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TOOL FOR ASSEMBLING AND DISASSEMBLING ELECTRICAL CONNECTORS

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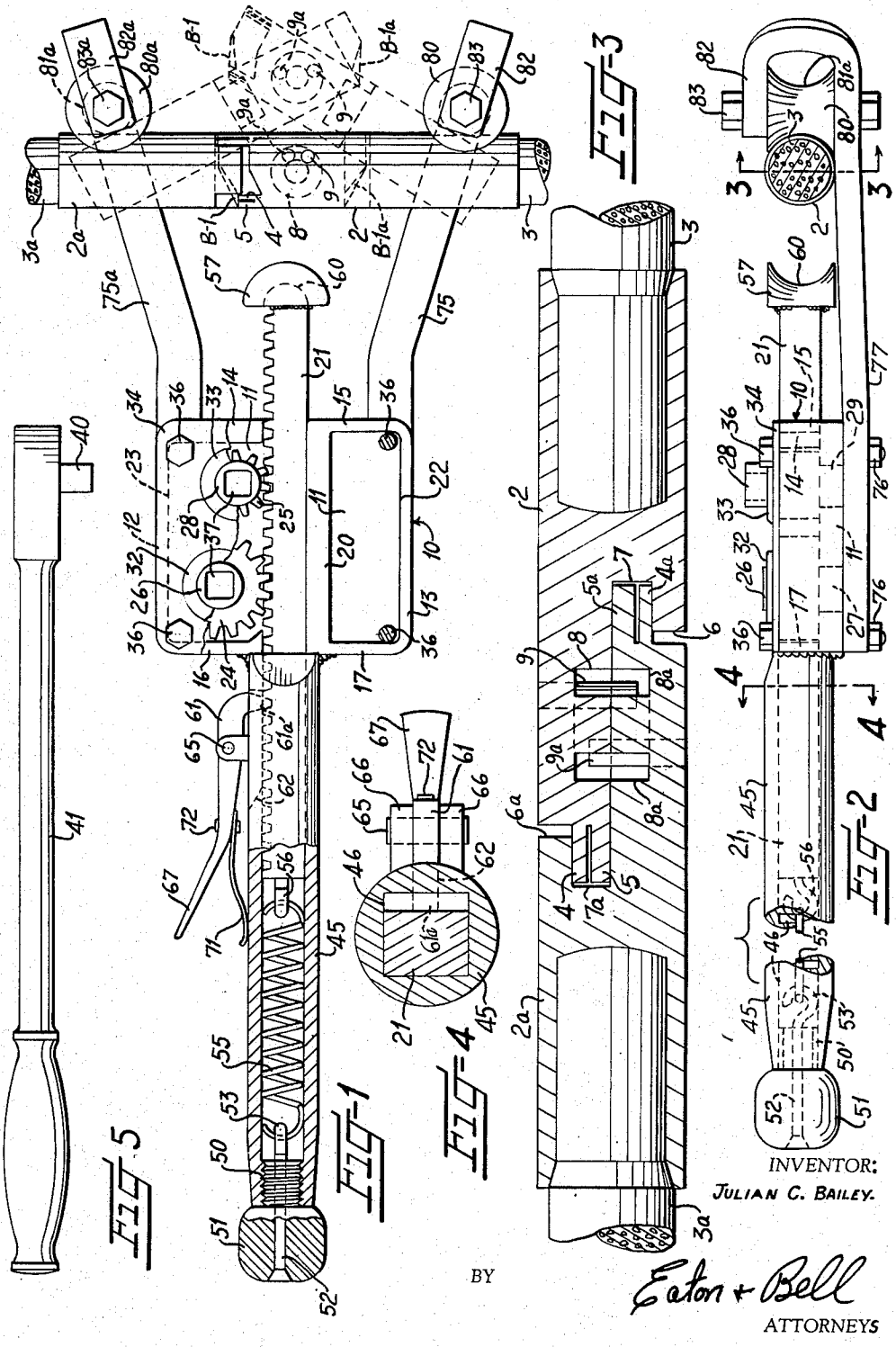


FIG-1

FIG-2

FIG-3

FIG-4

FIG-5

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TOOL FOR ASSEMBLING AND DISASSEMBLING ELECTRICAL CONNECTORS

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1 Claim. (Cl. 29—244)

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This invention relates to a special tool in the form of a jack-operated press which is particularly designed for assembling and disassembling the mating proximate ends of lugs of the type usually employed for connecting electric cables which extend between the generators and electric motors usually associated with a diesel-electric motor vehicle such as railroad dollies or in diesel-electric power plants. These lugs on the ends of the electric cables are generally termed in the art as "traction motor leads."

Due to malfunction of the usual generators or electric motors associated with diesel-electric railroad dollies or diesel-electric power plants, it is often necessary that either the electric motor or the generator be replaced. The cables extending from the electric motor to the generator are usually provided with mating lugs or traction motor leads each being provided with one or more projections which coincide with corresponding openings or grooves in the other of the lugs to form a pivotal connection therebetween and wherein it is necessary during assembly thereof to position the proximate ends of the lugs in angular overlapping relation to each other and then to press the lugs together in such a manner that they extend in axial alinement with each other, the openings or grooves in which the projections on the lugs are disposed being such that a considerable amount of pressure is required to assemble the lugs. This pressure is, of course, also required to disassemble the lugs which is performed in a reverse manner to the assembling thereof.

These lugs are necessarily made from an electrically conductive metal, such as brass or aluminum, and they are usually disposed within a relatively confined area and are, therefore, nearly inaccessible.

Heretofore, it has been necessary to assemble and disassemble the lugs by hammering the same with a suitable hammer in the hands of an operator which not only caused indentations in the lugs or otherwise damaged the same, but also often resulted in injury to the hands of the operator, which may strike the encumbering elements defining said defined area while swinging the hammer for assembling or disassembling the lugs.

It is, therefore, the primary object of this invention to provide a light, compact lug assembling and disassembling tool which may be held in one hand of an operator and inserted into a relatively confined area and which is provided with a pair of laterally spaced anvils which may be positioned against the adjacent lugs and adjacent opposed sides of the pivotal connection of

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said lugs. The tool is also provided with a jack-operated plunger which is movable in a plane transversely of the plane of the spaced anvils and substantially midway of the spaced anvils and which may, therefore, be positioned adjacent the opposite side of the lugs from that which is engaged by the anvils and in substantial alinement with the pivotal connection of the lugs whereby the plunger may be moved against the lugs to thus force the lugs towards the anvils. In disassembling the lugs, it is evident that the plunger would be moved beyond the transverse plane of the anvils for forcing the proximate ends of the lugs to an open position and, in the instance of the lugs being assembled, the proximate ends of the lugs would extend in diverging relation to the plunger and their outer ends would be in engagement with the anvils and, thus, the plunger would move the proximate ends of the lugs towards the plane of the anvils until the lugs were disposed in axial alinement with each other.

It is another object of this invention to provide a tool of the type described wherein the plunger is mounted for sliding movement in a base member in which one or more pinions are rotatably mounted, the plunger having rack teeth thereon engaging said pinions and said pinions being provided with means for accommodating a suitable wrench for manually imparting rotation to one of the pinions to impart movement to the plunger. The reason one or more pinions are provided is that these pinions may vary in size and thus provide different mechanical advantages depending upon the amount of force required for assembling or disassembling the lugs.

It is still another object of this invention to provide a tool of the type described wherein the base member or housing has an elongated tubular handle thereon by which the tool is supported by an operator. This handle is provided with a latch or pawl member thereon which engages the teeth in said rack and which is so arranged as to permit the rack to move outwardly only relative to the base, the pawl being provided with spring means to permit the pawl to be moved outwardly or radially of the axis of the plunger so the rack teeth of the plunger are released from the pawl, there being suitable spring means to subsequently urge the plunger in a reverse direction or towards the operator upon the pawl being moved to inoperative position. This provides means for quickly returning the plunger to its original position.

Some of the objects of the invention having

been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is a top plan view of the lug assembling and disassembling tool with parts broken away and showing a pair of cable connecting lugs positioned thereon in solid lines and said lugs also being shown in an alternate position in broken lines;

Figure 2 is an elevation looking up at the lower side of Figure 1 with parts broken away and showing the cable extending from the corresponding lug in cross-section;

Figure 3 is an enlarged vertical sectional view through a pair of assembled lugs taken substantially along the line 3—3 in Figure 2 and showing portions of the corresponding cables connected to the outer ends of the lugs;

Figure 4 is an enlarged fragmentary vertical sectional view along the line 4—4 in Figure 2;

Figure 5 is an elevation of a typical wrench which may be used for operating the lug assembling and disassembling tool.

The present lug assembling and disassembling tool is particularly provided for assembling and disassembling lugs which serve to connect cables extending from the electric motors and generators usually associated with diesel-electric engines as heretofore described. The lugs are of identical structure and are indicated at 2 and 2*a*, respectively. The lugs have suitable cavities in the outer ends thereof in which the corresponding ends of electric cables 3 and 3*a*, respectively, are suitably secured. The proximate ends of the lugs 2 and 2*a* are provided with closely spaced projections 4 and 5 and 4*a* and 5*a*, respectively, the inner proximate surfaces of the portions of the lugs which define the projections 5 and 5*a* being substantially longer than the outer surfaces of the projections 4 and 4*a* and being adapted to be disposed in overlapping relation to each other when the lugs 2 and 2*a* are assembled.

The lugs 2 and 2*a* are provided with shoulder portions 6 and 6*a*, respectively, which are spaced radially from the outer surfaces of the corresponding projections 5 and 5*a* and these shoulder portions 6 and 6*a* define notches or grooves 7 and 7*a* which are disposed in alinement with the outer ends of the projections 4*a* and 5*a* and 4 and 5, respectively. The walls of the notches 7*a* and 7 are spaced closer together than the normal displacement of the closely spaced projections 4 and 5 and 4*a* and 5*a* so that, when the lugs 2 and 2*a* are assembled in a manner to be later described, the projections 4*a* and 5*a* enter the notch 7 and the projections 4 and 5 enter the notch 7*a* and the projections 4 and 5 and 5*a* and 4*a* are thereby respectively biased inwardly towards each other thus requiring that these projections be forced into the corresponding notches 7*a* and 7. This insures that the lugs 2 and 2*a* will not come apart inadvertently once they have been assembled.

The proximate surfaces of the portions 5 and 5*a* of the lugs 2 and 2*a* are provided with coinciding annular grooves 8 and 8*a*, respectively, in which respective pins 9 and 9*a* are secured. It will be observed in Figure 3 that the pin 9 projects into the groove 8*a* and the pin 9*a* projects into the groove 8 when the lugs 2 and 3*a* are disposed in overlapping relation, to thereby provide means pivotally interconnecting the lugs 2 and 2*a*. These lugs are initially positioned substantially as shown in dotted lines in Figure 1

preparatory to being assembled. It will be noted that the pins 9 and 9*a* are disposed in substantially diametrically opposed relation to each other in the grooves 8 and 8*a* when the lugs 2 and 2*a* are disposed at an angle to each other preparatory to being assembled or after they have been disassembled as shown in dotted lines in Figure 1. However, upon the lugs 2 and 2*a* being positioned in axial alinement with each other as shown in solid lines in Figure 1, the pins are disposed in substantially closer relation to each other. The pins 9 and 9*a* serve to cause the lugs 2 and 2*a* to be pivoted about the axis of the annular grooves 8 and 8*a* when the lugs 2 and 3*a* are assembled or disassembled.

It will be noted that the leading edges of the projections 4, 5, 4*a* and 5*a* are tapered or beveled inwardly as at B–1 and B–1*a*, respectively, from a point substantially in line with the axis of the corresponding lugs 2 and 2*a* and inwardly towards the opposite ends of the corresponding lugs 2 and 2*a* to permit rotation of the members 2 and 2*a* about the axis of the annular grooves 8 and 8*a* until the lugs 2 and 2*a* have been tightly assembled to the closed position shown in solid lines in Figure 1.

Now, the assembling and disassembling tool, which is particularly adapted for assembling and disassembling the lugs 2 and 2*a* comprises a frame including a base or housing broadly designated at 10 which is provided with a bottom 11, side walls 12 and 13, a pair of laterally spaced front wall sections 14 and 15 and a pair of coinciding laterally spaced rear wall portions 16 and 17. The front and rear walls 15 and 17 are bridged by a partition 20 which defines one wall of a raceway for a plunger or rack 21. The walls 13, 15 and 17 and the partition 20 define a cavity 22 which is merely provided to relatively decrease the weight of the housing or base 10 although it is to be understood that this cavity 22 need not necessarily be provided. In the latter instance, a thickened portion of the bottom 11 may be provided in lieu of the walls 13, 15 and 17 and the partition 20.

The bottom of the raceway for the plunger or rack 21 is defined by the upper surface of the bottom 11 of the housing 10 and the side wall of the raceway remote from the partition 20 is defined by the inner edges of the front and rear wall portions 14 and 16. The walls 12, 14 and 16 of the housing 10 define a cavity 23 within which a pair of pinions or gears 24 and 25 are disposed. The gears 24 and 25 have respective upper and lower outwardly projecting hub portions 26 and 27 and 28 and 29 integral therewith. The gears 24 and 25 are of the same thickness as the depth of the cavity 23 and the lower surfaces slidably and rotatably engage the upper surface of the bottom wall 11 of the housing 10.

The hub portions 27 and 29 are rotatably mounted in the bottom 11 of the housing 10 and hub portions 26 and 28 of the pinions 24 and 25 are rotatably mounted in respective boss portions 32 and 33 integral with a closure plate or cover 34, preferably of cast construction. The closure plate or cover 34 extends over the cavities 22 and 23 and, also, defines a top wall for the raceway in which the rack or plunger 21 is slidably mounted.

The closure plate 34 is secured against the upper surfaces of the walls 12 to 17, inclusive, and the partition 20, by any suitable means such as screws 36, which extend through the correspond-

ing cavities 22 and 23 and threadably penetrate the bottom wall 11 of the housing 10. It will be noted that the pinions 24 and 25 mesh with the teeth of the rack or plunger 21 and of different diameters to provide a variable mechanical advantage in moving the plunger 21. Each of the hub portions 26 and 28 of the respective pinions 24 and 25 has a polygonally-shaped cavity or socket 37 therein which is shown as being square in Figure 1.

These polygonally-shaped cavities 37 are provided to slidably receive a correspondingly-shaped projection 40 on a suitable socket wrench 41. The socket wrench may be of any desired construction and its structure does not necessarily constitute a part of the present invention other than to provide means for effecting rotation of the pinions 24 and 25 independently of each other for moving the rack 21 forwardly.

The outer or rear surfaces of the bottom wall 11 and the rear walls 16 and 17 have the front end of an elongated tubular handle 45 suitably secured thereto as by welding. If so desired, this tubular handle 45 may be cast integral with the housing 10. The tubular handle 45 has a longitudinally extending passageway or bore 46 therein which is preferably rectangular in cross-section and the handle per se is preferably circular in cross-section.

It will be noted that the passageway 46 in the tubular handle 45 coincides with the raceway defined by the bottom 11, the inner edges of the walls 14 and 16 and the inner surface of the partition 20. The rack or plunger 21 not only extends through the said raceway but also has longitudinal sliding movement in the passageway 46. The outer end of the handle 45 has a threaded bore 50 therein in which a reduced threaded portion of a cap member 51 is threadably embedded. The cap member 51 is penetrated by a shank portion 52 of a hook member or spring anchor 53 which may be headed at its outer end as shown and slidably penetrate the cap member 51 or the spring anchor 53 may be otherwise secured to the inner end of the cap member 51.

The spring anchor 53 has the outer or rear end of a tension spring 55 connected thereto which is disposed within the passageway or cavity 46, the other end of which is connected to the corresponding end of the plunger or rack 21 by means of a spring anchor 56 suitably secured in the corresponding end of the plunger or rack 21 by any suitable means as by being threaded thereinto.

The end of the plunger or rack 21 remote from the end to which the tension spring 55 is connected has a pressure block 57 suitably secured thereto, as by welding. This pressure block 57 is preferably semi-circular in shape and is provided with a semi-circular groove 60 therein which is cut in the periphery of the outer portion of the pressure block 57 for purposes to be presently described.

It is evident that upon rotating either of the pinions 24 and 25 in a counter-clockwise direction in Figure 1, the plunger or rack 21 will move from left to right or outwardly of the right-hand or front walls of the housing 10. Now, in order to prevent the rack or plunger 21 from moving in a reverse direction under tension of the spring 55 upon the position of the socket wrench 41 being changed, as would be required in operating the tool in a limited area, the teeth of the rack are engaged by a tooth portion 61*a* of a pawl 61. The tubular handle 45 is provided with a suitable

opening or slot 62 which is penetrated by the hook portion 61*a* of the pawl 61.

The pawl 61 is pivotally mounted, as at 65 between a pair of projections or ears 66 welded or otherwise secured to the handle 45 and extending outwardly therefrom adjacent opposed sides of the slot or opening 62. The pawl 61 extends rearwardly and is normally disposed in slightly spaced relation to the handle 45. The rear end of the pawl 61, that is, the end thereof remote from the tooth portion 61*a*, has an outwardly flaring paddle portion 67 integral therewith which is adapted to be engaged by an operator for depressing the paddle 67 towards the handle 45 and to thereby move the tooth portion 61*a* of the pawl 61 out of engagement with the teeth in the rack or plunger 21. The tooth portion 61*a* of the pawl 61 is normally biased towards the teeth in the rack 21 by any suitable means such as a leaf spring member 71 which is suitably secured, as by a rivet 72, to the inner surface of the pawl 61 adjacent the paddle 67 and which leaf spring member extends rearwardly and is curved inwardly and engages the corresponding surface of the tubular handle 45.

It is thus seen that, due to the position of the pivot point 65 relative to the leaf spring member 71 and the tooth portion 61*a* of the pawl 61, upon rotating either of the pinions 24 and 25 in a counter-clockwise direction, the teeth of the rack or plunger 21 cause the pawl 61 to move outwardly as each tooth on the rack 21 passes thereby thus permitting the corresponding tooth on the rack 21 to pass by the inner end of the tooth portion 61*a* of the pawl 61. On the other hand, this will prevent reverse movement of the plunger or rack 21 until the paddle 67 is depressed by an operator.

The latter instance will permit the tension spring 55 to reverse the movement of the rack 21 to thereby move the same to withdrawn position. It is to be understood that the portion 40 of the socket wrench 41 is removed from engagement with either of the sockets 37 in the pinions 24 and 25 when the teeth of the rack or plunger 21 are released from the tooth portion 61*a* of the pawl 61 thereby permitting the gears or pinions 24 and 25 to rotate in a clockwise direction as the spring 55 pulls the plunger 21 inwardly or rearwardly from right to left in Figure 1.

The screws 36, which secure the cover 34 to the housing 10, also serve to secure a pair of forwardly diverging arms 75 and 75*a* to the lower surface of the bottom wall 11 of the housing 10. These screws 36 slidably penetrate suitable holes provided therefor in the corresponding arms 75 and 75*a* and the arms are secured against the bottom surface of the bottom 11 of the housing 10 by suitable nuts 76 threadably mounted on the lower ends of the screws 36.

It will be noted that the arms 75 and 75*a* not only extend in diverging relation to each other beyond the front walls of the housing 10, but they are also bent upwardly at a point indicated at 77 in Figure 2 to thus position respective anvils or pressure receiving members, in the form of rollers 80 and 80*a*, in substantially the same plane as the longitudinal axis of the plunger 21. The rollers slidably and rotatably engage the upper surface of the respective arms 75 and 75*a* adjacent the free ends thereof as is clearly shown in Figure 2.

The rollers 80 and 80*a* have concave peripheral grooves 81 and 81*a* therein which are disposed in substantial alinement with the peripheral groove

60 in the pressure block 57 on the outer end of the plunger or rack 21. The free or front ends of the arms 75 and 75a are bent upwardly and rearwardly upon themselves as at 82 and 82a respectively, the portions 82 and 82a being disposed above and in sliding engagement with the upper surfaces of the respective rollers 80 and 80a. Suitable axles are provided for the rollers 80 and 80a which axles are shown in the form of bolts 83 and 83a which extend upwardly through the corresponding respective arms 75 and 75a and then through the corresponding rollers 80 and 80a and thus through the portions 82 and 82a of the arms 75 and 75a.

Now, assuming the lugs 2 and 2a are assembled as shown in the solid line position in Figure 1, the rollers 80 and 80a are positioned against the peripheral surfaces of the lugs 2 and 2a adjacent the outer edges thereof with the pivot point of the lugs disposed substantially half-way between the rollers 80 and 80a and with the beveled or angularly cut surfaces B–1 and B–1a facing towards the pressure block 57.

The operator then inserts the projection 40 of the socket wrench 41 into one of the sockets 37, depending upon the leverage required, and imparts rotation to the corresponding pinion 24 or 25 in a counter-clockwise direction in Figure 1. This causes the plunger or rack 21 to move from left to right, in the manner heretofore described, whereupon the pressure pad 57 engages the lugs 2 and 2a adjacent the pivot point thereof. The pinion 24 or 25 is then rotated further and this causes the pressure block 57 to move the proximate ends of the lugs 2 and 2a forwardly to, and possibly beyond, the dotted line position shown in Figure 1.

The proximate ends of the lugs 2 and 2a are caused to pivot about the axis of the annular grooves 8 and 8a since the outer portions of the lugs 2 and 2a are pressed against the anvils or rollers 80 and 80a. When the lugs 2 and 2a have been swung to substantially the position shown in dotted lines in Figure 1, the paddle portion 67 of the pawl 61 may be depressed thereby permitting the plunger 21 to suddenly return to its original position, i. e., with the pressure block 57 bearing against the housing 10. The assembling and disassembling tool may then be removed from engagement with the lugs 2 and 2a and the lugs 2 and 2a are then easily taken apart.

Now, when it is desired to assemble the lugs 2 and 2a, the pressure receiving members or rollers 80 and 80a are positioned in engagement with the opposite surfaces of the lugs 2 and 2a from that shown in Figure 1 and with the lugs extending forwardly from the pressure block 57 in diverging relation to each other rather than in converging relation to each other as they would be in the course of the disassembling operation.

The lug assembling and disassembling tool is then operated in the identical manner heretofore described to pivot the lugs 2 and 2a about the axis of the grooves 8 and 8a until they assume a position in axial alinement with each other substantially as shown in solid lines in Figure 1 with the exception that the beveled portions or surfaces B–1 and B–1a would be facing outwardly or away from the plunger block 57 instead of towards the plunger block 57 as they do during the disassembling operation.

It is thus seen that I have provided a compact and easily operable tool for bending a substantially straight member inwardly to substantially the shape of the letter U or, in the instance of a pair of lugs such as that shown in the drawings, for forcing the lugs inwardly at their juncture to facilitate separating the lugs 2 and 2a from each other. Of course, it will be equally effective in straightening a bowed member or in assembling a pair of lugs such as the lugs 2 and 2a shown in Figure 1 to move them from the angular position relative to each other to an axially alined position.

The tool shown in the drawings is particularly designed for assembling and disassembling the lugs as heretofore described. However, the tool may be employed for bending a bar which may be circular or rectangular in cross-section so that opposed ends of the bar may extend in angular or in parallel relation to each other.

For purposes of brevity in the claims the lugs 2 and 2a may be termed the equivalent of a bar or a pair of pivotally interconnected members requiring pressure for moving the members relative to each other about the axis of the pivotal connection thereof.

In the drawings and specification there has been set forth a preferred embodiment of the invention and although specific terms are employed they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claim.

I claim:

A tool for assembling and disassembling a pair of pivotally interconnected lugs having overlapping portions pivotally mounted with respect to each other and having notches in their proximate faces into which the corresponding ends of the overlapping portions are secured by a pressed fit when the lugs are in an assembled position in axial alinement with each other; said tool comprising a base, a plunger mounted for longitudinal sliding movement in the base and having a rack thereon, a pair of arms secured to the base and extending forwardly therefrom astride the front end of said plunger, a pair of transversely alined rollers rotatably mounted on said arms and being normally disposed forwardly of and to opposite sides of the front end of the plunger, the axes of said rollers being parallel, but at substantially right angles to the longitudinal axis of said plunger, each roller having a concave peripheral surface, at least one pinion rotatably mounted on said base and meshing with the rack on the plunger, means on said pinion for receiving a wrench for manually imparting rotation to the pinion for moving the plunger between the rollers whereby the pivotally interconnected lugs may be placed against the rollers with the pivot point thereof in alinement with the longitudinal axis of the plunger and, upon movement of the plunger into engagement with the lugs, the lugs may be pivoted about the pivotal connection thereof, said plunger and its rack extending rearwardly beyond said base, a tubular handle secured on said base and in which the portion of the plunger extending beyond the rear of the base is slidably mounted, a tension spring disposed within the tubular handle and connected to the rear end of the plunger, means in the tubular handle for anchoring the end of the tension spring remote from the end which is connected to the rear end of the plunger to thus normally bias the plunger in a rearward direction, an elongated manually movable latch pivotally mounted intermediate its ends on said handle and extending parallel to said handle and having a tooth portion on its front end, said handle having an opening therein through which

said tooth portion of the latch normally extends to engage the rack on said plunger, a second spring means normally urging the rear portion of the latch outwardly to thereby urge the tooth portion into engagement with the rack on the plunger whereby said rack overrides the tooth portion on the latch as the plunger is moved forwardly, the position of said second spring means being such as to cause the tooth portion of the latch to remain in engagement with the rack upon forward pressure on the plunger being released and whereby a rearward pressure is then exerted on the plunger by the tension spring and, also, whereby, upon releasing the tooth portion of the manually movable latch from engagement with the rack, said tension spring will return the plunger to its rearward position.

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