Dec. 30, 1941. W. A. MARRISON 2,267,936

IMPULSE CODE CONVERTER

Filed July 27, 1940 2 Sheets-Sheet 1

FIG. 1

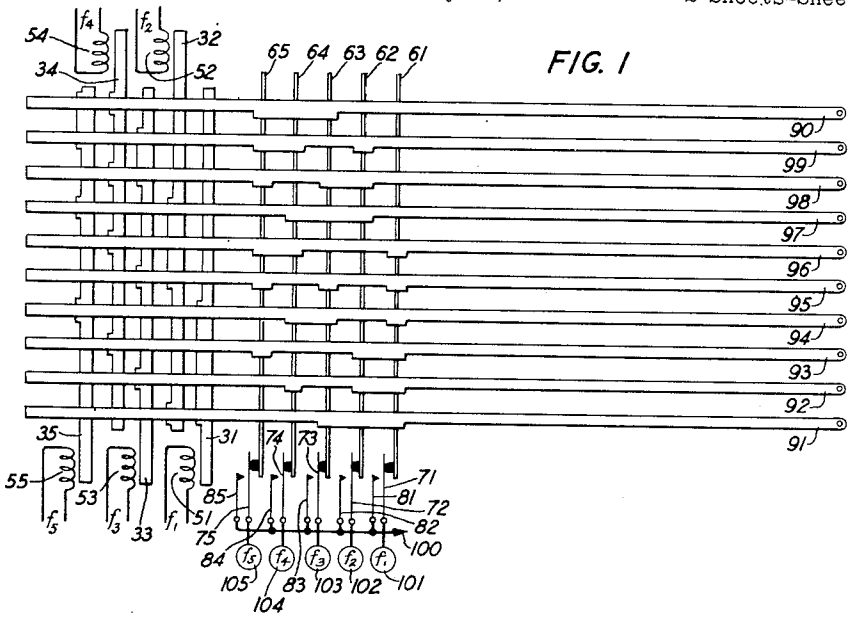

FIG. 2

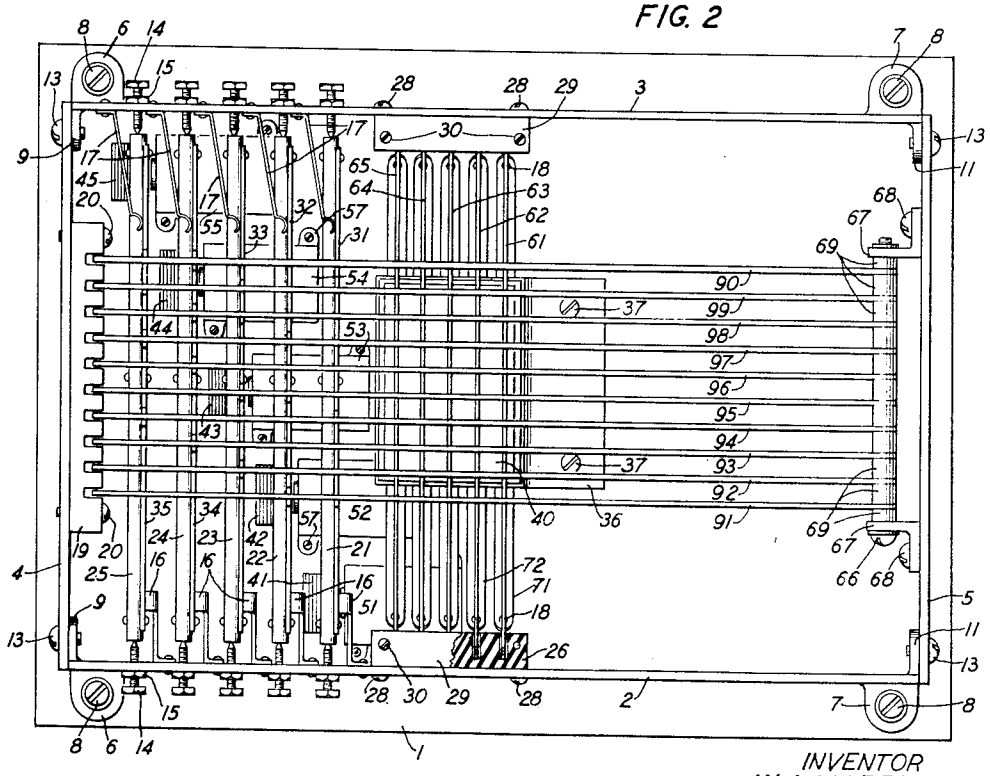

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FIG. 3

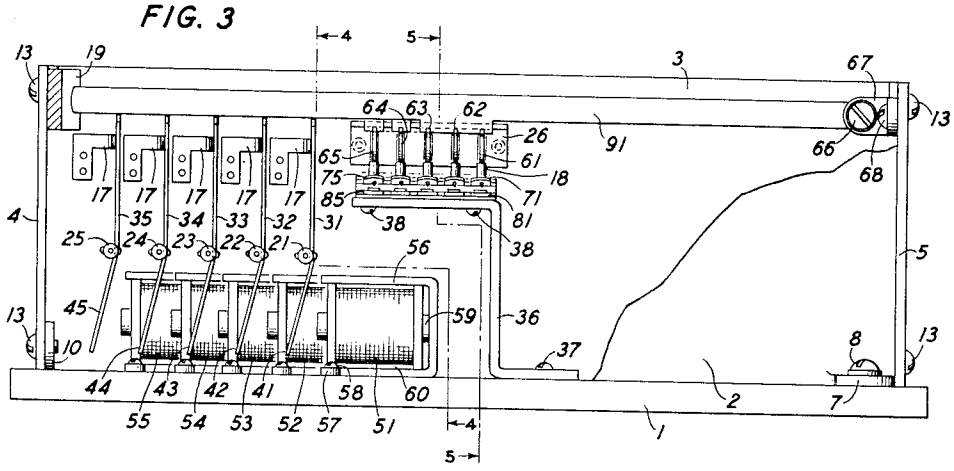


FIG. 4

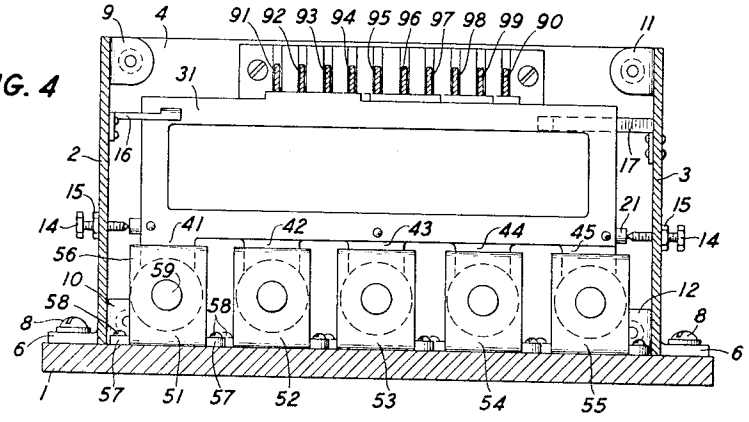
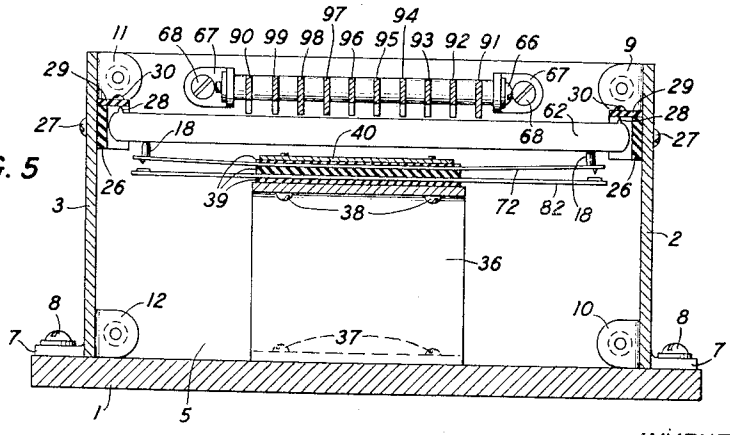


FIG. 5



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Patented Dec. 30, 1941

2,267,936

UNITED STATES PATENT OFFICE

2,267,936

IMPULSE CODE CONVERTER

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Application July 27, 1940, Serial No. 347,927

4 Claims. (Cl. 177—380)

This invention relates to signaling systems and more particularly to systems for converting incoming signals of one code type into outgoing signals of a different code type.

In various signaling systems that have been proposed, information is often transmitted from one point to another by combinations of simultaneous or sequential impulses comprising two or more of a group all functionally alike. Thus, for example, ten distinct signals can be transmitted by the ten combinations of two impulses at a time over five channels, which channels may be five separate physical circuits or five separate carriers on one physical circuit. When the final signal desired is one of a simple numerical sequence, it is necessary to employ some means to convert from the code type of signal. A general method of accomplishing this has been heretofore proposed which comprises as many comb bars as there are impulses in the code group and as many contact operating bars as there are signals to be registered in the sequential group. The contact operating bars cross the comb bars and are normally restrained from operation by the comb bars and the comb bars are so toothed or otherwise conformed that when the comb bars are actuated by their individual operating magnets in various combinations in response to code signals, different individual ones of the contact bars corresponding to the digital values of the code signals will be actuated. One simple conversion is from a code the signals of which comprise different combinations of two impulses out of a maximum five into ten sequential signals. Other examples would be the conversion from a code the signals of which comprise different combinations of three impulses of a maximum of five into ten sequential signals or the conversion from a code the signals of which comprise different combinations of three impulses out of a maximum of six into twenty sequential signals.

It is the object of the present invention, however, to afford facilities of a simple and compact character whereby code signals of one character may be converted into code signals of another character.

As illustrative of the manner in which this object may be attained it will be assumed that it is desirable to convert from a code the signals of which comprise different combinations of two impulses out of a maximum of five into a code the signals of which comprise different combinations of three impulses out of a maximum of five. In accordance with the present invention this may be accomplished by a very simple and compact apparatus assembly comprising five receiving comb bars individually operable by signal receiving magnets, five contact operating bars arranged parallel thereto which may be employed to retransmit code signal impulses and ten translating comb bars extending transversely of the receiving comb bars and the contact bars. The receiving comb bars are provided with cam extensions along one edge thereof which are so positioned that with none of such comb bars operated, all of the translating comb bars are restrained from operation. The translating comb bars are also provided with cam extensions along one edge thereof which are positioned above the contact operating bars.

It will be assumed that the five operating magnets of the receiving comb bars are operable in different combinations of two at a time by currents of different frequencies which are incoming over a single physical circuit and that the translating comb bars are arranged to operate the contact operating bars in different combinations of three at a time to connect three out of five sources of different frequency to a single outgoing circuit. For this purpose, therefore, the cam extensions on the five receiving comb bars are so arranged that when any two of such bars are moved by their magnets, one of the ten translating comb bars corresponding to the digital value of the code signal received will be permitted to operate and, in operating, to operate a combination of three of the contact operating bars.

For a more comprehensive understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 shows schematically the arrangement of comb bars and contact operating bars for making a particular code conversion;

Fig. 2 is a top plan view of a code converter based upon the arrangement of Fig. 1;

Fig. 3 is a side elevational view of the converter disclosed in Fig. 2 with a portion of one side member broken away;

Fig. 4 is a cross-sectional view taken along section line 4—4 of Fig. 3; and

Fig. 5 is a cross-sectional view taken along section line 5—5 of Fig. 3.

The code converter, illustrative of the present invention, has a base 1 on which a rectangular frame having side members 2 and 3 and end members 4 and 5 is mounted. The side members 2 and 3 are provided with ears 6 and 7, outturned at right angles from their lower edges by means of which such members are secured by screws 8 to the base 1 and with ears 9, 10, 11 and 12 turned inwardly at right angles from their ends to which the end members 5 and 6 are secured by screws 13.

Pivotally supported in parallel relationship on trunnion screws 14 threaded through tapped holes in the side members 2 and 3 of the frame are five armature shafts 21 to 25, inclusive. The trunnion screws are held in their adjusted posi-

tions by locking nuts 15 threaded on such screws. Secured to each shaft in any suitable manner, as by rivets, is a rectangular frame one of which is shown most clearly in Fig. 4, the upper horizontal member of which serves as a code bar, the lower horizontal member of which is secured to the armature shaft and a downwardly extending portion of which serves as an armature. These frames are identified by the numerals 31 to 35, inclusive, and will hereinafter be referred to as receiving code bars. It will be noted by reference to Fig. 4 that the armature portions 41 to 45 of these code bars extend downwardly at different positions along their lower members so that the magnets 51 to 55 for operating such bars may be mounted side by side but in staggered relationship on the base 1.

Each magnet, such as 51, comprises a U-shaped pole-piece yoke 56 having ears 57 by means of which the magnet is secured to the base 1 by screws 58, a core 59 secured to the base of the yoke and extending forwardly between the arms of the yoke and an operating coil 60 supported on the core between the arms of the yoke.

Secured to the inner face of side member 2 are back stops 16 associated with the code bars 31 to 35, inclusive, and against which the code bars are normally biased by the biasing springs 17 which are secured to the inner face of side member 3, and positioned with their ends in engagement with the code bars with which they are associated.

Extending transversely between the side members 2 and 3 of the frame and parallel to each other are five contact operating bars 61 to 65, inclusive. The ends of these bars are supported in slots in the supports 26 which are secured to the side members 2 and 3 by screws 27. Each end of each contact bar is provided with a fulcrum knife edge 28, which knife edges engage against the under-side of plates 29 secured to the upper surfaces of the supports 26 by screws 30.

A Z-shaped bracket 36 is positioned beneath the contact operating bars with one of its arms secured to the base 1 by screws 37 and having secured to the upper surface of its other arm a spring pile-up comprising five pairs of double-ended contact springs. The pairs of springs 71, 81; 72, 82; 73, 83; 74, 84 and 75, 85 are positioned directly underneath the contact bars 61 to 65, inclusive, and are secured to the upper arm of the bracket 36 by screws 38 which extend through holes in the bracket, holes in the interposed strips 39 of insulation which insulate the springs from each other, from the bracket 36 and from the upper clamping plate 40, into threaded holes in this clamping plate. Secured to each of the springs 71 to 75, inclusive, near its ends, are studs 18 of insulating material which engage against the under edges of the contact bars 61 to 65, inclusive. The springs 71 to 75, inclusive, are normally tensioned out of engagement with their mate springs 81 to 85, inclusive, and press the knife edges 28 of the contact bars upwardly against the plates 29. Whenever any contact bar is moved downwardly either bodily or at either end with the knife edge 28 at the other end serving as a fulcrum, the associated pair of springs will be forced into contact engagement.

Positioned above the receiving code bars 31 to 35, inclusive, and above the contact bars 61 to 65, inclusive, and extending at right angles thereto and parallel to each other are ten translating code bars 90 to 99, inclusive. These bars are all pivoted at one end on a bolt 66 which extends through holes in the brackets 67 secured to the end member 5 of the frame by screws 68, through holes in the ends of the bars and through holes in the spacing sleeves 69. The other ends of the bars are vertically and freely movable in slots in the guide member 19 which is secured near the top edge of the end member 4 of the frame by screws 20. These translating code bars normally rest with their free ends supported by the cam extensions of the receiving code bars 31 to 35, inclusive, as disclosed most clearly in Fig. 3, and with the cam extensions formed on their lower edges engaged against the upper edges of the contact bars 61 to 65, inclusive, as best disclosed in Fig. 5.

Referring to Fig. 1, in which the code bars and contact bars have been schematically illustrated, it will be noted that the translating code bar 91 is normally supported by cam extensions on the receiving code bars 31 and 32 and that the cam extension of bar 91 overlies the three contact operating bars 61, 62 and 63. Therefore, if the receiving code bars 31 and 32 are both rotated by their operating magnets 51 and 52, the bar 91 will be permitted to fall by its own weight or, if required, by a tension spring secured thereto, thereby depressing the contact operating bars 61, 62 and 63 to engage their associated pairs of contact springs 71, 81, 72, 82 and 73, 83. The engagement of these pairs of springs may, for example, connect the three generators 101, 102 and 103, tuned to generate three different frequencies $f1$, $f2$ and $f3$, to a common outgoing channel 100.

In a similar manner the translating code bar 92 is normally supported by cam extensions on the receiving code bars 31 and 33 and the cam extensions of bar 92 overlie the three contact bars 61, 62 and 64. Therefore, if the code bars 31 and 33 are both rotated by their operating magnets 51 and 53, the bar 92 will be permitted to fall thereby depressing the contact bars 61, 62 and 64 to engage their associated pairs of contact springs 71, 81, 72, 82, and 74, 84. The engagement of these pairs of springs connect the three generators 101, 102 and 104, tuned to generate the frequencies $f1$, $f2$ and $f4$, to the channel 100.

The following table illustrates the code bars and contact bars which would be operated to convert a code of signals for the digits 1 to 0 which comprise different combinations of two frequencies out of a maximum of five into a code of signals which comprises different combinations of three frequencies out of a maximum of five.

Digit	Frequencies of incoming signals	Receiving code bars operated	Translating code bars operated	Contact bars operated	Frequencies of outgoing signals
1	$f1, f2$	31, 32	91	61, 62, 63	$f1, f2, f3$
2	$f1, f3$	31, 33	92	61, 62, 64	$f1, f2, f4$
3	$f1, f4$	31, 34	93	61, 62, 65	$f1, f2, f5$
4	$f1, f5$	31, 35	94	61, 63, 64	$f1, f3, f4$
5	$f2, f3$	32, 33	95	61, 63, 65	$f1, f3, f5$
6	$f2, f4$	32, 34	96	61, 64, 65	$f1, f4, f5$
7	$f2, f5$	32, 35	97	62, 63, 64	$f2, f3, f4$
8	$f3, f4$	33, 34	98	62, 63, 65	$f2, f3, f5$
9	$f3, f5$	33, 35	99	62, 64, 65	$f2, f4, f5$
0	$f4, f5$	34, 35	90	63, 64, 65	$f3, f4, f5$

It will be apparent that in a similar manner a conversion of a code of signals which comprises different combinations of three frequencies out of a maximum of five into a code of signals which comprises different combinations of two frequencies out of a maximum of five could be accomplished. By providing six receiving comb bars with appropriately located cam extensions

and operable by associated magnets, six contact operating bars and twenty translating comb bars with appropriately located cam extensions, it would be possible to convert a code of signals for twenty digits which comprises different combinations of either two or three frequencies out of a maximum of six into a code of signals which comprises different combinations of either three or two frequencies out of a maximum of six. Although the received and transmitted signals have been illustrated and described as being of different frequencies, it is to be understood that these signals could be of any desired character.

What is claimed is:

1. In an impulse code converter a plurality of comb bars, operating magnets therefor, a plurality of contact operating bars and a plurality of levers extending transversely of said comb bars and said contact operating bars, said levers being selectively operable upon the simultaneous operation of different groups of said comb bars to selectively operate different groups of said contact operating bars.

2. In an impulse code converter a plurality of rotatable comb bars, operating magnets therefor, a plurality of depressible contact operating bars and a plurality of levers extending transversely of and overlying said comb bars and said contact operating bars, said levers being selectively operable upon the simultaneous operation of different groups of said comb bars to selectively depress different groups of said contact operating bars.

3. In an impulse code converter a plurality of receiving comb bars, operating magnets therefor, a plurality of contact operating bars and a plurality of translating comb bars extending transversely of said receiving comb bars and said contact operating bars, each of said translating comb bars having a differently toothed comb overlying said contact operating bars whereby upon the simultaneous operation of different groups of said receiving comb bars said translating comb bars are selectively operated to selectively operate different groups of said contact operating bars.

4. In an impulse code converter a plurality of rotatable comb bars, operating magnets therefor, a plurality of depressible contact operating bars, a signaling means associated with each of said contact operating bars, a pair of contacts in the circuit of each of said signaling means closable by the associated contact operating bar and a plurality of translating comb bars extending transversely over the combs of said receiving comb bars and over said contact operating bars, each of said translating comb bars having a differently toothed comb overlying said contact operating bars whereby upon the simultaneous rotation of different groups of said receiving comb bars said translating comb bars are selectively operated to selectively depress different groups of said contact operating bars to close the pairs of contacts associated therewith.

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