percent lead, must be used as the material for the frame-work of the grid-plates. All kinds of improvements have been built into batteries, between their end terminals, but these terminals themselves have been allowed to remain as a makeshift mechanical coupling between the lead lug and a brass clamp, in the face of the physical fact that lead flows under heavy pressure like water. This invention retains all the advantage of using a lead connection to the end plate itself, with its immunity to acid attack, and then transforms the unsuitable lead connecter into one made of a metal especially selected to give unfailing, and high duty service, as a line connecter.

The possibility of using an end terminal connecter, secured in the manner indicated, rests on the further characteristic of all modern battery plate metals of being alloys of lead and antimony. These alloys are used mainly because they expand considerably on cooling, filling the moulds tightly and giving what are known in the foundry art as sharp castings. The result of this characteristic is that a very perfect bond is obtained between the metal of the terminal and the metal of the plate, and this perfection of bond is increased by making the union at the time the plate is being poured, so that the invention not only relates to the product itself but includes the process by which it is made.

What I claim as my invention is:

1. A battery terminal consisting of a battery lug and a sheet metal copper strip, partly imbedded in said lug by casting, and provided with a free end terminal adapted to be joined securely to a wire.

2. An end terminal for a storage battery comprising a flat metal plate, and joining means between a portion of said plate and the grid plate of a storage battery consisting of a lug, of the same thickness as the grid plate, and cast integral therewith and over said flat plate portion, whereby the exposed portion of the flat metal plate is of less thickness than the lug secured thereto.

3. A battery terminal connecter comprising a metal member cast into a battery lug at one end and provided at the other end with a stirrup like projection, designed to receive a wire and to form a pocket for solder.

4. A battery terminal consisting of a battery lug and a sheet metal strap, partly imbedded in said lug by casting, and provided with a free end portion, designed to be joined securely to a wire.

5. The combination with a battery plate having an integral lug of a terminal connecter made of a metal uniting well to copper by fusion, and presenting a reduced cross-section portion around which the lug is cast, and a terminal portion projecting from said lug.

6. A storage battery terminal connecter comprising a free portion, designed to engage a conductor, and a portion rigidly anchored to the grid metal of a battery plate by a lug cast to both said plate and said rigidly anchored portion of the connecter, said connecter being made of a metal having a higher melting point and better soldering properties than the metal of the lug.

7. A terminal connection for the plate of a battery cell, designed to be connected to a circuit wire, consisting of a lug, integral with the battery plate, and a connecter element locked to said lug by parts, integral with said element, and between which the lug is cast.

8. The process of connecting a line wire connecter element to a battery plate element, which consists in permanently and hermetically joining the metal of the connecter element to the metal of the battery element, by casting a ligature, or lug, integral with the battery element and embracing part of the connecter element, as a detail of the plate casting operation.

RALPH S. PIPER.