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J. H. HAM, JR., ET AL

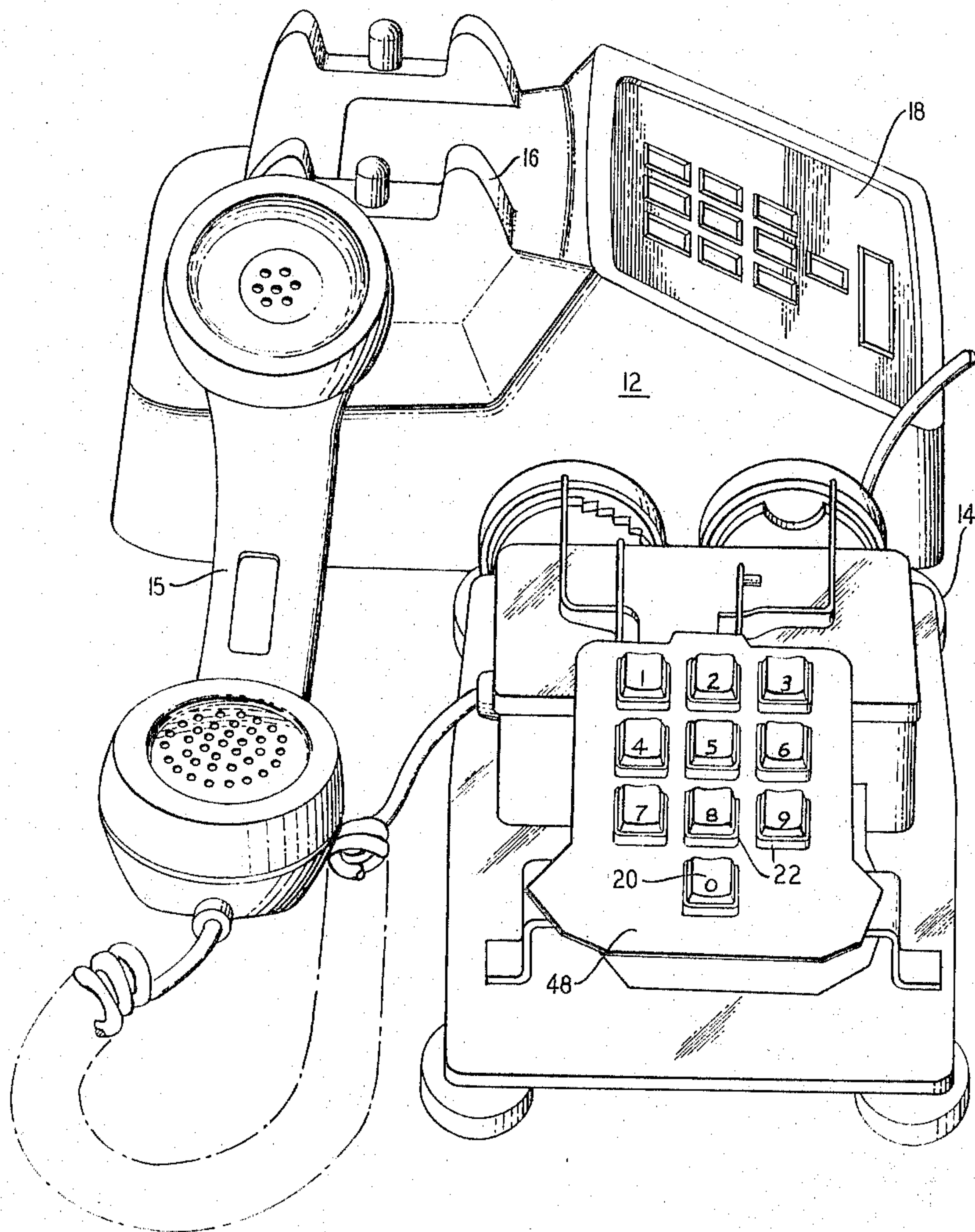
3,316,357

CODE TRANSMITTER

Original Filed July 1, 1963

3 Sheets-Sheet 1

FIG. 1



INVENTORS J. H. HAM JR.
J. F. RITCHEY
W. R. TOLMAN

BY *Harry C. Newman*
ATTORNEY

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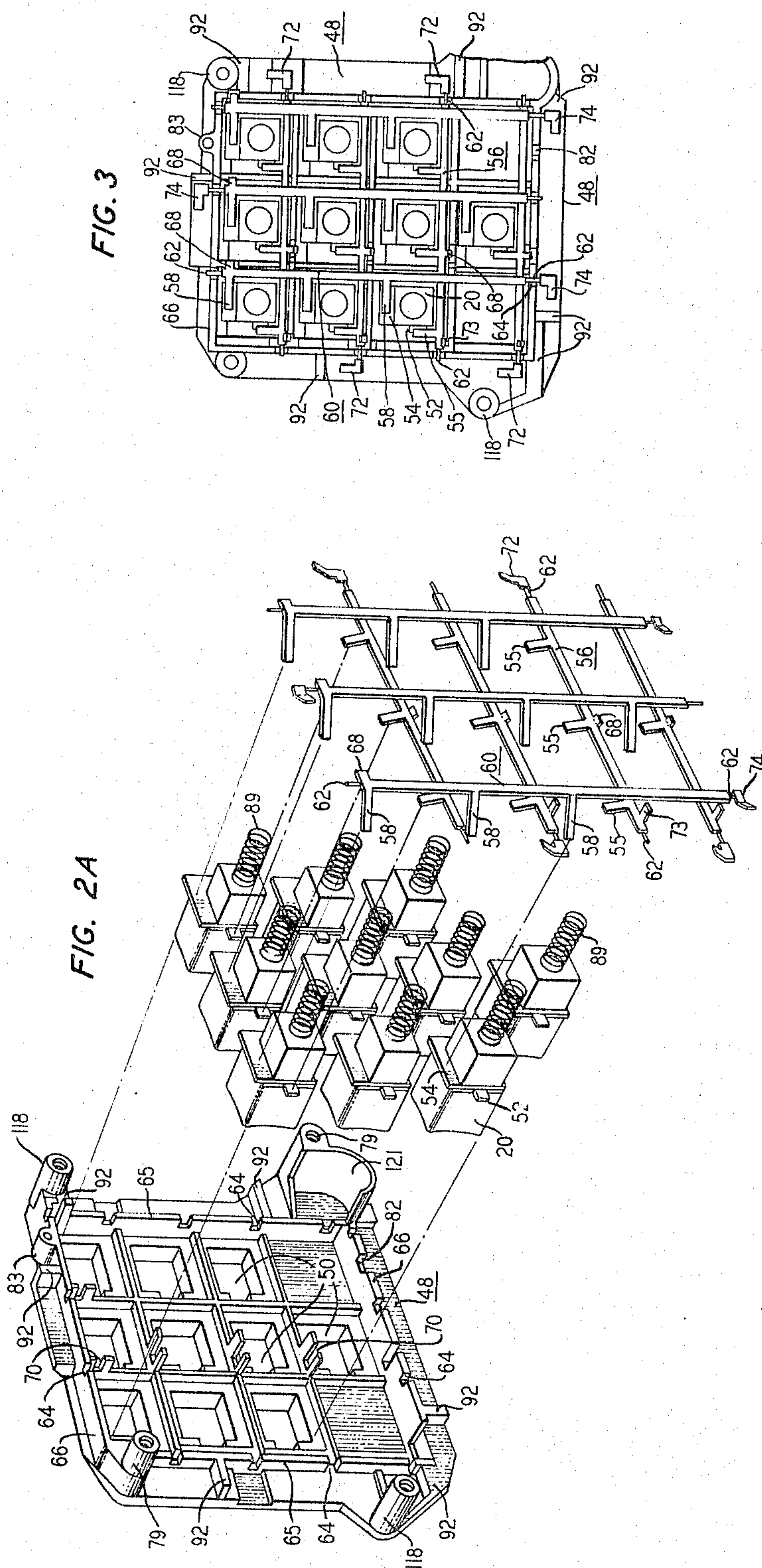
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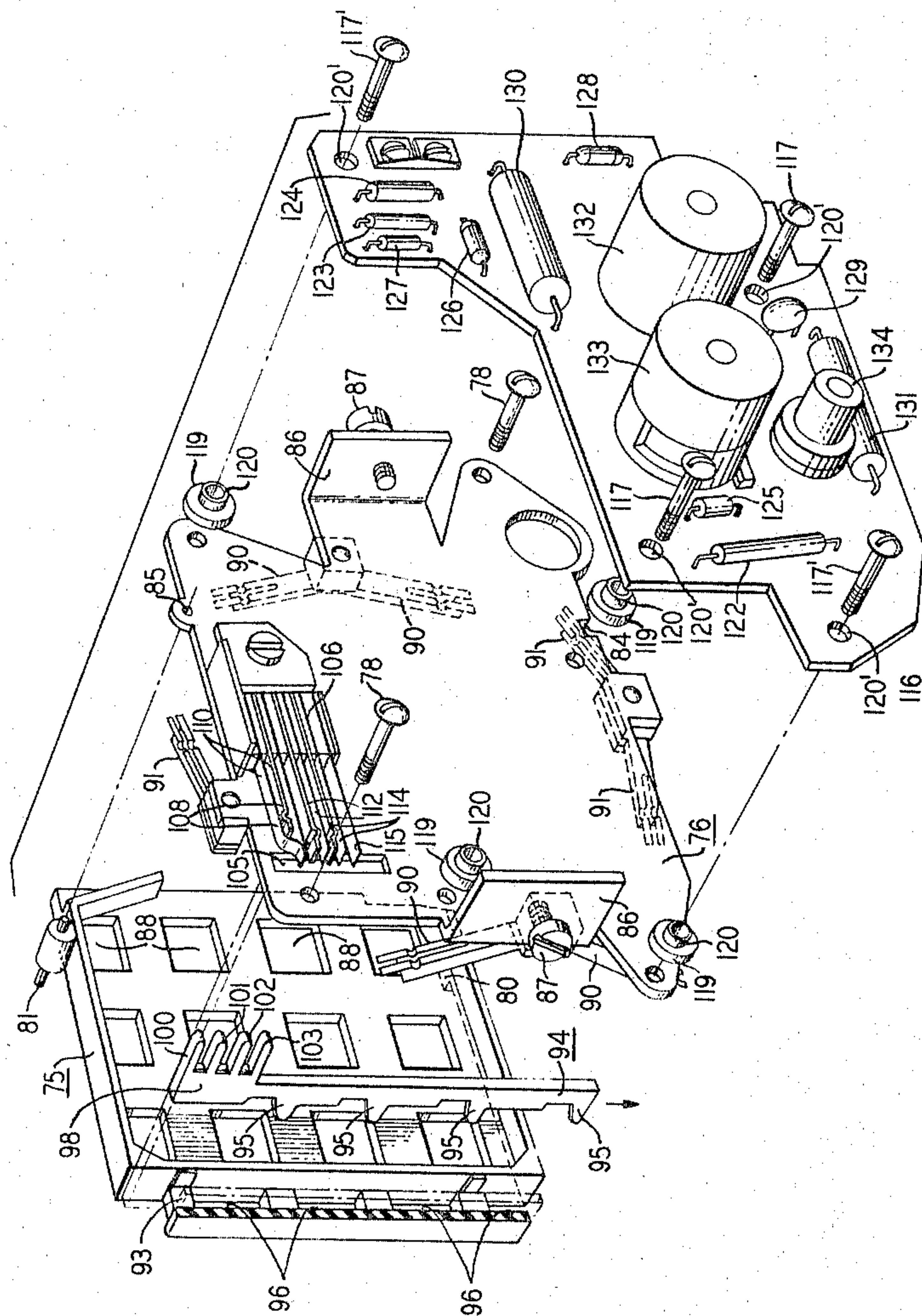
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CODE TRANSMITTER

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FIG. 2B



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CODE TRANSMITTER

James H. Ham, Jr., Indianapolis, James F. Ritchey, Carmel, and Warren R. Tolman, Indianapolis, Ind.; said Tolman assignor to Western Electric Company, Inc., New York, N.Y., a corporation of New York, and said Ham and said Ritchey assignors to Bell Telephone Laboratories, Inc., New York, N.Y., a corporation of New York

Original application July 1, 1963, Ser. No. 291,770, now Patent No. 3,274,345, dated Sept. 20, 1966. Divided and this application May 24, 1966, Ser. No. 552,457
2 Claims. (Cl. 179-90)

This invention, which is a division of application Ser. No. 291,770, filed July 1, 1963, now Patent No. 3,274,345, relates to code transmitters and particularly to code transmitters operated by means of pushbuttons.

An illustrative embodiment of the code transmitter of the present invention comprises a pushbutton call transmitter including a multifrequency signal generator. The pushbutton call transmitter comprises a cover member having a plurality of holes therein arranged in an array of longitudinal columns and transverse rows. A plurality of guide collars extend from the topside of the cover member and respectively encompass the holes, and a plurality of prestressing studs extend from the underside of the cover member. An individual pushbutton is situated in each of the holes in the cover member, each pushbutton being associated with a different digit which is characterized by two unique frequencies and each pushbutton further being movable between an extended position and a depressed position and being biased toward its extended position.

A plurality of longitudinal and transverse rotatable shafts are journaled in the cover member, an individual shaft extending along one side of each column and each row of pushbuttons. Each shaft has a plurality of projecting levers, and individual levers on each shaft respectively extend into the paths of travel of the individual pushbuttons alongside of which the shaft extends, whereby the depression of an individual pushbutton results in the rotation of a unique pair of shafts.

A pair of spring contacts for selecting a discrete frequency of a resonant circuit of the signal generator is associated with each shaft. A first contact of each pair is biased against a lever of its associated shaft and a second contact is biased against a prestressing stud on the cover member, the lever moving the first contact into engagement with the second contact upon rotation of the shaft.

A displaceable member having a plurality of cam surfaces is associated with the transverse shafts. Each cam surface is associated with an individual shaft and is in juxtaposition with one of the levers of the shaft, the rotation of any one of the transverse shafts displacing the displaceable member. The displaceable member extends into engagement with a switching means for the signal generator, and the displacement of the displaceable member results in the operation of the switching means. Thus upon actuation of any one of the pushbuttons a unique pair of shafts is rotated to close two pairs of frequency selecting spring contacts and displace the displaceable member to operate the switching means in a particular sequence.

A complete understanding of the invention and of these and other features and advantages thereof may be gained from consideration of the following detailed description taken in conjunction with the accompanying drawing wherein one embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description and

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is not to be construed as defining the limits of the invention.

In the drawing:

FIG. 1 is a perspective view of a telephone set including a call transmitter embodying the present invention, the housing of the telephone set being removed and positioned to one side to provide a clearer view of the call transmitter;

FIGS. 2A and 2B combined are an exploded perspective view of the elements comprising the call transmitter; and

FIG. 3 is a bottom view of the elements of FIG. 2A assembled.

Referring to the drawing and FIG. 1 in particular, a telephone set 12 including a call transmitter embodying the present invention is shown therein. The telephone set 12 comprises a base 14 and a handset 15, the handset when not in use being positioned in a cradle 16 at the rear of the base. The base 14 has a forwardly inclined faceplate 18 through which elements of the call transmitter extend, these elements being ten pushbuttons 20 and ten guide collars 22. The upper surface of each pushbutton 20 is curved convexly, and one of the digits 1 through 0 appears thereon, indicating the particular digit that the pushbutton represents.

Turning now to FIGS. 1, 2A, and 3, the call transmitter further comprises a cover member 48 having ten square holes 50 therein. Each of the holes 50 is encompassed by one of the guide collars 22, the collars being square and extending from the upper surface of the cover member 48. The holes 50 are arranged in longitudinal columns and transverse rows, and each pushbutton 20 has a square upper end thereof slidably positioned in one of the holes.

The collars 22 increase the height of the walls defining the holes 50, and the walls taper toward the upper end so that the upper inside edge of each collar interacts with the upper end of the pushbutton 20 positioned therein to guide the movement thereof. In addition, the collars 22 in projecting through the faceplate 18 of the telephone set 12 provide a rigid intermediary between the face plate and the pushbuttons 20 that locates the call transmitter with respect to the faceplate and eliminates the possibility of interference between the pushbuttons and the faceplate, thereby assuring free operation of the pushbuttons.

Each pushbutton 20 includes a pair of flanges 52 and 54 extending laterally therefrom and between the ends thereof, the flange 52 lying in a higher plane than the flange 54. The flanges 52 and 54 extend beneath the portions of the under surface of the cover member 48 to the sides of the holes 50 and thereby limit the upward motion of the pushbuttons 20. The portions of the under surface of the cover member 48 in juxtaposition with the flanges 52 are relieved so that the flanges 52 and 54 engage corresponding under surfaces simultaneously.

The flanges 52 and 54 of each pushbutton 20 respectively overlie a lever 55 of a transverse shaft 56 and a lever 58 of a longitudinal shaft 60, the levers extending laterally from the shafts. An individual transverse shaft 56 extends along one side of each row of pushbuttons 20, and an individual longitudinal shaft 60 extends along one side of each column of pushbuttons. Thus when any pushbutton 20 is depressed, the levers 55 and 58 of a unique pair of transverse and longitudinal shafts 56 and 60 are deflected downwardly.

Each transverse shaft 56 and longitudinal shaft 60 includes journals 62 that are respectively accommodated by notches 64 in longitudinal side walls 65 and transverse side walls 66 depending from the underside of the cover member 48. The notches 64 serve as bearings in which the shafts 56 and 60 rotate, and consequently the deflection of the levers 55 and 58 of a pair of transverse and longitudinal shafts results in the rotation of the shafts.

The longitudinal side walls 65 are of a lesser height than the transverse side walls 66 so that the transverse shafts 56 lie in a higher plane than the longitudinal shafts 60. The transverse and longitudinal shafts 56 and 60 thereby rotate without interfering with one another.

Each transverse shaft 56 and longitudinal shaft 60 includes a tab 68 that extends into a slot 70 in the underside of the cover member 48 to maintain the shafts in their proper axial position. In addition, each transverse shaft 56 has both a contact actuating lever 72 at one end thereof and an operator actuating lever 73 adjacent to one end thereof, while each longitudinal shaft 60 has only a contact actuating lever 74 at one end thereof.

Turning now to FIGS. 2A and 2B, underlying the cover member 48 is a frame member 75 and a base member 76. Fasteners 78 secure the base member 76 to bosses 79 depending from the underside of the cover member 48, and the frame member 75 is sandwiched between the base member and the cover member. To properly locate the frame member 75 with respect to the cover member 48 and the base member 76, a key 80 and a pin 81 extending upwardly and downwardly from the frame member are respectively accommodated by a notch 82 and a sleeve 83 in opposing transverse side walls 66 of the cover member and a notch 84 of an orifice 85 in opposing edges of the base member.

The base member 76 has downwardly extending lugs 86 in which fasteners 87 are threaded, and the fasteners are employed to secure the base member and thereby the call transmitter to a support within the telephone set.

The frame member 75 butts against the bottom edges of the transverse walls 66 and longitudinal walls 65 of the cover member 48 and thereby retains the longitudinal shafts 60 and transverse shafts 56 in the bearing notches 64. In addition, the frame member 75 has an array of square holes 88 therein that receive square lower ends of the pushbuttons 20, the walls defining the holes 88 interacting with the lower ends of the pushbuttons 20 to guide the movement thereof. The holes 88 in the frame member 75 are in alignment with the holes 50 in the cover member 48, and the walls defining the holes 88 thereby cooperate with upper inside edges of the collars 22 (FIG. 1) of the cover member to direct the movement of the pushbuttons 20 parallel to the longitudinal axes thereof.

The underside of each pushbutton 20 has a hole therein and a helical compression spring 89 positioned in each hole bears against the base member 76 to bias the pushbuttons upwardly and normally maintain the pushbuttons in an extended position. When a pushbutton 20 is depressed, the spring 89 is compressed within the hole in the pushbutton and the downward movement of the pushbutton is arrested by the engagement of the underside thereof with the base member 76.

Pairs of normally open frequency selecting spring contacts 90 and 91 are insulatedly secured to the upper surface of the base member 76. The pairs of spring contacts 90 and 91 are disposed about the periphery of the base member 76, and the lower contact of each pair underlies and is prestressed against a prestressing stud 92 depending from the underside of the cover member 48. The upper contact of each pair of spring contacts 90 underlies and is prestressed against the actuating lever 72 of an individual transverse shaft 56, and the upper contact of each pair of spring contacts 91 underlies and is prestressed against the actuating lever 74 of an individual longitudinal shaft 60. The prestressing of the spring contacts assures the generation of good contact pressure with very small travel of the spring contacts.

The upper contacts of the pairs of frequency selecting spring contacts 90 and 91 respectively act to maintain the levers 55 of the transverse shafts 56 in engagement with underside of the pushbutton flanges 52 and the levers 58 of the longitudinal shafts 60 in engagement with the underside of the pushbutton flanges 54, and when the

pushbuttons 20 are in their extended position, the upper contacts are spaced from the lower contacts. However, when any one of the pushbuttons 20 is depressed, the transverse shaft 56 and longitudinal shaft 60 extending alongside thereof are rotated, and the respective contact actuating levers 72 and 74 of the shafts move the upper contacts of the pairs of spring contacts 90 and 91 associated with the levers into engagement with the lower contacts. The upper contacts deflect the lower contacts from their associated prestressing stud 92, and relative motion occurs between the contacts that provides a wiping action of the contact surfaces.

It is to be noted that the positioning of the pairs of frequency selecting spring contacts 90 and 91 around the periphery of the base member 76 places them out in the open and thereby makes them readily accessible for adjustment and cleaning without having to disassemble the pushbutton dial 44. Furthermore, as seen in FIG. 3 from the positions of the contact actuating levers 72 and 74 and the studs 92, the cover member 48 overlies the pairs of frequency selecting spring contacts 90 and 91 and thereby prevents damage to the spring contacts when the call transmitter is being handled.

The underside of the frame member 75 includes a channel 93 that extends along a longitudinal side thereof, and captured within the channel and between the frame member and the base member 76 is a slidably displaceable switch operator 94. The operator 94 has four spaced cam portions 95 extending upwardly therefrom that respectively extend through spaced holes 96 in the channel 93. Each cam portion 95 extends into engagement with the operator actuating lever 73 of an individual transverse shaft 56, and upon the rotation of any one of the transverse shafts by the depression of a pushbutton 20, the operator actuating lever thereof interacts with the cam portion with which it is in engagement to displace the operator 94 along the channel 93 in the direction of the arrow in FIG. 2B.

The operator 94 has a contact actuating comb portion 98 extending downwardly therefrom that consists of spaced teeth 100, 101, 102, and 103. The teeth 100 through 103 extend through a slot 105 in the base member 76 and into engagement with a common switch 106 secured to the underside of the base member. The common switch 106 comprises a make-before-break combination consisting of normally closed contacts 108 and normally open contacts 110, two pairs of normally closed contacts 112 and 114, and a biasing spring 115. The movable contact members of the make-before-break combination, the normally closed contacts 112, and the normally closed contacts 114 respectively extend into juxtaposition with the teeth 100, 101, and 102 and the biasing spring 115 extends into engagement with the tooth 103.

The biasing spring 115 biases the cam portions 95 of the operator 94 toward the operator actuating levers 73, and thereby tends to maintain the cam portions in engagement with the levers. The teeth 100, 101, and 102 are spaced so that when the operator 94 is displaced by the depression of a pushbutton 20, the contacts are actuated in the following sequence: the normally closed contacts 114 are opened, the normally closed contacts 112 are opened, the normally open contacts 110 are closed, and the normally closed contacts 108 are opened. The sequence is reversed upon the return movement of the operator 94.

From the foregoing description it can be seen that the depression of any pushbutton 20 serves to close one pair of frequency selecting spring contacts 90 and one pair of frequency selecting spring contacts 91 and to operate the common switch 106. The displacement of the operator 94 is arranged so that the pairs of frequency selecting spring contacts 90 and 91 are closed before the normally closed contacts 108 of the common switch are opened.

Underlying the base member 76 alongside of the common switch 106 is a printed circuit board 116. A pair

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of fasteners 117 secure the printed circuit board 116 directly to the base member 76, and a pair of fasteners 117' extend through holes in the base member to secure the printed circuit board to bosses 118 depending from the cover member 48. The fasteners 117 and 117' extend through dielectric bushings 119 mounted in the printed circuit board 116, the bushings having slotted collars 120 that are forced into holes 120' in the printed circuit board. The bushings 119, which are thereby held captive in the holes 120', space the printed circuit board 116 from the underside of the base member 76.

The foregoing arrangement provides support for the printed circuit board 116 with a minimum of fasteners, and where maintenance of the board is required, it permits the board to be removed from the base member 76 without disturbing the mechanical elements. Where maintenance of the mechanical elements is required, it permits the board 116 to be removed as a unit with the base member 76 without disturbing the electrical elements on the board.

A plurality of electrical components are mounted on the underside of the printed circuit board 116. These components in combination with the common switch 106 comprises a multifrequency signal generator of the call transmitter. These components consist of resistors 122, 123, and 124; varistors 125, 126, 127, and 128; capacitors 129, 130, and 131; transformers 132 and 133; and a transistor 134. Connections are made from the components to printed circuitry (not shown) on the upper surface of the printed circuit board 116 by inserting the leads of the components through small holes in the board. Mechanical connection as well as electrical connection is then made by a process such as solder dipping.

To operate the call transmitter, the user lifts the handset 15 from the cradle 16 and listens for a dial tone. Upon hearing a dial tone, he sequentially depresses the pushbuttons 20 which correspond to the telephone number of the desired subscriber. Signals corresponding to the telephone number are thereby transmitted to the central office.

Although the call transmitter as disclosed is not illuminated, it may be illuminated by the addition of a light bulb that is positioned adjacent to a reflector 121 depending from one corner of the cover member 48 and by the addition of a generally rectangular light guide that is positioned between the frame member 75 and the base member and is confined within the walls depending from the frame member. The pushbuttons 20 would then be formed from a translucent material, and the opaque characters on the pushbuttons would be viewed against an illuminated background.

Although the code transmitter of the present invention has been shown and described in terms of being used as a call transmitter, it will be understood that this is but one illustrative use. Other uses, as for example, as a data transmitter, may be made thereof. In addition, various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A code transmitter comprising:

- a cover member having a plurality of holes therein arranged in an array of longitudinal columns and transverse rows, a plurality of guide collars extending from the topside of the cover member and respectively encompassing the holes to increase the height of the walls defining the holes, the walls defining the holes tapering inwardly toward the upper ends thereof, the cover member further having a plurality of contact prestressing studs extending from the underside of the cover member, the studs being disposed just inside the periphery of the cover member;
- a base member secured to the underside of the cover member;
- a frame member sandwiched between the base member

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and the cover member, the frame member having an array of holes positioned in alignment with the holes in the cover member;

an individual pushbutton situated in each of the holes in the cover member and extending through the corresponding hole in the frame member, each pushbutton having a flange intermediate the ends thereof and an aperture in the underside thereof, the upward movement of the pushbutton being limited by the engagement of the flange with the underside of the cover member and the downward movement of each pushbutton being limited by the engagement of the lower end thereof with the base member;

a spring member positioned in the aperture of each pushbutton, the spring member bearing against the base member and biasing the pushbutton upwardly;

a plurality of longitudinal and transverse rotatable shafts journaled in the cover member and retained in position by the frame member, an individual shaft extending along one side of each column and each row of pushbuttons, each shaft having a plurality of laterally projecting levers, the individual levers on each shaft respectively extending beneath the individual flanges of the pushbuttons alongside of which the shaft extends;

a plurality of pairs of spring contacts secured to the periphery of the base member, each pair being associated with an individual shaft, one contact of each pair being biased against one of the levers of its associated shaft, the other contact being biased against a contact prestressing stud of the cover member, each pair of spring contacts being positioned just within the periphery of the cover member;

an operator positioned between the frame member and the base member, the operator being slidably displaceable along a channel in the underside of the frame member, the operator having a plurality of spaced cam surfaces, an individual cam surface being associated with each transverse shaft and being in juxtaposition with one of the levers of its associated shaft, the operator further having a contact actuating comb portion extending through an aperture in the base member, the comb portion having a plurality of differentially spaced teeth; and

a spring contact pileup secured to the underside of the base member, the spring contact pileup having individual spring contacts thereof respectively extending into engagement with individual teeth of the comb portion of the operator and being sequentially operated by the displacement thereof.

2. In combination:

a cover member having a plurality of holes therein arranged in an array of longitudinal columns and transverse rows, a plurality of guide collars extending from the topside of the cover member and respectively encompassing the holes to increase the height of the walls defining the holes, the walls defining the holes tapering inwardly toward the upper ends thereof;

an individual pushbutton situated in each of the holes in the cover member, each pushbutton being movable in a path of travel between an extended position and a depressed position and being biased toward its extended position;

two sets of rotatable shafts journaled in the cover member, one set extending generally perpendicular to the other set, an individual shaft of one set extending along one side of each column of the pushbuttons and an individual shaft of the other set extending along one side of each row of the pushbuttons, each shaft having a plurality of laterally projecting levers, individual levers on each shaft respectively extending into the path of travel of the individual pushbuttons alongside of which the shaft extends;

a first plurality of pairs of contacts, each pair of contacts being associated with an individual shaft, one

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contact of each pair being biased against one of the levers of its associated shaft, each pair of contacts being positioned just within the periphery of the cover member;

- a displaceable member having a plurality of spaced cam surfaces, each cam surface being associated with an individual shaft of one of the sets of shafts and being in juxtaposition with one of the levers of its associated shaft, the displaceable member further having a contact actuating comb portion the comb portion having a plurality of differentially spaced teeth; and
- a second plurality of pairs of contacts having individual contacts thereof respectively extending into engagement with individual teeth of the comb portion of

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the displaceable member and being sequentially operated by the displacement thereof.

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KATHLEEN H. CLAFFY, *Primary Examiner*.

RICHARD MURRAY, *Examiner*.

H. ZELLER, *Assistant Examiner*.