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DECODING DEVICE FOR STATISTICAL MACHINES

Filed Dec. 14, 1950

4 Sheets-Sheet 1

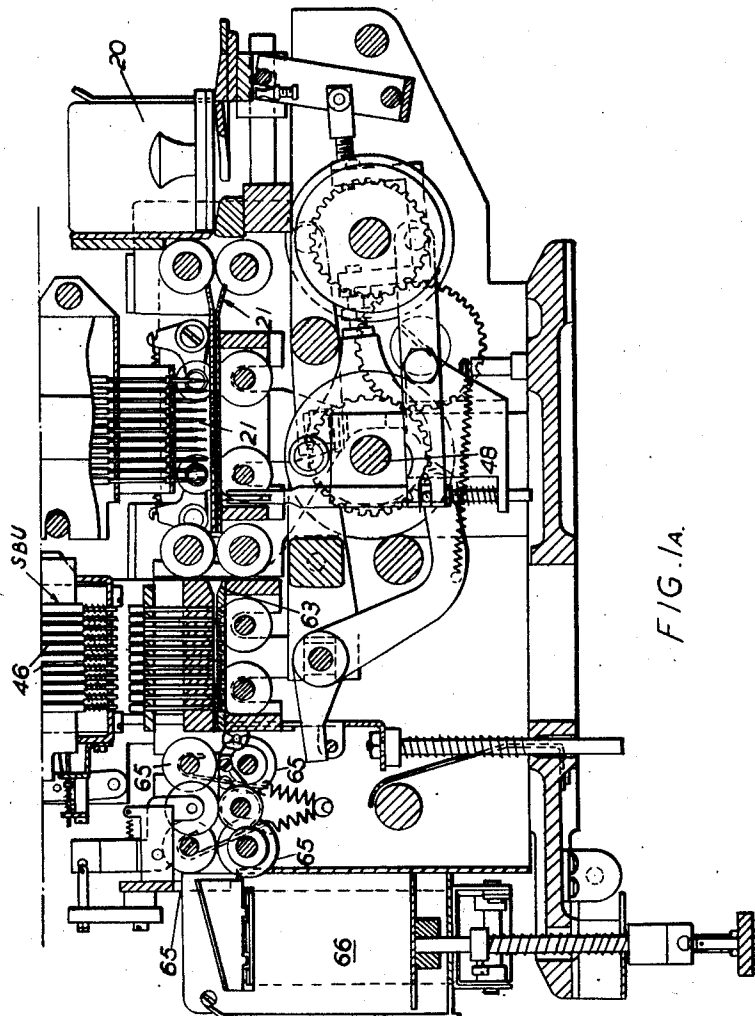


FIG. 1A.

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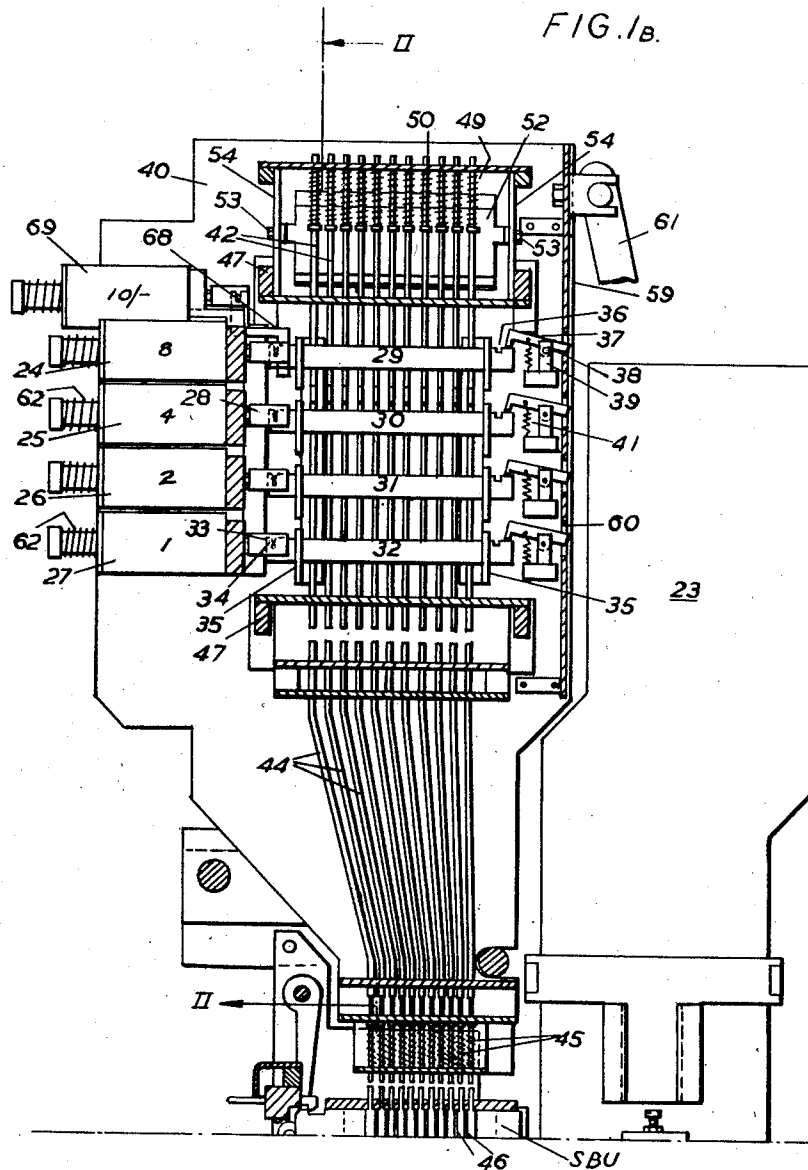
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4 Sheets-Sheet 2



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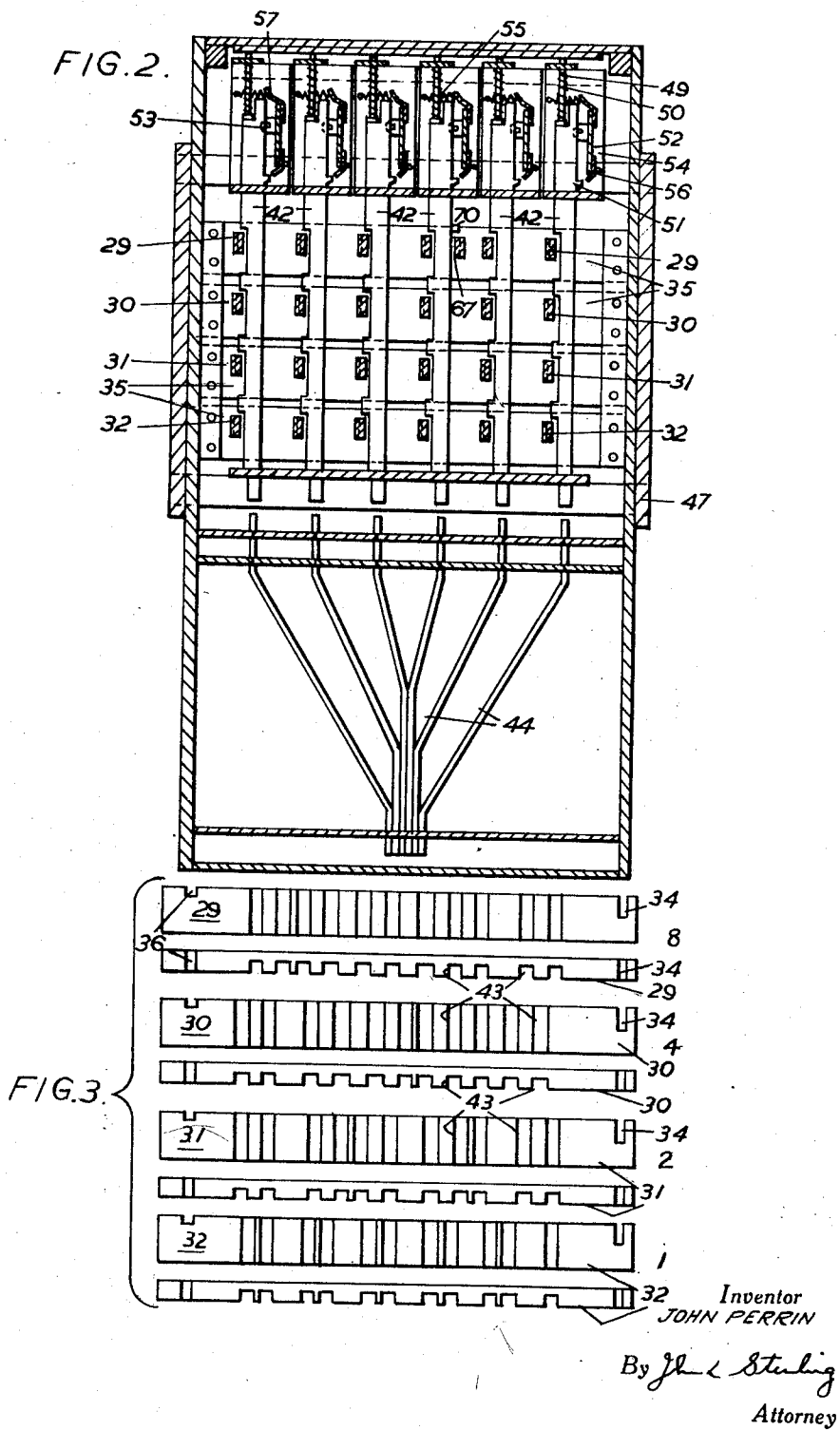
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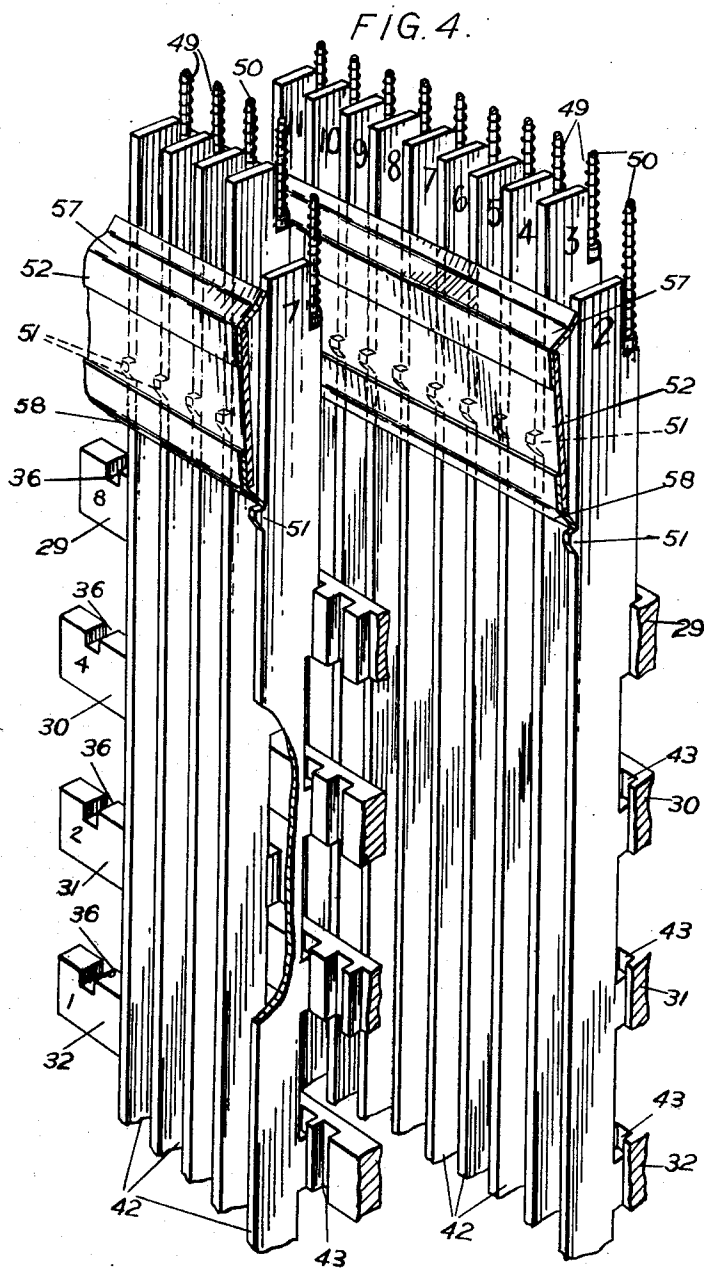
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DECODING DEVICE FOR STATISTICAL MACHINES

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6 Claims. (Cl. 235—61.6)

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This invention relates to statistical machines. In some kinds of statistical machine some functions of the machine are effected by the use of numbers transmitted to a particular part of the machine in code form. With such machines, when it is also desired to employ in a further part of the machine numbers according to their ordinary significance it is necessary to decode the numbers before use is made thereof in such further part of the machine. One form of statistical machine of this kind is a multiplying machine in which a multiplicand and a multiplier are sensed from a record and transmitted to a calculating apparatus which in turn transmits the answer to the problem to a punch unit adapted to punch the answer in a result field of the record from which the multiplicand and the multiplier are sensed. In such a machine the multiplicand and the multiplier may be sensed from the record as numbers according to their ordinary significance these numbers being translated into a predetermined code before being transmitted to the calculating apparatus. Accordingly, the answer transmitted by the calculating apparatus is also in code and before it can be punched in the result field of the record in terms of numbers of ordinary significance, the answer must be decoded. It is an object of the present invention to provide a decoding device for use with statistical machines.

According to the invention there is provided for a statistical machine, a decoding device wherein a selected one of a column of translator elements each representative of an uncoded number of ordinary significance is movable lengthwise to impart an impulse to a device to be actuated thereby, the selection of an element of the column being effected by a plurality of decoding bars normally obstructing the movement of the translator elements, each bar being provided with guides one to correspond with each of the translator elements of the column, the guides on the different decoding bars being so spaced relatively one to another that when the bars are in their normal positions no set of guides representative of like uncoded numbers are in alignment to permit the passage through the bars of the translator element representative of that number but on movement of a selected one of the bars or of a selected combination

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thereof from the normal position to a predetermined active position the guides representative of like uncoded numbers on each of the bars are brought into alignment to permit the passage therethrough of the translator element representative of that number.

In one embodiment according to the invention the translator elements are supported by a reciprocable frame for movement relative to the decoding bars, the translator elements being mounted on the frame for movement relative thereto to permit continued movement of the frame relative to the decoding bars when translator elements are obstructed by the decoding bars and thereby prevented from passing therethrough. With this arrangement each translator element is provided with a projection engageable by a shutter pivoted to the frame and rotatable about its pivot on downward movement of the frame by engagement of obstructed translator elements with one end of the shutter whereby the other end of the shutter is moved into active engagement with the projection on the selected translator element thereby positively to move the selected translator element through the associated aligned guides in the decoding bars.

A decoding bar may be moved from its normal to its active position by an impulse applied to one end of the bar and a latch arranged to retain the bar in its active position. The means to receive and apply an impulse to the decoding bar may comprise an electro-magnet the armature of which is connected to the bar.

In one embodiment of the invention the decoding apparatus is adapted for operation according to a four-figure code known as the 8-4-2-1 code and when so constructed the device has four decoding bars associated with a column of translator elements, the decoding bars being respectively representative of the code numbers 8, 4, 2, 1 whereby numbers transmitted to the decoding device in accordance with the 8-4-2-1 code are decoded into impulses representative of numbers according to their ordinary significance, the impulses being imparted by the translator elements.

A decoding device according to the invention may be provided in combination with a punch mechanism which includes punches, a set bar

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unit and transmission elements to set the set bars of the set bar unit, the transmission elements being arranged for actuation by impulses imparted thereto by the translator elements when the latter are moved through the decoding bars.

In order that the invention may be more clearly understood one embodiment will now be described, by way of example, with reference to the accompanying diagrammatic drawings in which:

Figures 1A and 1B together are an elevation, partly in section, of a sensing and punching mechanism, a decoding device according to the invention being shown in combination with the punching mechanism,

Figure 2 is a section to an enlarged scale on line II—II, Figure 1B,

Figure 3 shows, in side elevation and top plan, the arrangement of decoding bars employed in conjunction with the punch mechanism, the decoding bars being shown in their normal or inactive positions, and

Figure 4 is a diagrammatic perspective view showing the manner in which decoding bars are operated to permit the translation of coded numerals to numerals of ordinary significance.

Referring to the drawings, the machine shown in Figures 1A and 1B is arranged for association with an electrical calculating machine, not shown, adapted to receive, for example, a multiplicand and a multiplier sensed from a record card, to effect the calculation, and to transmit the answer obtained to the decoding mechanism associated with the punch unit of the machine.

Punched record cards are fed one at a time from a magazine 20 into a sensing chamber 21 mounted in known manner for reciprocation towards and away from sensing pins 22 which sense the factors for the calculation and transmit them to a coding mechanism indicated diagrammatically at 23. When the factors have been coded by the coding mechanism 23 they are transmitted as electrical impulses to the calculating machine and the answers obtained by the calculating machine are transmitted as electrical impulses to the decoding unit associated with the punch mechanism for the machine. The electrical impulses transmitted from the calculating machine are received by electro-magnets 24, 25, 26 and 27 representative respectively of the code numbers 8, 4, 2, 1 according to the four-figure code known as the 8-4-2-1 code.

As is well understood in the art, the punches for punching the answer in the result field of a record are arranged in columns, one column for each denomination, and the mechanism associated with each column is of similar construction. It is, therefore, only necessary to the understanding of the invention to describe the arrangement of the mechanism for an individual column and in Figures 1A and 1B one such column is illustrated.

The armatures 28 of the electro-magnets are connected respectively to the ends of the decoding bars 29, 30, 31 and 32 by pins 33 located in slots 34 formed in the ends of the decoding bars. The decoding bars are supported for lengthwise movement in fixed brackets 35 and each decoding bar is movable lengthwise by its associated electro-magnet to the same predetermined extent.

When an electrical impulse is received by an electro-magnet the decoding bar associated therewith is moved thereby to the right, as viewed in Figure 1B, until a notch 36 is engaged by a

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latch 37 pivoted at 38 to brackets 39 secured to machine frames 40. Springs 41 urge the latches downward into engagement with their notches 36.

The four decoding bars 29, 30, 31 and 32 are aligned one above the other and when in their normal or inactive positions, as shown in Figure 1B, are so disposed as to prevent the downward movement of each of the translator elements 42 of a column as shown in Figure 1B. Each of the translator elements 42 is representative of an un-coded number of ordinary significance from 1 to 11, as indicated in the drawings, and the decoding bars are provided with guides formed as slots 43, see Figures 3 and 4.

As can be seen from Figure 3 each of the decoding bars is provided with eleven slots 43, each slot being representative of a number of ordinary significance as represented by a corresponding one of the translator elements. The slots 43 are so arranged on the respective decoding bars 29, 30, 31 and 32 that when the decoding bars are in the normal or inactive position, as shown in Figure 1B, no four slots representative of like numbers are in alignment with each other and therefore it is not possible for any one of the translator elements to be moved downwards through the translator bars.

The slots 43 on the respective decoding bars are, however, so disposed with relation one to the other that when one of the bars, or a combination of the bars of a column, is moved to its latched position as above described, the decoding bars are so disposed with relation one to the other that the slots in each bar representative of a particular number are disposed to be in alignment with each other and it is then possible for the translator element 42 representative of that number to pass through the aligned slots and to impart an impulse to a device to be actuated thereby.

In the machine being described, the device to be actuated by the translator elements is a punch unit and the impulses transmitted by the translator elements are received by rigid connection wires 44 which in turn transmit the impulses received to selector pins 45. These pins 45 in turn transmit the impulses received to set bars 46 forming part of a set bar unit S. B. U. of known construction.

The translator elements 42 are supported by a movable frame 47 which is reciprocated towards and away from the punch unit by a cam, not shown, on the main shaft 48 of the machine. The translator elements 42 are urged downwards by springs 49 acting on pins 50 each pin being provided with a head to engage against a shoulder at the upper end of its associated translator element.

Each translator element is provided with a projection 51 and each column of translator elements has associated therewith a shutter plate 52 pivoted at 53 to side plates 54 fixed to the moving frame 47. A spring 55 urges the shutter in a counter-clockwise direction, as viewed in Figure 2, about its pivot and into engagement with a stop pin 56.

On downward movement of the frame 47 the shutters move with the frame and those translator elements which are prevented from movement by being obstructed by the decoding bars engage the upper overhanging portion 57 of the shutter thereby moving the shutter clockwise, as viewed in Figure 2, about its pivot so that the lower end 58 of the shutter is moved inwards towards the column of translator elements 42. By the time the lower end 58 of the shutter com-

pletes its inward movement it has passed beneath the projections 51 on the translator elements whose movement is obstructed by the decoding bars but it still maintains its relation with the selected translator element which is free to move between aligned guides in the decoding bars. Accordingly, on completion of the inward movement of the lower end 58 of the shutter, the portion 58 is moved into active engagement with the projection 51 on the selected translator element so that the selected translator element is moved downwards positively together with the frame 47 and passes through the aligned guides in the decoding bars. The extent of downward movement of the selected translator element is such that it is moved into engagement with the upper end of the rigid connection wire 44 associated therewith thereby imparting an impulse to the connection wire which, as stated above, is in turn transmitted to the appropriate set bar 46.

The decoding bar or bars which is or are in the active, latched, position is or are retained in latched position until after the frame 47 has been restored to its starting position together with the translator elements 42, whereupon a restoring plate 59 is operated to permit the active decoding bars to be returned to normal position. The restoring plate 59 is provided with slots 60, one for each of the latches 37, and is reciprocated by a lever 61 driven from a cam, not shown, mounted on the main shaft 43 of the machine. On downward movement of the restoring plate 59 the latches 37 are tripped out of the notches 36 in which they are located thus permitting the active decoding bars to be returned to their normal inactive position under the influence of springs 62 associated with the electro-magnets.

When the set bar unit has been conditioned, the card chamber 63, which now contains the record card from which the factors for the calculation were sensed, is raised upwards in known manner together with the punches 64 whereby those punches which are engaged by conditioned set bars 46 in the set bar unit are pushed through the record card in the card chamber thereby punching the answer transmitted from the calculating apparatus in the result field of the record card. The card chamber 63 is then lowered and the card is fed out of the chamber by rollers 65 and delivered into a receiver 66.

Should it be desired to employ the decoding device for decoding answers in sterling an additional decoding bar 67, Figure 2, is provided in a selected column and has one end connected by an arm 68 to an additional electro-magnet 69, Fig. 1B. The electro-magnet 69 receives electrical impulses from the calculating apparatus representative of tens of shillings and a selected one of the translator elements is provided with a projection 70 to co-operate with a guide slot in the additional decoding bar 67. Thus if the arrangement shown in Figure 2 is to be employed for decoding sterling amounts it may be assumed that the two translator elements at the extreme right of the figure represent decimal fractions of a penny, the third translator element from the right represents pence, the fourth element represents shillings, and the remaining two translator elements represent respectively the units of pounds and tens of pounds. It will, of course, be appreciated that further columns of translator elements and decoding bars may be provided if it is desired to extend the scope of the apparatus.

To explain the operation of the decoding device and its application to a punch unit it will be assumed that the punch unit contains six denominational columns. Accordingly six sets of decoding mechanism are employed, as indicated in Figure 2. Further, as the code employed is the four-figure 8-4-2-1 code, the numbers 1 to 11 of ordinary significance are represented in code as follows:

The code equivalent of 1 is 1
 The code equivalent of 2 is 2
 The code equivalent of 3 is 1-2
 The code equivalent of 4 is 4
 The code equivalent of 5 is 1-4
 The code equivalent of 6 is 2-4
 The code equivalent of 7 is 1-2-4
 The code equivalent of 8 is 8
 The code equivalent of 9 is 1-8
 The code equivalent of 10 is 2-8
 The code equivalent of 11 is 1-2-8

Let it now be assumed that the calculating apparatus has transmitted to the decoding unit an answer which, when decoded, will represent the number 450072. Accordingly in the units column, which in Figure 2 may be considered as the column at the extreme right of the figure, only the electro-magnet 25 will be energised so that only the decoding bar 31 will be moved to its active, latched position. In this position the guide 43 representative of the number "2" will be moved into alignment with the grooves representative of the number "2" in the bars 29, 30 and 32 so that when the frame 47 is moved downwards, the units translator element representative of the number "2" will be free to pass through the aligned guides while each of the other units column translator elements will be arrested by the decoding bars for that column.

In the tens column which is the second column from the right in Figure 2 a "7" is to be registered and accordingly the electro-magnets 25, 26 and 27 for that column are energised so that the three decoding bars 30, 31 and 32 are moved to latched position to bring the guides 43 thereon representative of the number "7" into alignment with the guide 43 representative of the number "7" in the decoding bar 35 which is not moved.

In the hundreds column and in the thousands column of the answer there are zeros and accordingly in the decoding device no electro-magnets are energised in the corresponding columns so that none of the decoding bars for these two columns are moved to active, latched position and on downward movement of the frame 47 none of the translator elements associated with these two columns is permitted to move downwards to transmit an impulse to the punch unit.

In the tens of thousands column a "5" is to be translated from its coded representation and accordingly the two electro-magnets 25 and 27 are energised, moving the two decoding bars 30 and 32 to the active, latched position so that the guide slots representative of the number "5" on these two bars are moved into alignment with the corresponding guide slots in the decoding bars 29 and 31 which are not moved.

In the hundreds of thousands column a coded "4" is to be decoded and accordingly only the electro-magnet 25 is energised. This causes the decoding bar 30 to be moved to active, latched position at which the guide slot representative of the number "4" on the bar 30 is moved into alignment with the corresponding guide slots on the

bars 29, 31 and 32 which bars have not been moved.

From the foregoing it will be understood that when the frame 47 is moved downwards only four translator elements are free to move downwards, these four translator elements representing respectively a "2" in the units column, a "7" in the tens column, a "5" in the tens of thousands column, and a "4" in the hundreds of thousands column. Thus in the result field of the card there will be punched holes representative of these numbers, it being understood that as zeros appear in the hundreds and thousands columns no holes will be punched in these columns as is the usual practice.

It is to be understood that although in the foregoing the invention has been described as applied to a decoding device adapted to decode numbers transmitted thereto in terms of the 8-4-2-1 code, if desired the device may be so constructed as to operate according to other codes.

It will also be understood that the impulses transmitted by the translator elements need not necessarily be employed to operate a punch unit as described herein as they may, for example, be employed to condition type elements to facilitate the printing of an answer instead of the punching thereof as has been described herein. Alternatively, as will be well understood in the art, a decoding device according to the present invention may be applied to a sorting machine in which records to be sorted according to numbers of ordinary significance are provided with coded indicia. In this instance the sensing device of the machine will transmit the sensed coded data direct to the decoding device described herein and the translators 42 will impart impulses to the timing devices controlling the shutters associated with the record receiving pockets of the machine so that the records are delivered to the pockets in accordance with the ordinary significance of the decoded data.

I claim:

1. For a statistical machine, a decoding device wherein a selected one of a column of translator elements each representative of an uncoded number of ordinary significance is movable lengthwise to impart an impulse to a device to be actuated thereby, the selection of an element of the column being effected by a plurality of decoding bars normally obstructing the movement of the translator elements, each bar being provided with guides one to correspond with each of the translator elements of the column, the guides on the different decoding bars being so spaced relatively one to another that when the bars are in their normal positions no set of guides representative of like uncoded numbers are in alignment to permit the passage through the bars of the translator element representative of that number but on movement of a selected one of the bars or of a selected combination thereof from the normal position to a predetermined active position the guides representative of like uncoded numbers on each of the bars are brought into alignment to permit the passage therethrough of the translator element representative of that number, and a reciprocable frame yieldably supporting said elements for positively advancing a released element relative to the decoding bars.

2. A decoding device according to claim 1, wherein the translator elements are supported by a reciprocable frame for movement relative to the decoding bars, the translator elements being mounted on the frame for movement relative thereto to permit continued movement of the frame relative to the decoding bars when translator elements are obstructed by the decoding bars and thereby prevented from passing there-through.

3. A decoding device according to claim 2, wherein each translator element is provided with a projection engageable by a shutter pivoted to the frame and rotatable about its pivot on downward movement of the frame by engagement of obstructed translator elements with one end of the shutter whereby the other end of the shutter is moved into active engagement with the projection on a selected translator element thereby positively to move the selected translator element through associated aligned guides in the decoding bars.

4. A decoding device according to claim 1 adapted for decoding sterling amounts, wherein a column of translator elements has associated therewith an additional decoding bar representative of tens of shillings, the additional bar being actuated by an impulse specific thereto and a predetermined one of the translator elements being arranged for co-operation with the first mentioned decoding bars and said additional decoding bar.

5. A decoding device having a column of reciprocable translating elements, and a plurality of associated decoding bars settable in a predetermined manner to release one element of the column for each setting of the bars, which comprises a reciprocable frame yieldably supporting said elements to reciprocate the released element, and means on the frame and operated by the unreleased elements to positively engage said last mentioned means with the released element whereby the released element is positively advanced and held in advanced position for a desired operation.

6. A decoding device having a column of reciprocable translating elements, and a plurality of associated decoding bars settable in a predetermined manner to release one element of the column for each setting of the bars, which comprises a reciprocable frame yieldably supporting said elements to reciprocate the released element, a pivoted means on the frame, a projection on the elements, one end of the pivoted means adapted to be engaged and cammed by the unreleased elements upon movement of the frame so as to engage the other end thereof with the projection of the released element whereby the released element is positively advanced and held in advanced position for a desired operation.

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