April 24, 1951 H. P. MIXER 2,550,079

WIRING UNIT

Filed Sept. 15, 1948 3 Sheets-Sheet 1

FIG. 1

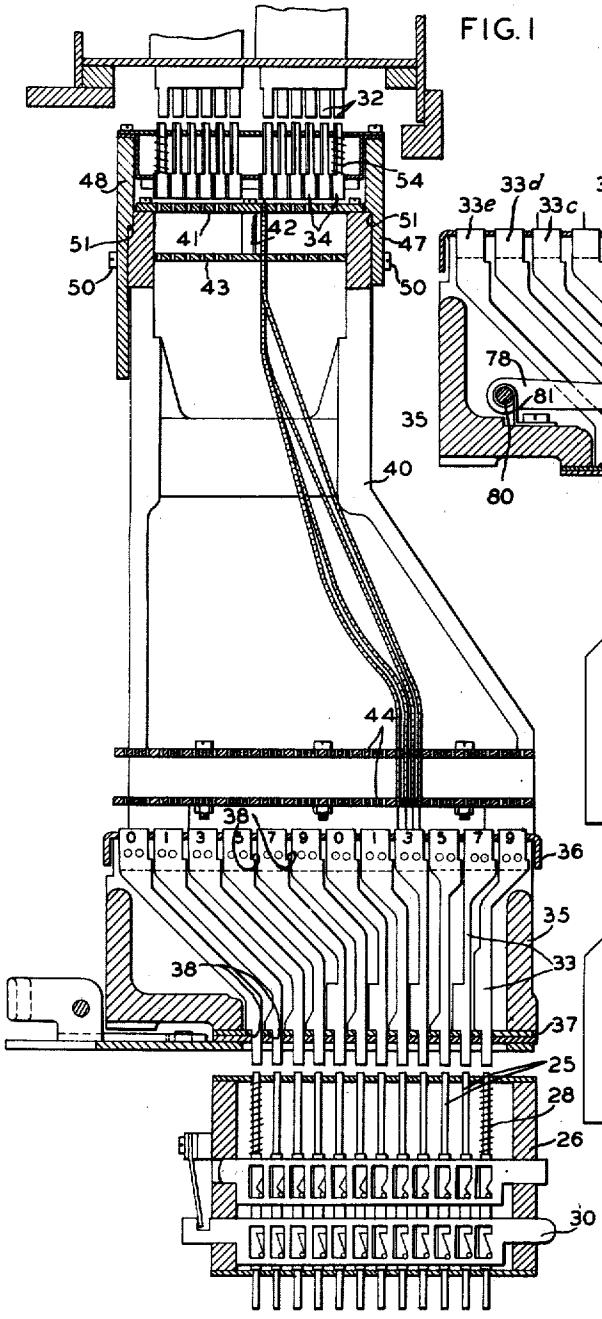
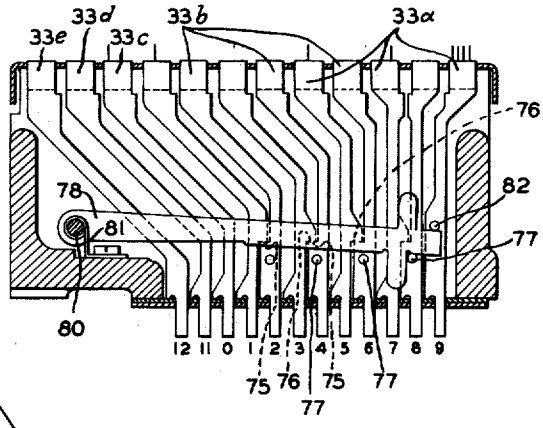


FIG. 6



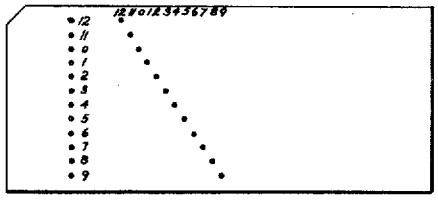


FIG. 8

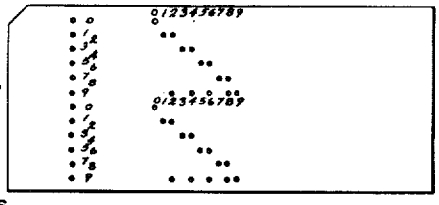


FIG. 7

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April 24, 1951 H. P. MIXER 2,550,079

WIRING UNIT

Filed Sept. 15, 1948 3 Sheets-Sheet 2

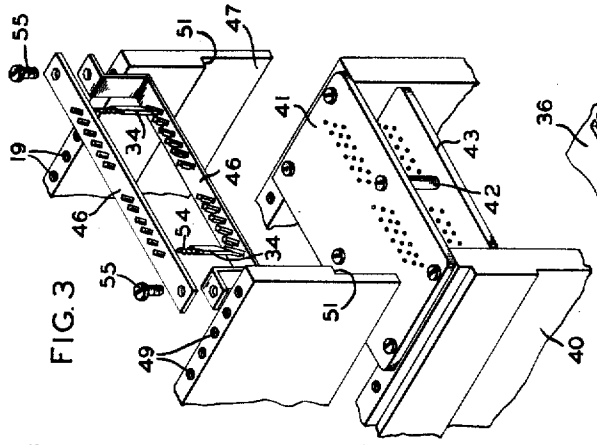


FIG. 3

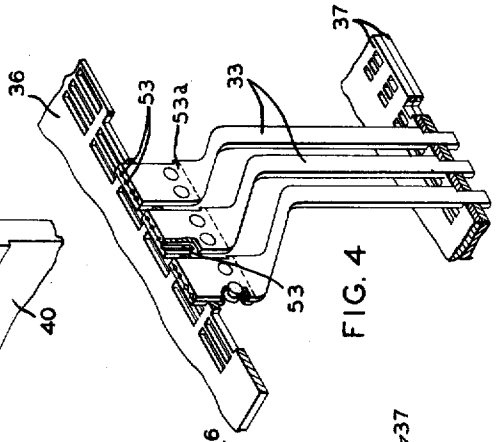


FIG. 4

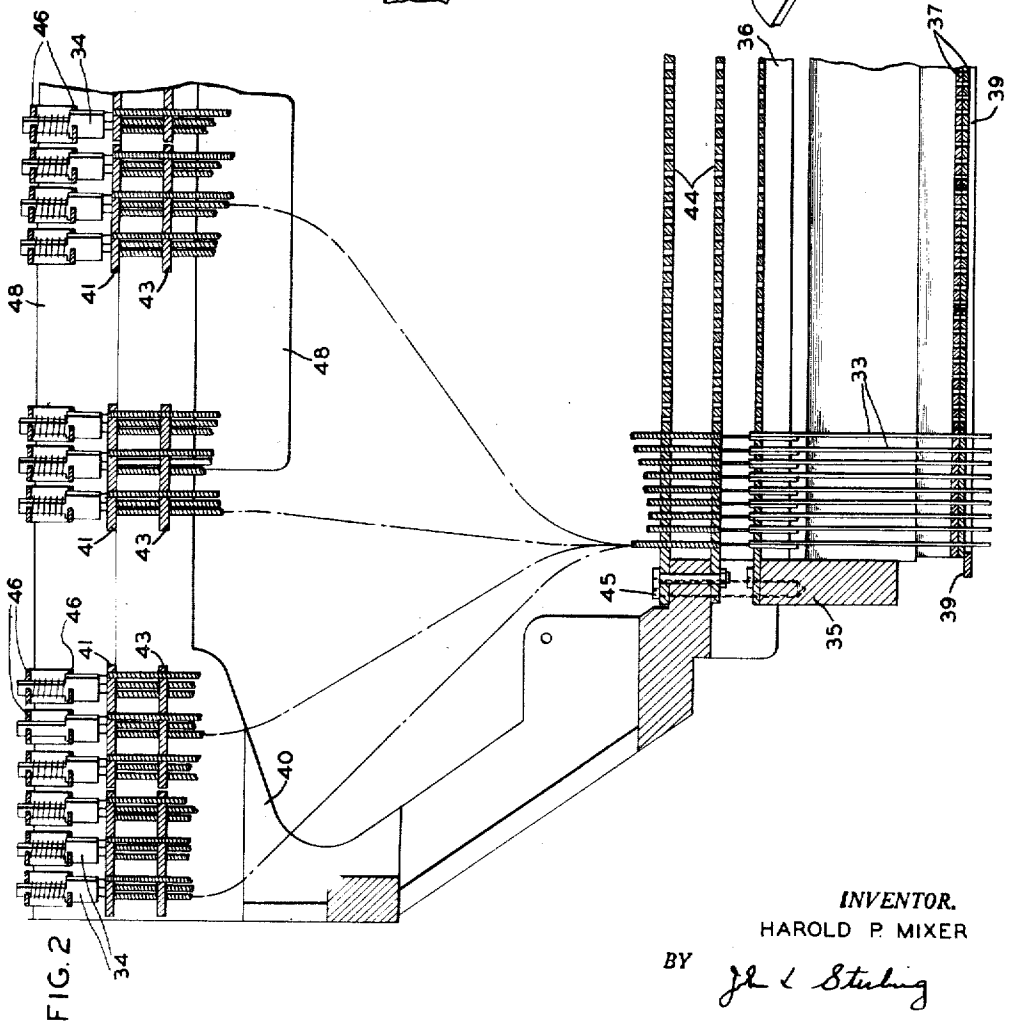


FIG. 2

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April 24, 1951 H. P. MIXER 2,550,079

WIRING UNIT

Filed Sept. 15, 1948 3 Sheets-Sheet 3

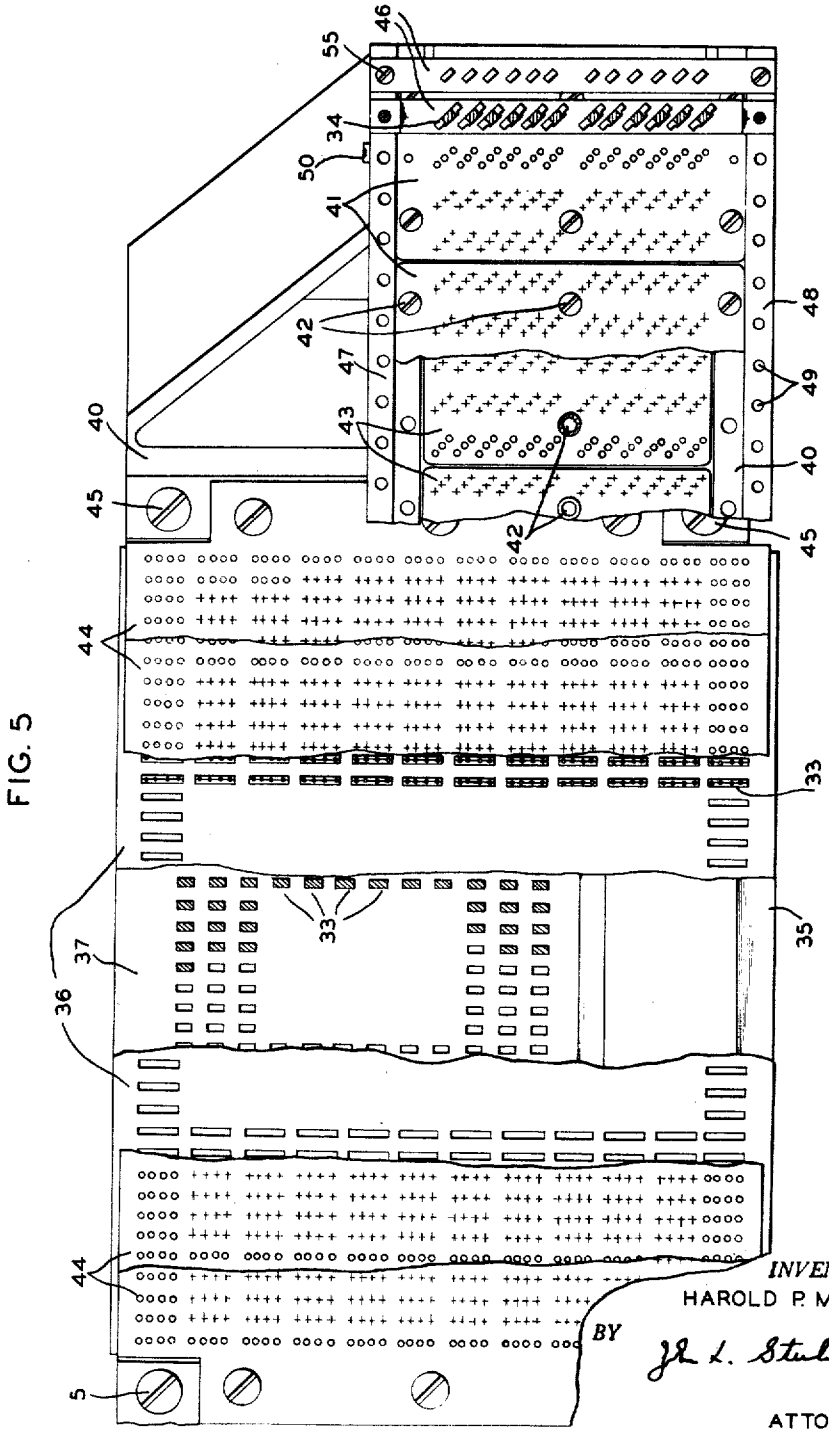


FIG. 5

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Patented Apr. 24, 1951 2,550,079

UNITED STATES PATENT OFFICE

2,550,079

WIRING UNIT

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Application September 15, 1948, Serial No. 49,350

6 Claims. (Cl. 235—61.6)

1

This invention relates to record controlled machines, and more particularly to an improved interchangeable wiring unit or translator for said machines.

In some of these machines such, for example, as the tabulator disclosed in Patent 2,381,361 to John Mueller, wiring units are used to transmit information via Bowden wires from a card sensing mechanism to a permutation unit adapted to decode said information for adding and/or printing purposes, and in other machines they are used to transmit information from some other source, such as a gag bar mechanism, to some other recipient mechanism, for example, one for punching the information in a card, one such machine being the summary punch disclosed in Patent 2,354,549 to Arthur Rindfleisch.

These machines are adapted to handle the well known Powers ninety column data cards which are divided into upper and lower zones, each zone containing forty-five columns of six index or perforation positions. Thus, a card contains five hundred and forty index or perforation positions which, if the full card is used, requires that a wiring unit contain at least an equal number of Bowden wires.

These machines are adapted to a variety of applications, each requiring a different mode of operation and, as a rule, each application requires that information from the source be transmitted to the recipient mechanism in a way peculiar to that application. This necessitates the provision of several wiring units, one of each of the several types of applications, and the operator, when setting up the machine, will insert into the machine the wiring unit peculiar to the application at hand.

In some applications it is desired that information from each of certain selected positions of the source be transmitted to a plurality of positions of the recipient mechanism, and in other applications it is desired to transmit information from a plurality of fields of the source to a single field of the recipient mechanism.

Heretofore, wiring units for such applications were provided with Y-wires or inverted Y-wires connecting one position at one terminus thereof with a plurality of positions at the other terminus. These Y-wires include a fixture which is quite bulky, and when a number of them are used they take up a considerable amount of the limited space in a wiring unit, making it difficult if not impossible to insert the required number of Bowdens in the unit.

2

It is one object of the invention to provide in an interchangeable wiring unit an improved substitute for Y-wires, whereby data entered into said unit at any position of its source terminus can be transmitted to a plurality of positions at the other terminus thereof.

Another object of the invention is to provide, in an interchangeable wiring unit, an improved substitute for inverted Y-wires, whereby data entered into said unit at a plurality of positions of the source terminus thereof may be transmitted to a single position at the other terminus.

Still another object of the invention is to so construct said substitutes as to minimize congestion of the space in a wiring unit and thus simplify the insertion of its wires.

In some punched card installations, the cards and machines used are not of the ninety column type, but are of the equally well known but older forty-five column type. These forty-five column machines are inferior in many ways to their newer ninety column counterparts, but their users have been prevented from exchanging them for the ninety column machines due to the fact that all their records are contained in the forty-five column cards, which said ninety column machines are incapable of handling. Furthermore, it would be impracticable to reproduce said records in ninety column cards. It has, therefore, long been desired to so equip the ninety column machines as to enable them to handle both forty-five and ninety column cards.

Another object of the invention is to provide means in a wiring unit whereby data entered therein in forty-five column code is translated into ninety column code and transmitted to the recipient mechanism as such.

Another object of the invention is to provide a wiring unit composed of pre-assembled sections adapted to be assembled together quickly and simply.

Other objects and structural details of the invention will be apparent from the following description when read in connection with the accompanying drawing, wherein

Fig. 1 is a vertical section of the wiring unit and fragments of its cooperating parts on a fore and aft plane;

Fig. 2 is a fragmentary vertical section of the wiring unit on a right to left plane;

Fig. 3 is an isometric partially exploded view of a part of the upper section of the wiring unit;

Fig. 4 is an isometric view of a part of the lower section of the wiring unit;

Fig. 5 is a plan view, with certain parts progressively cut away to show the construction beneath them;

Fig. 6 discloses an alternate mechanism for the lower part of the wiring unit shown in Fig. 1;

Fig. 7 shows a punched card and diagrammatically illustrates the ninety column numeric code; and

Fig. 8 shows a punched card and diagrammatically illustrates the forty-five column numeric code.

For clarity and brevity of description the invention will be disclosed as applied to a wiring unit to be used in a tabulator of the type disclosed in the above cited patent to Mueller, it being understood, of course, that the invention is not restricted to a wiring unit for that machine.

In that machine cards are gang sensed by a sensing mechanism which includes a full complement of set pins **25** (Fig. 1), there being one set pin for each index or perforation position of a card. These set pins are carried in a rectangular box-like casting **26** capped by a sheet metal plate **27** through which said set pins extend upwardly, and each pin is tensioned downwardly by a spring **28**. The sensing mechanism is of such sort that when a perforation is found in a card the corresponding set pin **25** is elevated, said pin being held in its elevated position by a locking slide **30**.

Such set pins as are elevated are adapted to actuate their associate Bowden wires in the wiring unit **31**, which is situated immediately above said set pins. The Bowdens in turn elevate certain permutation bars **32** adapted to decode the information transmitted thereto by said Bowdens for printing and/or adding purposes.

In some prior wiring units, the Bowdens contacted neither the set pins **25** nor the permutation bars **32**, certain push rods or plungers being provided at either end of the unit to coact with said wires. In the present instance, that terminus of the wiring unit proximate the set pins **25** is provided with a set of novel push rods **33** (Fig. 1) adapted to cooperate with said set pins, and the terminus of the wiring unit proximate the permutation bars is provided with a set of novel plungers **34**.

Framing

The wiring unit of the invention is composed of three pre-assembled sections fastened together, viz., one for the push rods, one for the Bowden wires, and one for the plungers.

The push rods **33** are supported in a box-like frame comprising a rectangular casting **35** (Figs. 1 and 2) having perforated sheet metal plates **36** and **37**, through which said push rods extend, fastened to its upper and lower edges, respectively. In order to provide the necessary rigidity, the plate **37** preferably comprises two sheet metal plates fastened together, and is shown as such in the drawing. It will be noted (Fig. 1) that the push rods **33** are provided with upper and lower shoulders **38** to limit on the edges of the perforations in the plates **36** and **37**, thus preventing said push rods from being dislocated during handling of the section.

The Bowden wires are supported in a frame comprising an irregularly shaped box-like casting **40** (Figs. 1 and 2) capped by a plurality of perforated plates **41**, each having another perforated plate **43** spaced beneath it and fastened to it by a suitable bolt **42** (see also Figs. 3 and 5). Near its lower end the casting **40** has two perforated

plates **44** secured therein. The Bowdens pass through the perforations in the plates **43** and the upper plate **44**, and have their casings threaded into the plates **41** and the lower plate **44**. It may be mentioned that whereas plates **44** extend the full width of the frame **40** the plates **41** and **43** are formed to carry a specified number of wires, say one hundred and twenty, and are inserted only where needed.

As shown in Figs. 2 and 5, the wiring section is adapted to be laid atop the push rod section where the frames of both are secured together by bolts **45**.

The plungers **34** are supported in a frame comprising front and rear frame bars **47** and **48** (Figs. 1, 3, and 5) which by means of shoulders **51** therein are located atop the wiring section where they are secured by suitable bolts **50**. The plungers **34** are arranged in front to rear rows of twelve each, and each row is carried between two sheet metal strips **46** fastened at either end to the tops of the frame bars **47** and **48**. It will be noted that the bars **47** and **48** are provided each with a row of tapped holes **49** to receive bolts to fasten a row of plungers in any desired position across the unit.

It is evident from the foregoing brief description of the framing that the three sections of the wiring unit are so constructed as to facilitate their individual insertion or removal from a wiring unit, it being possible to remove or insert a push rod section merely by the appropriate manipulation of four bolts, and to remove or insert a row of plungers by removing or inserting the two bolts at the ends of the row.

Machines utilizing these interchangeable wiring units are provided with guide rails to locate and fasten the wiring units in place, said guide rails cooperating with flanges or ears on the wiring unit. To this end, the wiring unit of the invention is provided with a heavy plate **39** (Figs. 1 and 2), immediately below the plates **37**, said plate **39** being provided with a cut out portion encompassing the perforated portion of the plate **37**, and extending beyond the ends thereof in left and right hand directions (Fig. 2) so as to cooperate with the said guide rails, which are not here shown.

Push rods

The push rods **33**, which transmit the settings of the set pins **25** to the Bowden wires, may be made in a variety of ways so as to accomplish a variety of results, and two types are shown in the drawing.

The type shown in Fig. 1 and designated **33** is adapted to be used in a wiring unit whose function it is to transmit the settings of certain of the set pins **25** each to a plurality of the permutations bars **32**. This requires that those set pins **25** be connected by Bowden wires each to a plurality of permutation bars **32**. Heretofore, this was accomplished by multiple Y-wires, which, as mentioned hereinbefore, were unsatisfactory.

In the present instance these multiple Y-wires are eliminated, the several permutation bars each being individually connected by a wire to the push rod **33** associated with the appropriate set pin **25**.

To this end the push rods **33** are fanned out from the close spacing at their narrow lower ends (Fig. 1), in order to permit of substantially wider upper ends. The push rods also are thicker at their upper ends and are pro-

vided with holes or wells **53** (Fig. 4) to accommodate the several Bowden wires mentioned above. The holes or wells **53** are preferably formed as shown in Fig. 4 by grooving the upper portion of the rods **33** and fastening a sheet metal plate **53***a* thereto by riveting or welding.

The construction is such that the desired number of Bowdens are passed through the perforations in the upper plate **44**, their casings threaded into the perforations in the lower plate **44** and their inner wires fitted into the appropriate wells **53**. Likewise, at their other ends the Bowdens are passed through the plate **43** and their casings threaded into the perforations in the plates **41**, aligning their inner wires with the appropriate plungers **34**.

In the present instance provision is made for each push rod **33** to accommodate four Bowden wires (Figs. 1 and 4), that is to say, four wells **53** are provided in each push rod, and in those few applications which require that certain push rods be wired to a greater number of positions one or more of the wires leading from each of said push rods are Y-wired to the extra positions. In such instances, these few Y-wires are not objected to inasmuch as a relatively small number of them increases the capacity of the wiring unit to an extent heretofore thought impossible. However, the push rods **33** could be provided with any number of wells **53** to accommodate greater numbers of wires, limited only by the extent to which it is possible to widen the upper ends of the push rods. To make possible the close spacing of the wells **53**, the Bowden wires are provided with a smaller casing than heretofore used, i. e., the casing is wound of thinner wire providing much smaller outside and inside casing diameters. This construction also provides a more efficient Bowden as the diameter of the inner wire can be made to approach the inner diameter of the casing without said wire becoming inflexible, thus eliminating the buckling or play of the wire in the casing. This is particularly of use in those instances where the inner wire is used to impart a measured amount of motion, and the Bowden is not arranged in a straight line but has several curves in it. In a case such as this, if the inner wire is pulled, it tends to hug the inner wall of the casing on the curves due to its having the smaller radius, and if the wire is pushed it tends to buckle out against the outer wall of the casing on the curves. In both instances, the effective length of the wire is changed. It is evident, therefore, that a casing having an inside diameter almost as small as that of the inner wire will greatly reduce this change in effective length of the inner wire.

Plungers

The plungers **34** are of novel construction and provide an extremely flexible method of transmitting the movements of the Bowden wires to the permutation bars **32**, particularly in those instances where it is desired to transmit the settings of a plurality of the set pins through Bowden wires to a single permutation bar. Heretofore, this was accomplished by inverted Y-wires with the same unsatisfactory results as mentioned above.

In the present instance the plungers **34** are adapted to be acted upon each by a plurality of Bowden wires, thus eliminating the inverted Y-wires, or minimizing them in those instances where it is desired to lead such a number of wires to a plunger that the capacity of the plunger is exceeded.

In the instant wiring unit the plungers **34** (Fig. 1, 3, and 5) are arranged, as usual, in front to rear rows of twelve, but each plunger has a wide lower end adapted to be contacted by several Bowden wires, and which is disposed diagonally with respect to the front and rear plates **47** and **48** so as to provide the tops of said plungers with the same spacing as the permutation bars **32**, and at the same time to minimize the amount of front to rear space required for said wide lower portions. Likewise, the perforations in the plates **41** and **43**, immediately below the plungers **34**, are arranged in diagonal rows so as to place the inner wires of the Bowden passing through said perforations into register with the under edges of the plungers. In the illustrated instance (Figs. 3 and 5) the construction is such that three Bowden wires can be brought into register with each plunger, but it will be understood that in other wiring units having different spacing requirements, a greater or lesser number of perforations could be provided in each diagonal row.

Each plunger **34** is normally tensioned downward by a spring **54** (Figs. 1 and 3), but if any of the Bowden wires in register with it are actuated, it will be elevated and, in turn, will elevate its associate permutation bar. It may be mentioned that the springs **54** acting through the Bowden wires also hold the push rods in their normal inactive position.

Recoding

In a number of punched card installations, some of the machines utilized are adapted to handle cards perforated not in accordance with the aforementioned ninety column code, but in accordance with the equally well known Powers forty-five column code. In many instances these machines are not capable of performing some of the operations possible with the more advanced ninety column machines and, therefore, it has long been desired to adapt the ninety column machines to handle forty-five column cards, and yet not change such machines in any way that would affect their adaptability to the ninety column code.

An example of the above is the tabulator disclosed in the cited patent to Mueller, in which it is possible to accumulate and print algebraic totals and grand totals from the same type racks under control of ninety column cards. This mode of operation is extremely useful in many accounting problems, and it has long been desired to modify said tabulator so as to permit of its being controlled in like manner by forty-five column cards.

The forty-five column card is arranged in forty-five vertical rows, each containing twelve index or perforation positions (Fig. 8), the same as the ninety column card. However, the rows are not sub-divided into upper and lower columns as in the latter, but each full row is one column. Thus, there are twelve index or perforation positions in each column representing, from top to bottom, the numbers 12, 11, 0, 1–9, inclusive. These same positions are, in a special field of the card, used to represent alphabetical data, but this will not be gone into for in the great majority of instances these cards contain only numeric data, and the means about to be described, whereby this data is translated into ninety column code, is used with such numeric data.

The sensing mechanism of a ninety column machine, such as the tabulator disclosed in the cited patent to Mueller, is identical with the sensing mechanism of a forty-five column machine, with but one exception. In the ninety column machine two locking slides **30** (Fig. 1) are provided for each front to rear row of twelve set pins, one for the upper column and one for the lower column, but in a forty-five column machine, only one such locking slide is provided for each row or column of twelve set pins. The reason for supplying one slide **30** for each "column" of six set pins in a ninety column machine is to provide for individual control of each said column for retracting purposes. However, this does not affect the present invention and need not be gone into.

It is evident, therefore, that the sensing mechanism of a ninety column machine is equally well adapted to sense both ninety and forty-five column cards, and that no change is required in this mechanism to accomplish the job at hand.

It will be remembered that in the ninety column code, "zero" and the odd digits "one" to "nine," inclusive, are represented by a single position in a column (Fig. 7), while the even digits are represented by the position of the next lower odd digit plus the "nine" position. It is evident, therefore, that in order to translate forty-five column numeric code into ninety column numeric code means must be provided whereby, in the present instance, each set pin representing an odd digit in forty-five column code is adapted to affect the permutation bar appropriate to that digit, and each set pin representing an even digit in forty-five column code is adapted to affect the permutation bar appropriate to the next lower odd digit and also the "nine" permutation bar.

This could be done by connecting each of the push rods **33** (Fig. 1) by Bowden wires to the appropriate plungers **34** (Fig. 1), and thereby to the permutation bars **32**. However, this would involve a very large number of wires and at least one inverted Y-wire in each column, and would, therefore, be unsatisfactory.

The invention provides means whereby this may be accomplished simply and efficiently, with a minimum number of wires and no Y-wires, and to make said means removable from the machine at will, it is incorporated in the push rod section of the wiring unit (Fig. 6). In so far as the framing and the upper and lower ends of the push rods which are designated are concerned, this section is identical with the one shown in Fig. 1. However, in order that those push rods **33***b* representing an even digit can, when elevated, in turn elevate the push rod **33***a* representing the next lower odd digit, each such even push rod is provided with a shoulder **75** underlying a shoulder **76** of the next lower odd push rod, and in order that the even push rods **33***b* in a column can, when elevated, in turn elevate the "nine" push rod of that column, each is provided with a stud **77** lying beneath a lever **78** pivoted on a rod **80** which is supported by suitable brackets **81** screwed to a ledge of the casting **35**. The "nine" push rod **33***a* is provided with a stud **82** lying above the free end of the lever **78**. There is, of course, a lever **78** for each row of push rods.

The construction is such that if a push rod **33***b* representing an even digit be elevated, its shoulder **75** will elevate the next lower "odd" push rod **33***a* and its stud **77** will raise the lever **78**, which in turn will raise the "nine" push rod through the stud **82**. However, if a push rod **33***a* representing an odd digit is elevated, it functions the same as a push rod **33**, and none of the other push rods are affected by it.

It will be noted that only the odd push rods **33***a* are provided at their tops with wires leading to the plungers **34**, the even push rods being adapted to elevate the next lower odd push rod and also the "nine" push rod, but not to actuate any wires directly. Thus, matter entered into the push rods at their bottoms in the forty-five column code emerges into the wires in ninety column code.

Referring to Fig. 6, it will be seen that the "zero" push rod **33***c* is also provided at its top with a wire which would be led to the appropriate plunger **34**.

In the columns of a forty-five column card devoted to numeric data, the "twelve" and "eleven" positions generally are not used. However, these positions are sometimes used, and it is for this reason that the "twelve" and "eleven" push rods **33***d* and **33***e* are provided (Fig. 6). Thus, if one of these positions is to be used, it is only necessary to provide it with a wire leading to the appropriate plunger **34**, or to some mechanism to be controlled by the presence or absence of a perforation in that perforation.

Referring to Fig. 6, it will be noted that the push rods **33***b* are each adapted to actuate a plurality of Bowdens, said push rods being provided with wells identical with the wells **53** in push rods **33***a*.

Whereas the wiring unit illustrated and described is for a tabulator such as that disclosed in the patent to Mueller, it is to be understood that the specific details of construction can be varied quite widely to meet conditions imposed by different machines without departing from the invention. For example a wiring unit to be used in the summary punch disclosed in the patent to Rindfleisch would be modified, so that the plungers **34** would be at the lower end thereof and would operate the punches, and the push rods would be at the upper end thereof and would have their ends shaped to cooperate with the gag bars.

While I have described what I consider to be a highly desirable embodiment of my invention, it is obvious that many changes in form could be made without departing from the spirit of my invention, and I, therefore, do not limit myself to the exact form herein shown and described, nor to anything less than the whole of my invention as hereinbefore set forth, and as hereinafter claimed.

What I claim as new, and desire to secure by Letters Patent, is:

1. In an interchangeable wiring unit for transmitting information from one set-up mechanism of a card controlled machine to another set-up mechanism of said machine, the combination of a push-rod actuated by the first said set-up mechanism and having a plurality of wells therein, one or more Bowden wires terminating in said wells and actuated by said push rod, and one or more plungers each actuated directly by one or more of said Bowden wires, said plungers in turn each actuating an element of the other set-up mechanism.

2. In an interchangeable wiring unit for transmitting information from one set-up mechanism of a card controlled machine to another set-up mechanism of said machine, the combination of a plurality of push rods actuated selectively by the first said set-up mechanism, a plurality of Bowden wires each connected with and actuated

by one of said push rods, and a plunger contacted and actuated by said Bowden wires, said plunger in turn actuating an element of the other set-up mechanism.

3. In a card controlled machine, an interchangeable wiring unit to receive information from one set-up mechanism in one code, to translate such information into another code and transmit it to another set-up mechanism in said other code, comprising in combination, a plurality of push rods actuated by the first said mechanism in accordance with the first said code, one or more Bowden wires actuated by each of a first group of said push rods, a lever actuated by the others of said push rods and when so actuated in turn actuating a predetermined one of the push rods of said first group, an interconnection between each push rod of the first group and the adjacent other push rod whereby the former is actuated by the latter, and a plurality of plungers each actuated by one or more of said Bowden wires, said plungers in turn actuating said other set-up mechanism in accordance with said other code.

4. In a card controlled machine, an interchangeable wiring unit to receive information from one set-up mechanism in one code, to translate such information into another code and transmit it to another set-up mechanism in said other code, comprising in combination, a plurality of push rods actuated by the first said mechanism and representing the numerals one to nine in accordance with the first said code, one or more Bowden wires actuated by each of the push rods representing an odd numeral, a lever actuated by the push rods representing the even numerals and when so actuated in turn actuating the "nine" push rod, a shoulder on each of the even numeral push rods, a shoulder on each of the odd numeral push rods overlying the shoulder on the adjacent lower odd numeral push rod, each said even number push rod also actuating the push rod representing the next lower odd digit, and a plurality of plungers each actuated by one or more of said Bowden wires, said plungers in turn actuating said other set-up mechanism in accordance with said other code.

5. An interchangeable wiring unit of the class described comprising in combination, a push rod section, a Bowden wire section, and a plunger section incorporating a series of rows of plungers, each said row being contained in a frame whereby it may be inserted in and removed from the section independently of the other rows, and each said plunger having a wide end to coact with a plurality of Bowden wires and also a narrow end, each plunger of a row being arranged diagonally with respect to the remainder of the unit to permit the narrow ends of the plungers in a row to be closely spaced.

6. In an interchangeable wiring unit, the combination of a Bowden wire carrying section, with a push rod section comprising a plurality of push rods each adapted to actuate a plurality of Bowden wires, and a plunger section comprising a plurality of plungers each adapted to be actuated by a plurality of said Bowden wires, said push rod and plunger sections being readily detachable from said Bowden wire section.

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