

Oct. 8, 1968

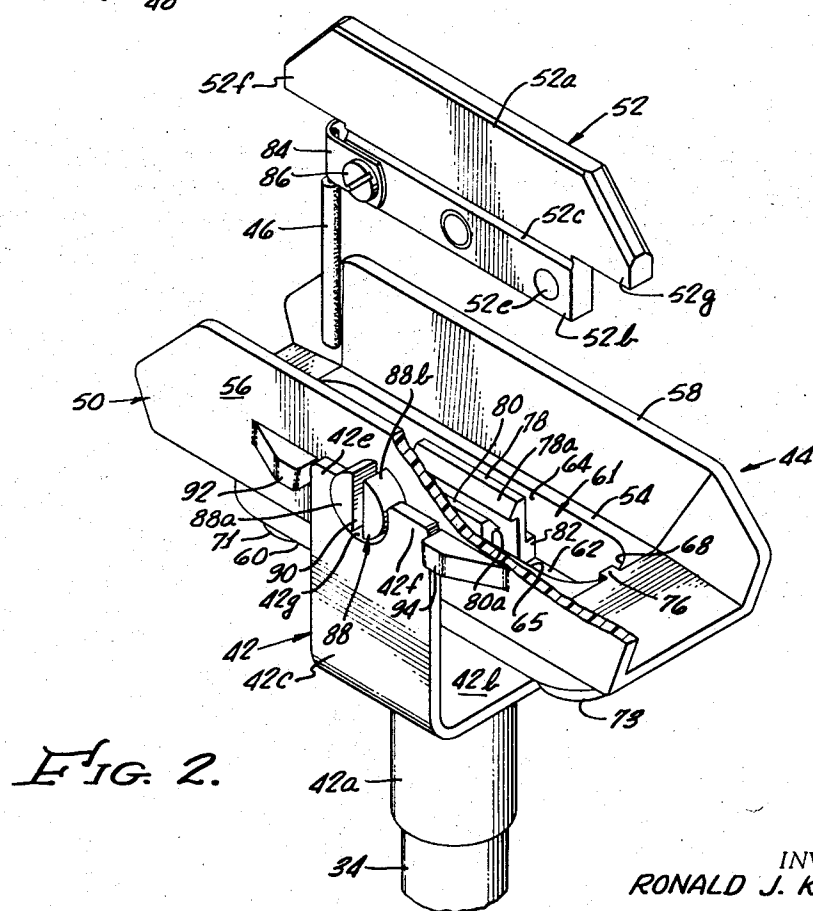
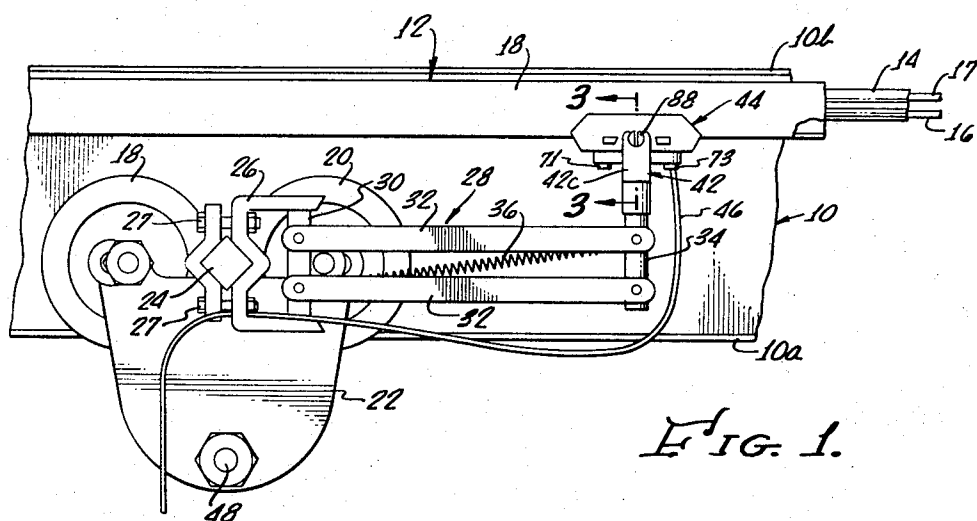
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3,405,240

MOBILE ELECTRIFICATION COLLECTOR HEAD

Filed Jan. 4, 1967

2 Sheets-Sheet 1



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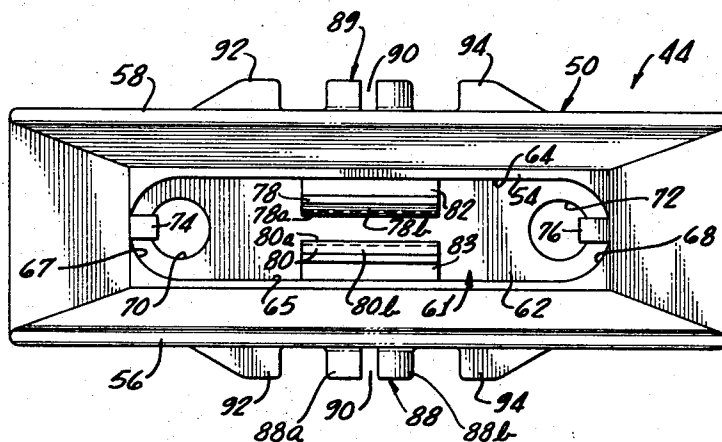
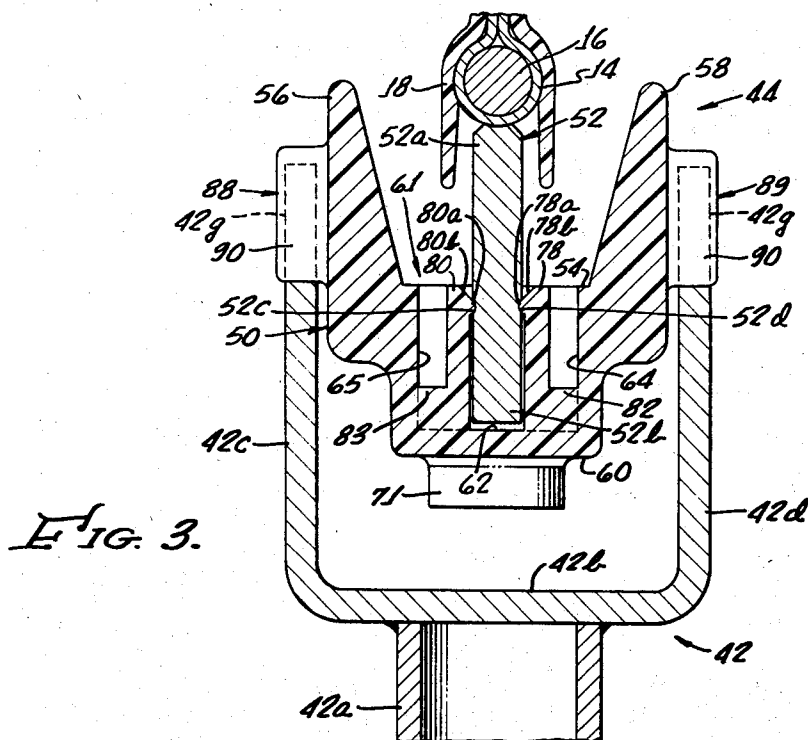
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MOBILE ELECTRIFICATION COLLECTOR HEAD

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2 Sheets-Sheet 2



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MOBILE ELECTRIFICATION COLLECTOR HEAD
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ABSTRACT OF THE DISCLOSURE

An integral collector case of insulating material is formed with a pair of upstanding flexible gripping elements spaced to receive a conductor shoe. A pair of projections on the gripping elements mate with grooves in the conductor shoe to releasably secure the shoe in the collector case.

Field of the invention

In the field of mobile electrification, it is necessary that an electrical conductor, known as a contact shoe or brush, be slideably supported in engagement with a fixed conductor bar for carrying current from a power circuit to control circuits on manipulating equipment such as mobile crane hoists or the like. This invention relates to an improved arrangement for supporting and securing the contact shoe in an insulation member known as a collector case.

Background of the invention and prior art

Since these contact shoes typically carry relatively large amounts of current, ranging from 30 amperes to 30,000 amperes, it is important from a safety standpoint that the possibility of current leakage to an ungrounded, exposed metal part in the electrification system be eliminated or minimized. Normally, the main overhead conductor bar is encased in insulation except on its underside where sliding contact is made with the conductive collector contact shoe. One form of prior art collector case is formed of two mating sections of insulating material which are connected by one or more metal nut and bolt combinations. The collector case essentially encases the shoe except where it mates with the fixed conductor bar. However, the metal nut and bolt parts are normally ungrounded; and, in view of their close proximity to the contact shoe, these exposed conductive components are a potential hazard in that they could conceivably be inadvertently connected to the electrically "hot" contact shoe.

In view of the continual sliding engagement of the contact shoe with the fixed conductor bar of the mobile electrical system, the contact shoe receives considerable wear and must be frequently replaced. Hence, it is highly desirable that the collector shoe can be easily and quickly replaced to thus minimize the man-hours required for such activity, and, more importantly, to minimize the time that associated expensive equipment is kept idle. The prior art approach of retaining the shoe within the collector case by using nuts and bolts requires considerable time for assembly and disassembly and it is not very convenient.

It is also desirable that the collector case be provided with means for facilitating the connection and disconnection of the collector head with its associated supporting yoke. In one previously known method, the arms of the supporting yoke for a collector head are bent into position with lugs on the case; however, this approach is less than satisfactory because the bending operation is difficult and it weakens the component.

Summary of the invention

In accordance with this invention, the whole collector case is molded of insulation material as a single piece

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with an elongated socket formed in its upper wall for receiving the lower portion of a contact shoe. A pair of spaced flexible gripping elements extend upwardly from the bottom of the socket to grip the lower portion of the contact shoe. The upper ends of the gripping elements are spaced from the adjacent side walls of the socket, and the thickness of the gripping elements is such that the upper ends of the elements are flexibly movable toward the adjacent socket side walls and toward each other.

The inner, upper sides of the gripping elements and the side walls of the contact shoe are formed with interengaging projections and grooves for retaining the shoe within the socket. As the shoe is inserted, the gripping elements are forced outward slightly until the projections and grooves are aligned, and at that point the flexibility of the gripping elements causes them to snap inwardly to securely retain the contact shoe within the collector case. Thus, it will be appreciated that the collector case of the invention has no metal parts since it is formed as a single integral unit, and the contact shoe can be easily replaced.

The collector case is further formed with a pair of outwardly extending lugs to be received in slightly smaller recesses in the upper ends of a supporting yoke. To facilitate assembly, the lugs are vertically split to permit flexing and insertion into the yoke recesses.

The present invention and attendant advantages are explained in greater detail in the following description of a preferred embodiment of the invention illustrated in the accompanying drawings, in which:

FIG. 1 is an elevational view of a portion of a mobile electrification system incorporating the collector head assembly of the invention;

FIG. 2 is an enlarged perspective, exploded and partially cut away view of the collector head assembly of the invention;

FIG. 3 is a cross-sectional view of the assembly on line 3—3 of FIG. 1; and

FIG. 4 is a plan view of the collector head.

Referring first to FIG. 1, there is shown a large overhead rail 10 having upper and lower flanges 10a and 10b. Adjacent the rail 10 is a conductor bar assembly 12 including a tubular conductor bar 14, preferably having a figure-8 shape, connected to conductors 16 and 17 and supported by a rigid insulating cover 18. The insulating cover 18 is open at its lower end to permit accessibility to the conductor bar 14.

The lower flange 10a of the rail 10 serves as a track for a pair of wheels 18 and 20 and additional wheels (not shown) on the other side of the rail. Supported by the wheels 18 and 20 is a plate 22 which in turn supports a mounting bar 24 carrying a base clamp 26 secured to the mounting bar 24 by suitable threaded fasteners 27. The base clamp 26 carries a collector assembly 28 including a vertical support element 30 and a pair of horizontally oriented support arms 32 which are pivotally supported at one end to support member 30 and pivotally attached at their opposite ends to a pin 34. A tension spring 36 extending diagonally between the horizontal arms 32 urges the arms upwardly.

Pin 34 carries on its upper end a combined collar and yoke 42 supporting a collector head 44. A conductor 46 connected at one end to the collector head 44 is supported by the clamp 26 before being ultimately connected to mobile power equipment (not shown) such as a mobile crane hoist or the like. The conductor 46, of course, transmits power from the conductor bar 14 through the collector head 44 to the equipment.

The lower end of support plate 22 carries a supporting pin 48 which is carried on its other end by a similar sup-

port plate not shown. The supporting pin 48 is used to carry the mobile equipment by a suitable hook and supporting structure.

Turning now to FIGS. 2-4, it may be seen that the collector, head 44 includes a collector case 50 and a conductor contact shoe 52. The case 50 is in accordance with the invention made as a one piece integral structure having an elongated shape with a top wall 54 extending between upstanding side walls 56 and 58, together with a bottom wall 60. Preferably, the case is injection molded of strong, slightly flexible plastic such as a polycarbonate resin known as "Lexan." As can be seen, the ends of the structure above top wall 54 and between the upstanding side walls 56 and 58 are completely open. Thus, the upper portion of the case 50 has a generally U-shaped cross-section with the top wall 54 forming the bight of the U.

Within the top wall 54 there is formed an elongated socket 61 having a generally racetrack shaped cross-section. This socket includes a bottom wall 62, upstanding side walls 64 and 65, and curved end walls 67 and 68. A pair of openings 70 and 72 located on opposite ends of the socket 61 extend through the bottom walls 60 and 62 and through tubular portions 71 and 73. Bosses 74 and 76 extend inwardly from the respective end walls 67 and 68.

In accordance with the invention, there is centrally located within the socket 61 a pair of upstanding gripping elements 78 and 80 having their lower ends attached to the bottom wall 62 of the socket 61. The lower portions of the gripping elements 78 and 80 are also connected to the adjacent socket side walls 64 and 65 by connecting sections 82 and 83, as best seen in FIG. 3. Near the upper end of the inner wall of the two upstanding gripping elements 78, 80 there are formed two elongated projections or bumps 78a and 80a, extending parallel to the socket bottom wall 62.

The collector contact shoe is formed of a highly conductive material, one example being an alloy of 95 percent copper and 5 percent graphite. As can be seen, the collector contact shoe 52 is a flat elongated element having an upper portion 52a and a lower portion 52b. The thickness of the shoe 52 is essentially constant throughout its height and it is slightly less thick than the primary space between the gripping elements 78 and 80 as can be seen in FIG. 3. Each side of the contact shoe 52 is formed with an elongated semi-circular groove 52c and 52d near the upper end of the lower portion 52b. The grooves 52c and d extend across the width of the shoe lower portion generally parallel to the upper and lower edge of the shoe.

The lower portion 52b also includes one or more openings 52e through which the necessary electrical connections may be made. The conductor 46 is shown clamped within the bight of the U-shaped clamp 84 secured to the lower portion 52b of the shoe 52 by a suitable fastener 86. The conductor 46 extends downwardly through the opening 70 in the collector case.

The upper portion 52a of the collector shoe is formed with outwardly extending wings 52f and 52g. As can be seen, these wings have sloping end surfaces and the edge of the sloping surface is bevelled, as is the upper edge of the collector shoe. The collector case extends beyond the wings on each end.

From the preceding description of the collector contact shoe 52 and the gripping elements 78 and 80, it is readily apparent that the shoe 52 is assembled to the collector case by simply inserting the lower portion 52b of the shoe into the socket 61 of the collector case between the two gripping elements 78 and 80. Bevelled surfaces 78b and 80b on the projections 78a and 80a facilitate insertion of the shoe. The distance between the two inwardly extending projections 78a and 80a is slightly less than the thickness of the collector shoe 52. Consequently, as the shoe 52 is being inserted, it forces the upper ends of the gripping elements outwardly until the contact shoe reaches

the position of FIG. 3 wherein the projections 78a and 80a are aligned with the grooves 52c and 52d. At this point, the projections snap into the grooves to securely retain the contact shoe 52 in position.

It will be appreciated that the flexibility of the gripping elements 78 and 80 is dependent upon the material employed, the thickness of the elements, and the height of the elements. The flexibility can be easily controlled by varying the height of the connecting portions 82 and 83 between the lower ends of the gripping elements and their adjacent socket side walls 64 and 65. In effect, this variation determines the flexible height of the elements 78 and 80.

While the contact shoe 52 is in position, its further downward movement is limited by the engagement of the contact shoe wings 52f and 52g with the upper surface or wall 54 of the collector head. Upward movement of the contact shoe is of course limited by the gripping elements. The contact shoe can be easily removed by simply pulling on the contact shoe or prying upwardly between one of the wings 52f and 52g and the upper wall 54 of the collector case.

The gripping elements and the projections 78a and 80a also position the shoe in a lateral or transverse direction and prevent cocking about an axis through the shoe parallel to the projections 78a and 80a in that the lower shoe portion 52b fits fairly snugly within the space between the relatively rigid lower ends of the gripping elements. The substantial length of the gripping elements limits twisting of the shoe about a vertical axis through the center of the shoe. Movement of the contact shoe in a longitudinal direction is prevented by precisely controlling the positioning of the bosses 74 and 76 on the ends of the socket. Thus, the shoe is positively fixed in all directions.

Centrally located on the outer side of each side wall 56 and 58 of the collector case, are formed outwardly extending lugs 88 and 89 each having a vertically oriented split or separation 90 which divides the lug into two sections. Spaced from the lug 88 on each side are a pair of stops 92 and 94 which are formed integral with the side walls of the collector case.

The yoke and collar unit 42 includes a tubular element 42a which fits over the upper end of the pin 34 and is formed integrally with the yoke 42b having a pair of upstanding arms 42c and d. The upper end of each arm is bifurcated into two fingers 42e and f separated by a recess 42g which is a circular segment somewhat more than semi-circular. The diameter of the recess is slightly greater than the diameter of the lugs 88 and 89, but the entry to the recess is slightly smaller than the lug diameter.

In assembly, the lugs 88 and 89 on the collector case are simply forced into the recesses 42g formed in the bifurcated upper ends of the yoke arms 42c and d. Although the lugs interfere with the entry to the recess, the split or separation 90 in the lug is wide enough to allow the two sections 88a and b of the lug to be forced towards each other enough to permit the lug to be inserted into the recess. When fully inserted, the slight flexibility of the lug sections returns the lug to its original shape so that the collector case is securely attached to the yoke.

During operation of the mobile electrification system, the collector head 44 is commonly rocked somewhat about the lugs 88 and 89 as the conductor 46 is moved or as the entire assembly 28 moves. The stops 92 and 94 limit this movement but permit adequate freedom.

In operation, the contact shoe 52 of course fits between the lower ends of the insulating cover 18 and engages the conductor bar 14, as seen in FIG. 3. The collector case side walls 56 and 58 extend on opposite sides of the insulating cover so that the conducting members are protected. As the collector assembly 28 is moved on the wheels 18 and 20 along the rail 10, the contact shoe 52 is held in sliding contact with the bar 14. As the relatively soft contact shoe becomes worn from the sliding operation, and replacement of the shoe 52 is required, the collector head 44 may be pulled downwardly and away from

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the bar 14; the shoe simply pulled or pryed from the gripping elements, and a new shoe snapped into place. Since the collector case is a one piece, rugged construction made of insulating material, no exposed metallic connecting elements are involved and no disassembly of components is required.

I claim:

1. In a mobile electrical collector assembly for electrically connecting a conductor of a movable device to a power conductor bar linked to a source of electrical energy,

a one piece integral collector case made of insulating material having an elongated socket formed in its top wall for receiving the lower portion of a conductor shoe;

shoe gripping means within said socket including a flexible gripping element formed integral with the case and located adjacent a side wall of the socket, the element being sufficiently free from said side wall to be flexed outwardly toward said side wall by insertion of the shoe into the socket, the flexible gripping element and the shoe having mating projection and groove means for releasably holding the shoe within the socket.

2. The assembly of claim 1, wherein said gripping means includes a second gripping element adjacent a second side wall of the socket and spaced from the other element, said second element being sufficiently free from said second side wall to permit outward movement as the shoe is inserted into the socket between the elements, said second element and said shoe having mating projection and groove means for releasably holding the shoe within the socket.

3. In a mobile electrical collector assembly for electrically connecting a conductor of a movable device to an electrical conductor bar linked to a power source,

an integral collector case made of insulating material having a top wall and a pair of elongated side walls; an elongated socket formed in said collector case and opening to said top wall;

a conductor shoe having an upper portion for engaging said conductor bar and a lower portion extending into said socket, the side walls of said socket being spaced from the sides of said conductor shoe;

a pair of upstanding gripping elements having their lower ends formed integral with the bottom of said socket, said gripping elements being disposed on opposite sides of the lower portion of said conductor shoe, the upper ends of said gripping elements being spaced from the adjacent side walls of the socket so that the upper ends of the elements are flexibly movable toward said side walls to permit said shoe to be inserted between said gripping elements; and,

inter-engaging projection and groove means formed on the inner walls of said gripping elements and the outer side walls of said shoe lower portion for releasably holding the shoe within the collector case.

4. The assembly of claim 3, wherein the inter-engaging projection and groove means includes a pair of elongated projections formed on the upper side walls of said gripping elements, and includes a pair of elongated mating grooves formed on the side walls of said shoe for receiving said projections.

5. The assembly of claim 5, wherein said projections extend substantially parallel to the bottom wall of said socket.

6. The assembly of claim 3, wherein the lower outer side walls of said gripping elements are connected to the adjacent side walls of said socket such that the height of the connecting portions with respect to the height of said

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gripping elements controls the flexibility of said elements.

7. The assembly of claim 3, including a pair of lugs formed integral with said collector case and extending outwardly from the central portion of the elongated side walls of said collector case, each of said lugs having a vertically oriented centrally located split separating the lugs into two slightly flexible sections.

8. The assembly of claim 7, including a U-shaped yoke having its arms spaced to receive said collector case, each arm of the yoke having an upwardly opening recess formed on its upper end for receiving a respective one of said lugs, the width of said lugs being less than the widest portion of said recess but slightly greater than the entry to said recesses so that said lugs must be forced into said recesses by forcing said lightly flexible lug sections toward each other.

9. The assembly of claim 8, wherein said lugs are circular and said recesses are more than semi-circular.

10. In a mobile electrical collector assembly for electrically connecting one or more power conductors of a movable device to an electrical conductor bar linked to a power source,

a unitary collector case made of insulating material having an elongated shape with a top wall, a bottom wall and a pair of spaced upstanding side walls which extend upwardly from said top wall;

an elongated socket formed in said collector case between said upstanding side walls and opening to said top wall;

an elongated conductor shoe having a lower portion positioned within said socket and an upper portion extending upwardly between said upstanding side walls to engage said conductor bar, a groove formed on each side of said shoe located near the upper edge of said lower portion; and,

gripping means within said socket for releasably gripping the lower portion of said conductor shoe to hold the shoe securely within the socket, said shoe gripping means including an upstanding pair of gripping elements attached at their lower ends to the bottom of said socket and spaced at their upper ends from the adjacent side walls of said socket so that the upper ends of said elements are flexibly movable toward said socket side walls, the lower portion of said conductor shoe being positioned between said gripping elements, and said gripping elements being spaced such that the major portion of their inner surfaces are slightly spaced from the conductor shoe, said gripping elements each having an inwardly extending elongated projection formed on its inner side wall positioned within said grooves.

11. The assembly of claim 10, including means formed on the ends of said socket engaging the ends of said shoe lower portion for limiting movement of the shoe between the socket end walls, said shoe upper portion having a wing on each end which extends outwardly beyond the end of said socket, and said wings engage said top wall to limit the downward movement of the shoe in the collector case.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,405,240

October 8, 1968

Ronald J. Kilburg

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 31, "30,000" should read -- 3,000 --; line 40, cancel "by", first occurrence. Column 5, line 63, claim reference numeral "5" should read -- 4 --. Column 6, line 15, "lightly" should read -- slightly --.

Signed and sealed this 17th day of February 1970.

(SEAL)

Attest:

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Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents