

Jan. 9, 1968

E. C. HARDESTY ETAL

3,363,223

PLUG CONNECTOR HAVING SNAP MOUNTING BLADE

Filed Aug. 12, 1966

2 Sheets-Sheet 1

FIG. 1

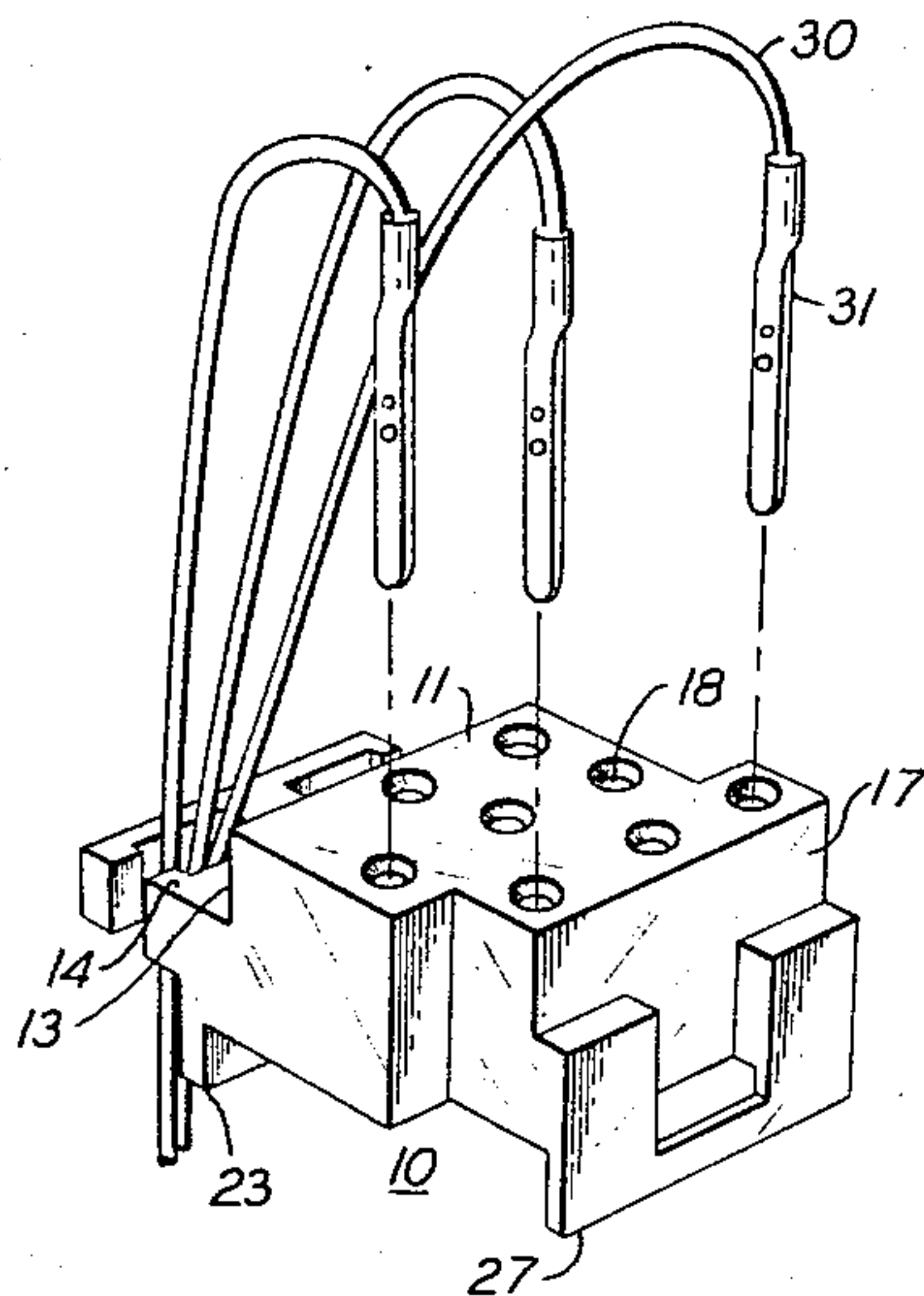


FIG. 2

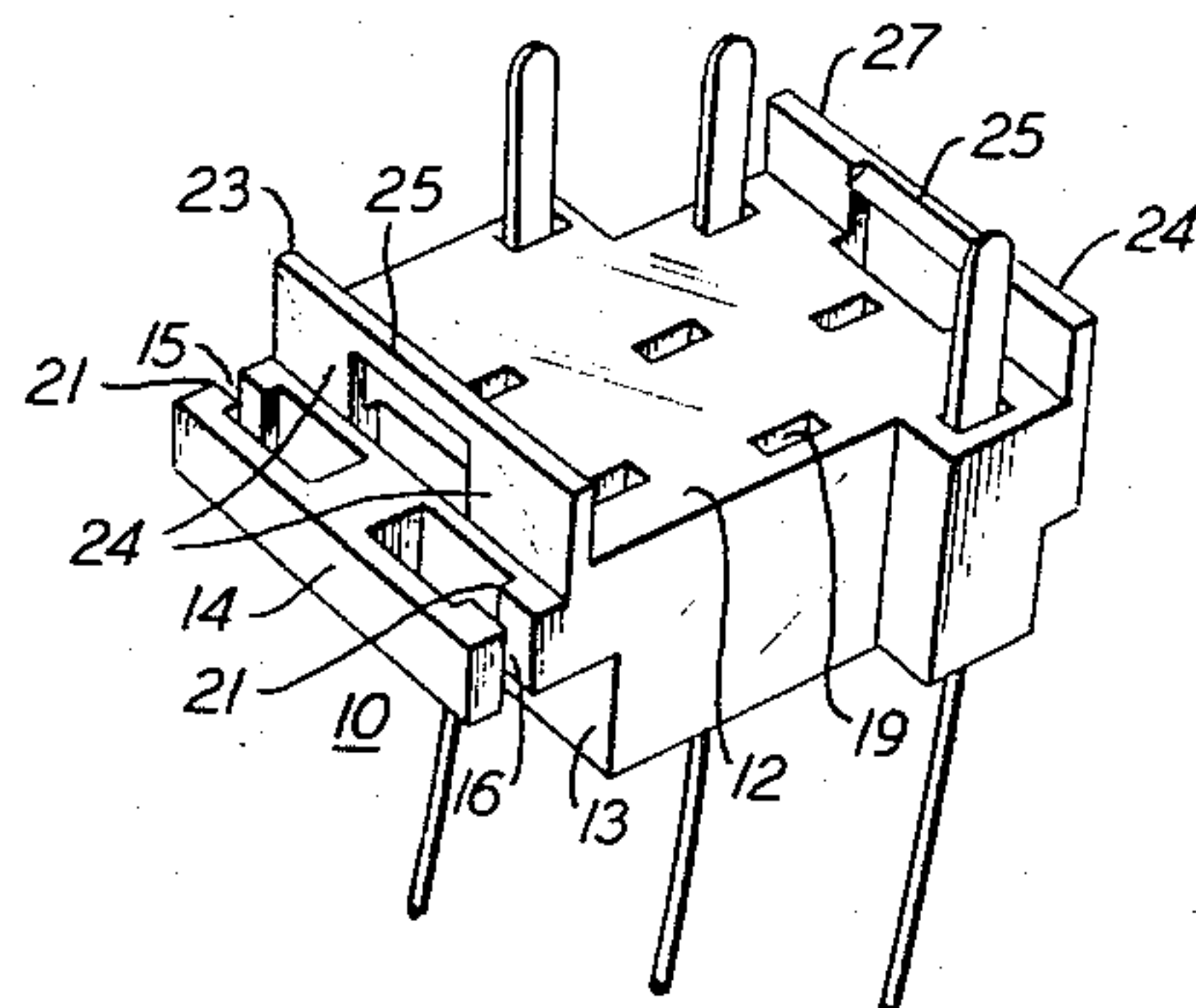
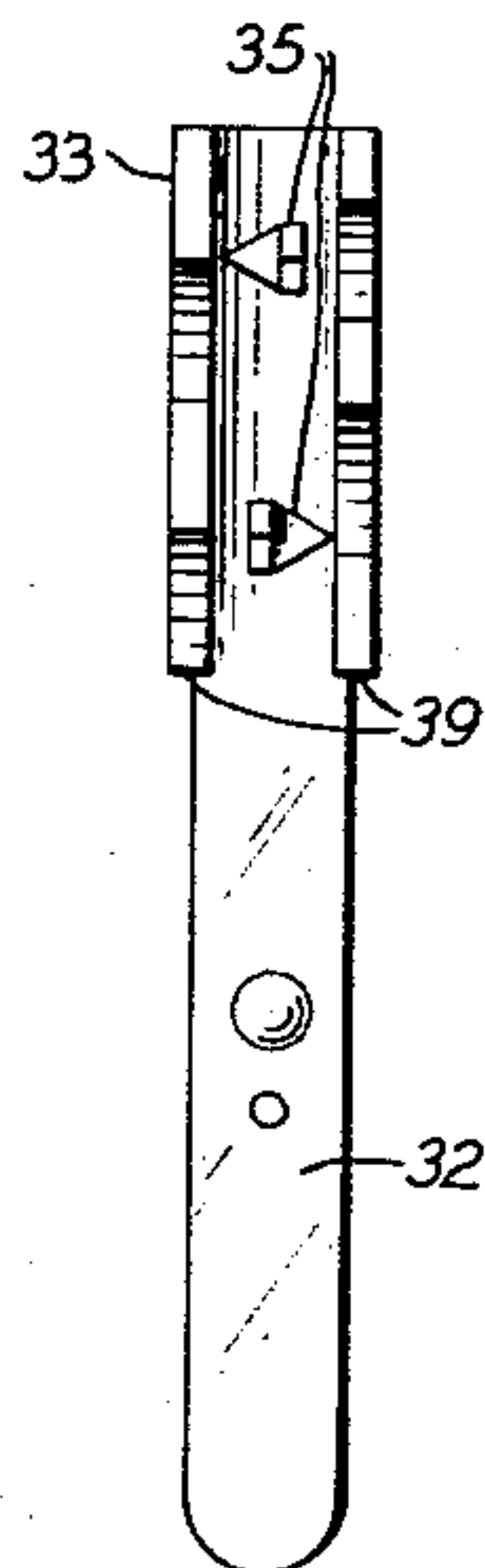


FIG. 4



INVENTORS E. C. HARDESTY
R. E. WIRSCHING
BY *Charles E. Graves*

ATTORNEY

Jan. 9, 1968

E. C. HARDESTY ETAL

3,363,223

PLUG CONNECTOR HAVING SNAP MOUNTING BLADE

Filed Aug. 12, 1966

2 Sheets-Sheet 2

FIG. 3

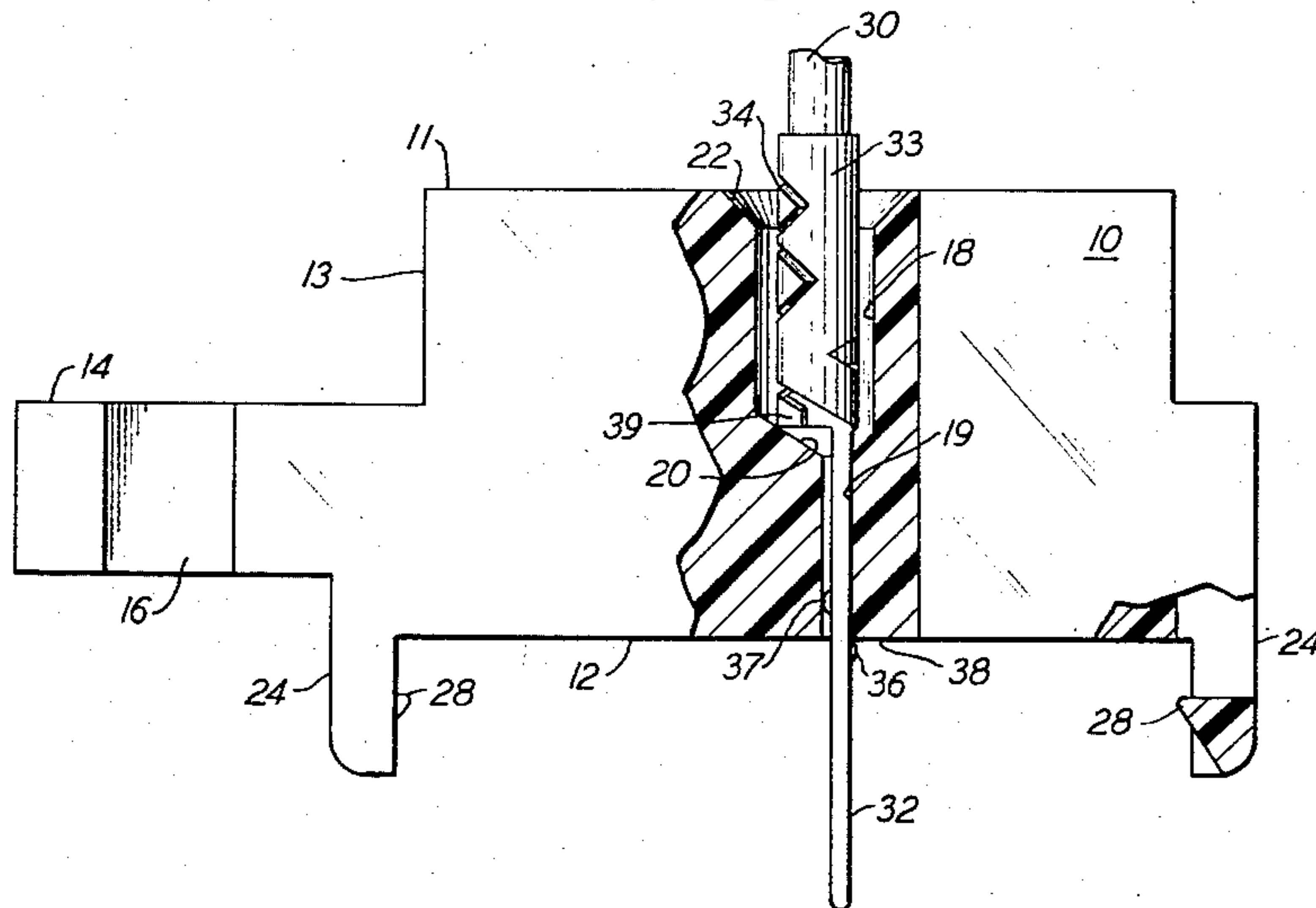
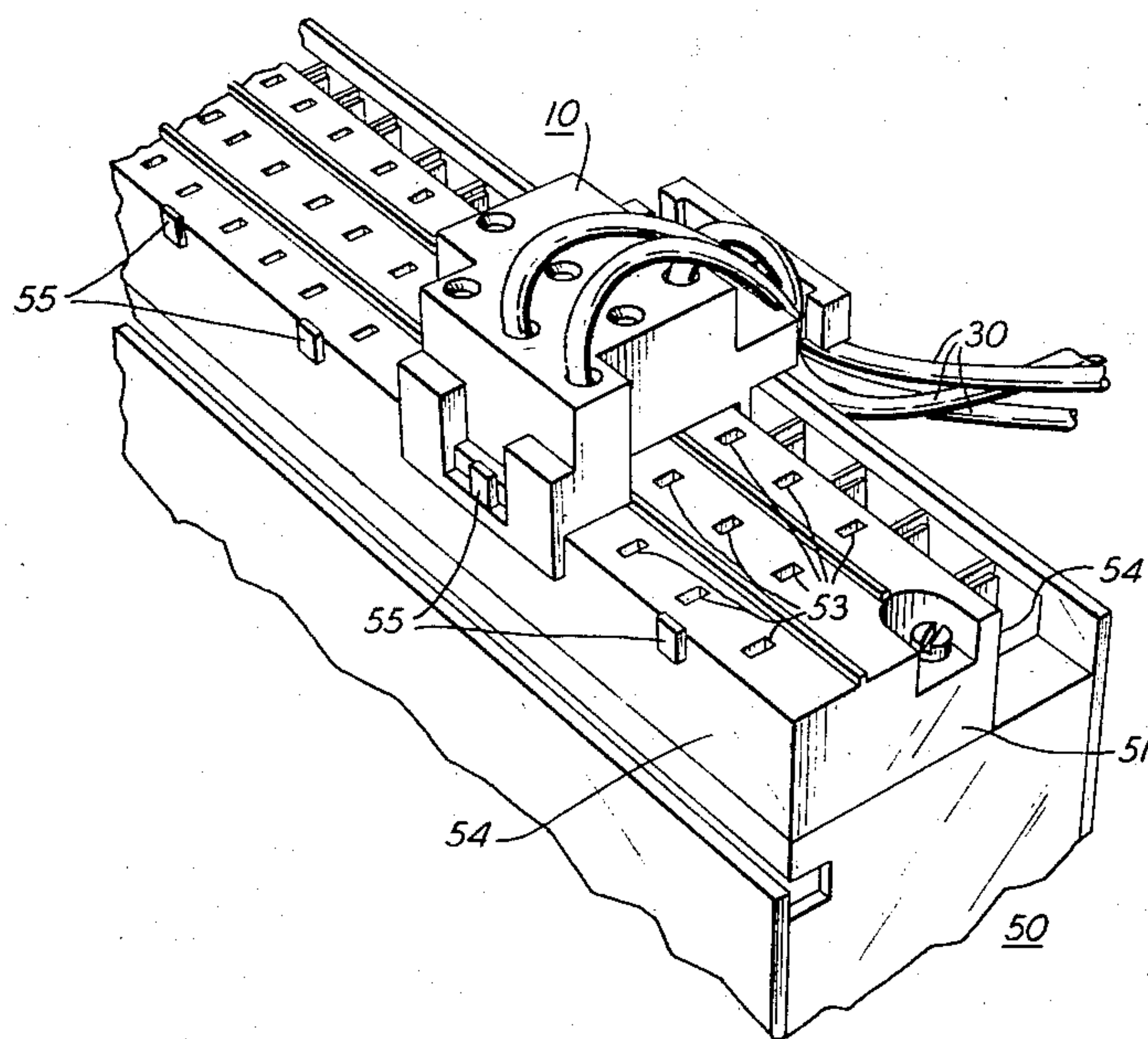


FIG. 5



1

3,363,223

PLUG CONNECTOR HAVING SNAP MOUNTING BLADE

Edwin C. Hardesty, Perry Hall, Md., and Robert E. Wirsching, Greenfield, Ind.; said Hardesty assignor to Western Electric Company, New York, a corporation of New York, and said Wirsching assignor to Bell Telephone Laboratories, Incorporated, Berkeley Heights, N.J., a corporation of New York

Filed Aug. 12, 1966, Ser. No. 572,111

5 Claims. (Cl. 339-221)

ABSTRACT OF THE DISCLOSURE

A telephone plug connector is disclosed in which offset passages in a base receive conductor tips which are likewise offset. The blade includes crowns to engage the side and bottom edges of each passage. The connector snap-mounts onto the underside of a telephone key, with the conductors led away through retaining loops.

This invention relates to electrical cord plugs and in particular to multiconductor plugs for use with compact multicontact switches, such as the telephone key disclosed in the copending patent application of R. E. Wirsching, Ser. No. 424,997 now Patent No. 3,271,530 assigned to applicants' assignee.

A primary object of the invention is to reduce the time and cost of making connections to a telephone key.

An added object of the invention is to avoid disturbing circuits connected by other plugs to the key when regrouping conductors on a given plug.

A further object of the invention is to reduce the cost and assembly time of cord plugs.

Another object of the invention is to facilitate regrouping of the conductors on the plug so as to provide different connections between the conductors and the associated switch contacts of the key.

A further object of the invention is to improve the anchoring of the conductors to the plug, within relatively little headroom.

In accordance with the invention, the cord plug comprises a unitary body having several connector blade retaining slots, each offset to one side of a tapered shoulder that joins with a cylindrical cavity. The cord tips that mate with the plug each comprise a round conductor gripping end and an axially offset flat blade extension with crowns staggered on opposite sides of the blade. The lateral distance between crown crests is slightly greater than the slot width; and accordingly, as the blade enters the slot during installation it flexes slightly. When the blade protrudes from the slot a selected amount, the outer crown overrides the slot end and lodges thereon as the blade unflexes. Also at this point, the inner edge of the gripping end contacts the tapered shoulder and the inner blade crown remains in contact with the slot wall. Each blade is thus retained by a snap-friction fit securely enough to mate with the key switch contacts without dislodging, but can be removed from the plug with relatively little plier pressure. The plug further comprises end fasteners which snap over fingers along the key's socket surface to align and secure the plug to the key. Extending from one of the end fasteners and beneath the level of the plug top is an apertured shelf for anchoring the conductors to the plug.

A complete understanding of the invention, its features and advantages may be gained from the detailed description to follow of an illustrative embodiment taken in conjunction with the drawing in which:

FIG. 1 is a top perspective view of the cord plug;

FIG. 2 is a bottom perspective view of the cord plug;

2

FIG. 3 is a front view in partial section of the plug showing an inserted connector blade and the plug's mounting legs;

FIG. 4 is a side view of the cord tip; and

FIG. 5 is a perspective view of the plug mounted on a key.

The cord plug, designated generally as 10 in FIGS. 1 and 2, is a unitary molded structure having a flat top surface 11 and a parallel bottom surface 12. A number of similar axially parallel passages run between surfaces 11 and 12 which accommodate cord tips 31 of conductors 30 (three shown for illustration) in a manner to be described. Extending from a side 13 of plug 10 is a shelf 14 in which, in accordance with one aspect of the invention, a number of apertures are provided, for example, apertures 15, 16 to aid in anchoring conductors 30 to plug 10. The top surface of shelf 14 is appreciably below the top surface 11 of plug 10. Sides 13, 17 of plug 10 include two extensions 23, 27 which are molded integrally with plug 10 and, as shown in FIG. 6, secure to fingers 55 of a plug socket 51 in a key 50. Advantageously, plug 10 may be molded from material such as Cylolac, in an injection process.

FIG. 3 illustrates the construction of the cord tip passages. Each passage (only one shown) comprises a generally cylindrical cavity 18, an elongated slot 19 of rectangular cross-section axially offset to one side of cavity 18, and a tapered shoulder joining the base of cavity 18 with the top of slot 19. Cavity 18 is countersunk at 22 to make blade installation easier. The slot 19 rectangular cross-sections typically have the same orientation in space; thus, as shown in FIGS. 1 and 2, the long edges of slot 19 are all perpendicular to sides 13 and 17. Or, as shown in FIG. 3, the long edges of slot 19 may be parallel to sides 13 and 17.

As seen in FIGS. 3 and 4, the cord tips 31 each comprise a flat elongated blade 32 axially offset to one edge of a round conductor gripping end 33. The latter includes conventional means for securing to a conductor, as, e.g., staggered folds 34 and contact tabs 35. Blade 32 includes an outer crown 36 extending away from end 33 and an inner crown 37 extending under end 33.

A cord tip 31 with a conductor 30 crimped onto it is installed by inserting it into a selected cavity 18 so that the lower edge 39 of end 33 lines up with shoulder 20. Cord tip 31 is guided into slot 19 by the shoulder 20 and flexes slightly owing to the distance between crown crests being greater than the slot 19 width. Cord tip 31 is forced down until, as shown in FIG. 2, blade 32 extends a prescribed distance beyond bottom surface 12. At this point, crown 36 emerges from slot 19 allowing blade 32 to unflex and force crown 36 to override and seat upon an edge 38 formed by the juncture of slot 19 and surface 12. Also at this point, the second function of shoulder 20 comes into play as the lower edge 39 of end 33 lodges upon shoulder 20. The inner crown 37 remains in contact with the adjacent wall of slot 19 causing the opposite side of blade 32 to abut against the opposite wall of slot 19. In this fashion, cord tip 31 is secured within plug 10.

Conductor rearrangements on this type telephone key typically are quite recurrent and consequently saving of time and material in this task are important.

Pursuant to one aspect of the invention, cord tip 31 may be urged out of its locked position with light plier action on end 33, and withdrawn entirely from plug 10 for reinsertion in another passage. With a strong connection between cord tip 31 and its conductor 30, and with a selected low degree of blade flexure during insertion, it is possible to design a plug-blade combination in which a tugging upon conductor 30 is sufficient to remove the

3

blade. In either case, the rearrangement of conductors with respect to the key contacts is greatly facilitated, without requiring use of a new plug or disturbing other plugs or the conductors themselves.

To anchor the conductors 30 onto plug 10, the conductors are grouped and led through aperture 15, for example, in the plug shelf 14. A pair of lips 21 at the entrance to each aperture 15, 16 help to retain the conductors therein. Since the crimped ends 33 of each cord tip 31 lie flush with respect to top surface 11 each conductor 30 may be drawn flat across surface 11, which conserves space. Shelf 14 is situated below the level of surface 11, and therefore as shown in FIG. 5 the conductors 30 lead downwardly from surface 11 before entering slots 15, 16. With the conductors so anchored and the plug 10 in place, the cord tips cannot be dislodged from their passages by tugging upon the conductors. Additionally, owing to the snap-mounting of plug 10 upon the key as described below, the plug itself will not be dislodged by such tugging, providing conductors 30 are led laterally as shown in FIG. 5.

The side extensions 23, 27 of plug 10 each comprise a pair of legs 24 with a foot 25 joining them. Extensions 23, 27 are substantially identical, although in the embodiment shown are not symmetrically situated upon plug 10. As best seen in FIG. 3, the legs 24 and the joining foot 25 of each side extension 23, 27 are recessed or set back, beginning at the plane of bottom surface 12. Each foot 25, at about its midpoint, includes a nub 28 facing inwardly. Shelf 14 is formed as an outgrowth of side 23.

FIG. 5 illustrates a plug 10 in place upon the socket base 51 of a key 50 such as that described in the cited copending application of R. E. Wirsching. The base 51 includes several arrays of blade sockets, each array being patterned to receive the blades of a plug 10. Each socket array, as for example, the array designated as 53, serves the contacts of a particular pushbutton key (not shown) beneath the sockets.

Offset along each of the side walls 54 of base 51 are several protruding fingers 55. The tops of fingers 55 are flush with the top surface of base 51, and each finger is in a predetermined aligned relation with one side of a particular socket array. There are thus two fingers on base 51 to each array.

With blades and conductors in place, a plug 10 is inserted into an array of sockets until the nubs 28 of the leg pairs 24 snap over the fingers 55. At this point the bottom surface 12 of plug 10 is substantially flush with the top surface of socket base 51. Owing to the fact that plug 10 is secured to key 50, it is possible in accordance with one aspect of the invention to extract some or all the cord tips 31 from a given plug 10 without removing or disturbing the seating of plug 10. By avoiding having to remove the entire plug to rearrange connections, time is saved and the chances of upsetting the other plug connections are lessened. Further, other circuits need not be disturbed. On the other hand, if it is desired to interchange two or more plugs on a key, the operation is simply one of unsnapping the plugs, removing them and repositioning them in the required new configuration.

It is to be understood that the above-described arrangements are merely illustrative of the applications and the principles of the invention. Numerous other arrangements may be devised by those skilled in the art.

What is claimed is:

1. A plug connector comprising, in combination: a base having planar parallel top and bottom surfaces; a plurality of axially parallel passages between said surfaces, each passage comprising a cylindrical cavity opening onto said top surface, a slot of rectangular cross-section running between said bottom surface and said cavity and axially offset to one side of the latter and a tapered shoulder intermediate said cavity and said slot; one or more conductor cord tips each comprising a round grip-

4

ping end and an axially offset flat blade, said blade having an inner crown under said gripping end and an outer crown a fixed vertical distance from said gripping end on the opposite side of said blade, the lateral distance between the crests of said crowns being slightly greater than the width of said slot; means including said crown crests responsive to insertion of said blade in said slot for flexing said blade; and means responsive to the contact of said gripping end lower edge with said shoulder for unflexing said blade, said outer crown overriding the entrance of said slot and lodging on said bottom surface, and said inner crown and the opposite side of said blade frictionally contacting opposite walls of said slot; whereby each said cord tip is retained through a snap-friction fit within said plug base.

2. A plug connector in accordance with claim 1, wherein said base further comprises a pair of opposite sides, a pair of legs extending downwardly from each said side and beyond said bottom surface, means connecting the end portions of each said leg pair, each said leg pair and connecting means being recessed outwardly of the adjacent side beginning at the level of said bottom surface, and each connecting means including an inwardly-extending nub for engagement with a mating catch on a socket base.

3. A plug in accordance with claim 2, wherein said base further comprises a shelf extending from one of said sides, the upper surface of said shelf disposed in a plane intermediate said base top and bottom surfaces, said shelf including at least one vertical slot for accommodating conductors fed down from said cord tips.

4. A plug connector and socket mount comprising, in combination: an electrically non-conductive unitary base having parallel top and bottom surfaces and two parallel side surfaces; a plurality of passages between said top and bottom surfaces, each said passage comprising an upper end of circular cross-section, a lower end of rectangular cross-section offset to one side of said upper end, the long sides of the rectangular cross-section lower end being oriented in space in the same fashion, and a transitional tapered shoulder intermediate said ends; a plurality of conductor cord tips for engagement with respective ones of said passages, each said cord tip comprising a blade end and a contiguous connector gripping end, said blade end including an inner crown adjacent said gripping end and an outer crown on the side of said blade opposite said first crown; means including said shoulder for guiding said blade into said passage lower end on insertion of said cord tip therein, said outer crown overriding the edge of said slot as said gripping end lodges on said shoulder, thereby releasably securing each said cord tip in said respective passage; a pair of legs extending downwardly from each said side and beyond said bottom surface; means connecting the end portions of each said leg pair, each said leg pair and connecting means being disposed outwardly of the respective adjacent side beginning at the level of said bottom surface, and each connecting means including an inwardly-extending nub; and a socket base comprising an elongated bottom surface and a pair of elongated side surfaces, said bottom surface having a plurality of arrays of sockets, each socket array having the same pattern as said pattern of said plug base passages for accommodating the cord tip blades of a given plug, and a pair of catches adjacent opposite sides of each socket array, each catch extending from said base bottom surface outwardly of the adjacent said side surface, and each catch pair engaging a nub of said leg pair upon insertion of said plug in a selected socket array.

5. A plug connector and mount in accordance with claim 4, wherein said plug further comprises a shelf extending from one of said sides, the upper surface of said shelf disposed in a plane intermediate said plug top and bottom surfaces, said shelf including at least one slot for anchoring the conductors of said plug, each

said slot further including an entrance lip portion for retaining said conductors.

References Cited

UNITED STATES PATENTS

1,237,857	5/1917	Averill	339—256
2,224,902	12/1940	Currie et al.	339—221
2,468,368	4/1949	Jackson	339—217
2,752,580	6/1956	Shewmaker	339—221
2,989,723	6/1961	Hopkins	339—221

3,010,093	11/1961	Berg	339—256
3,048,812	8/1962	Heidler	339—252
3,065,448	11/1962	Hopkins et al.	339—217
3,069,652	12/1962	Greco	339—217
3,104,925	9/1963	Macnamara	339—217
3,167,373	1/1965	Kostich	339—217
3,189,863	6/1965	Leach	339—221

MARVIN A. CHAMPION, *Primary Examiner.*

10 R. S. STROBEL, *Assistant Examiner.*