

April 5, 1938.

J. W. BRYCE

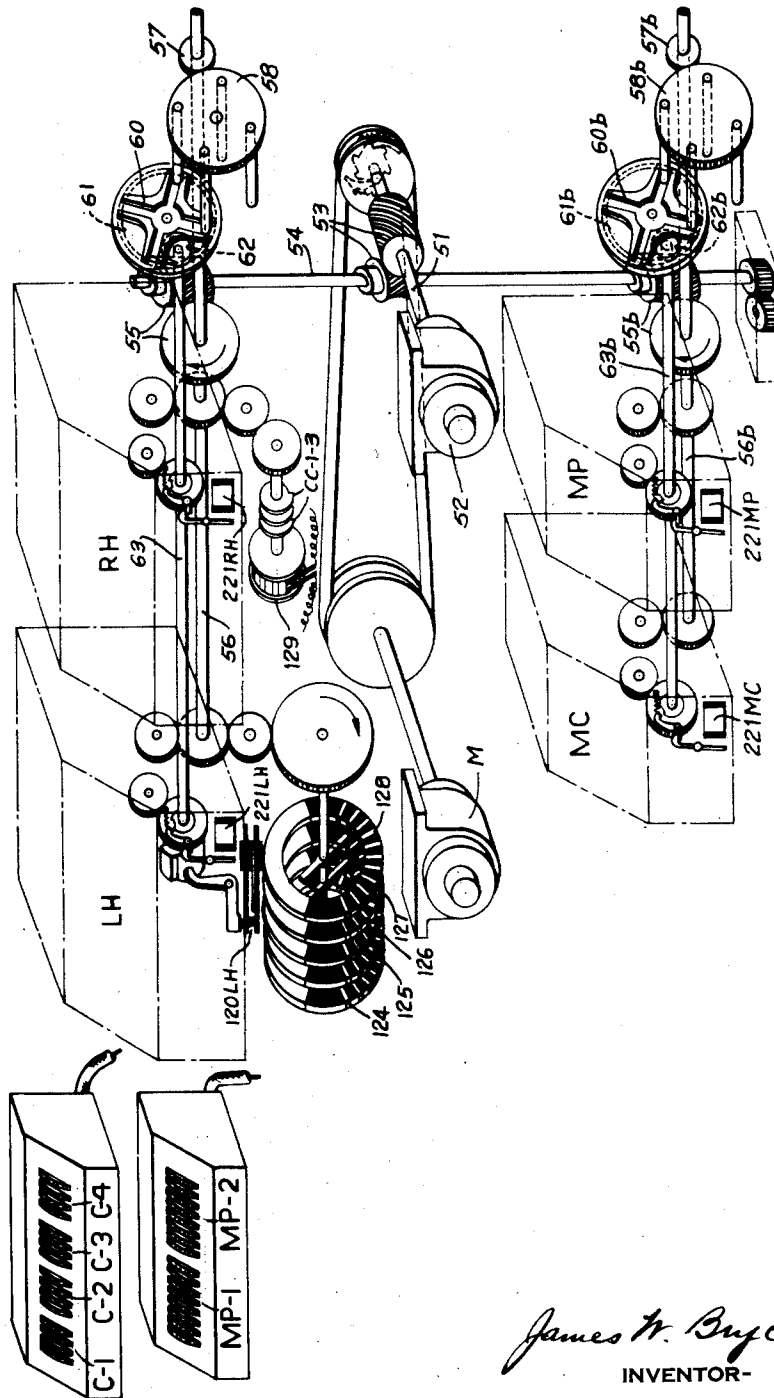
2,113,229

MULTIPLYING DEVICE

Filed March 25, 1933

12 Sheets-Sheet 1

FIG.1.



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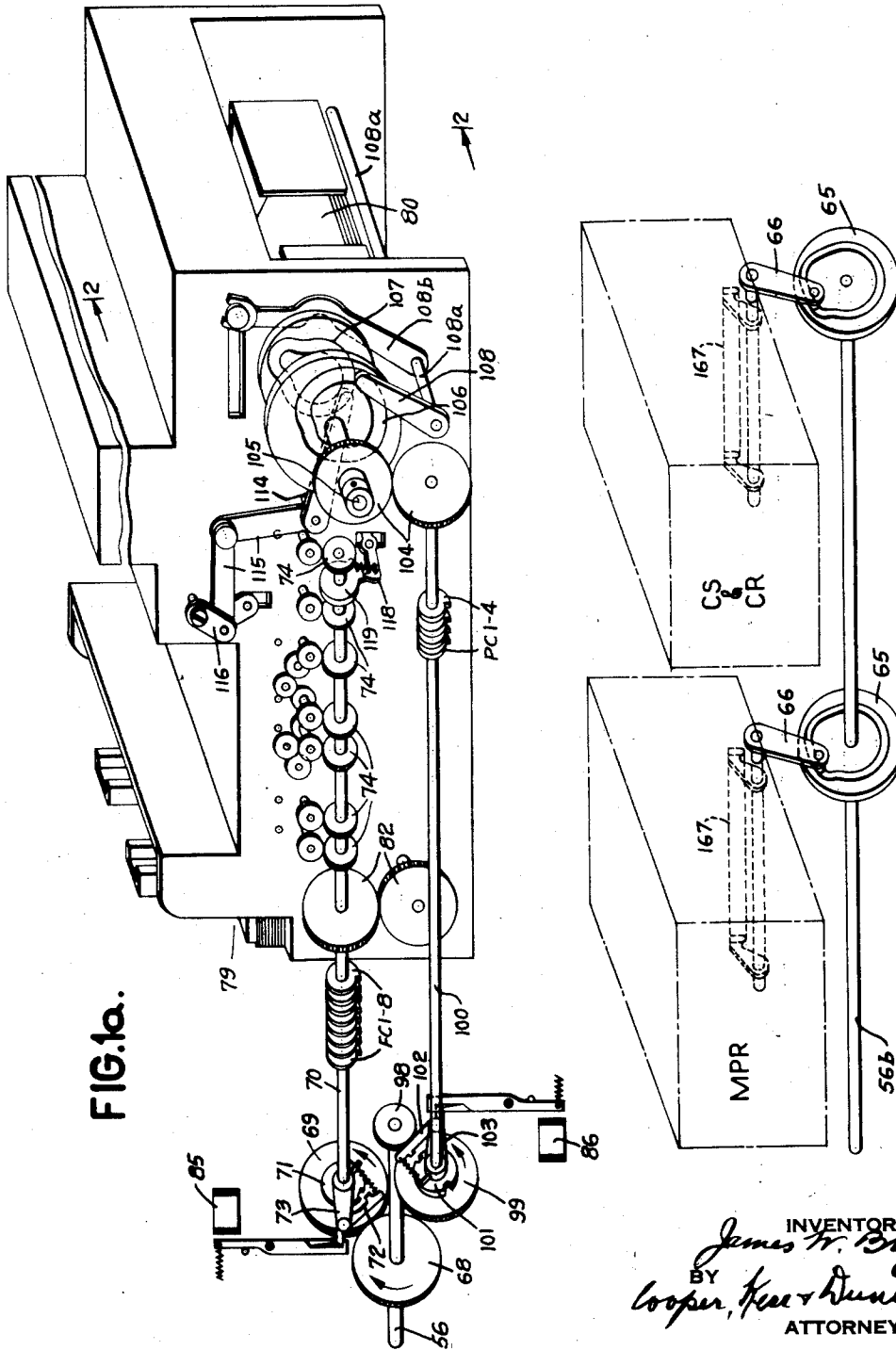
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MULTIPLYING DEVICE

Filed March 25, 1933

12 Sheets-Sheet 2



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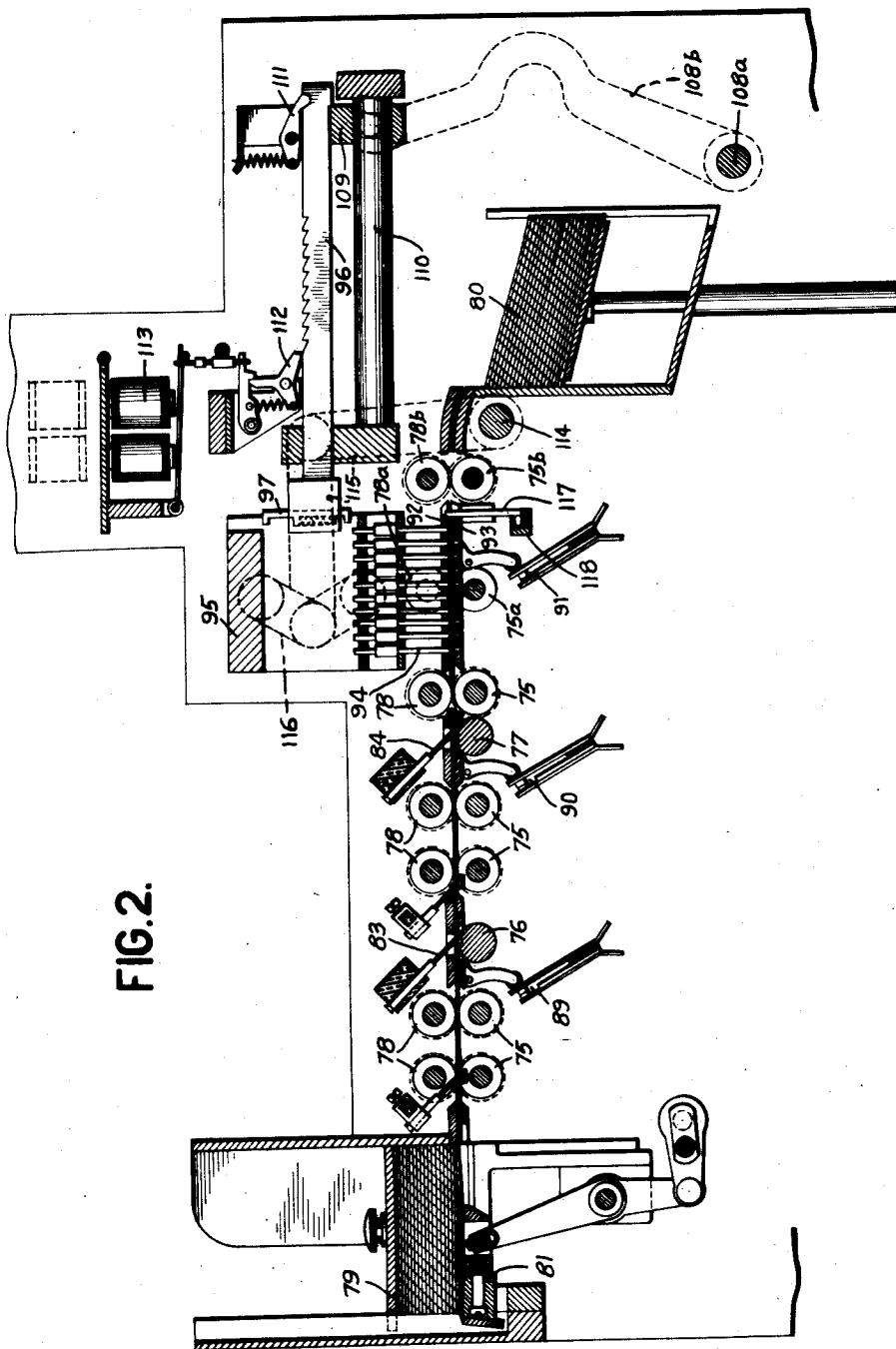


FIG. 2.

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FIG.6.

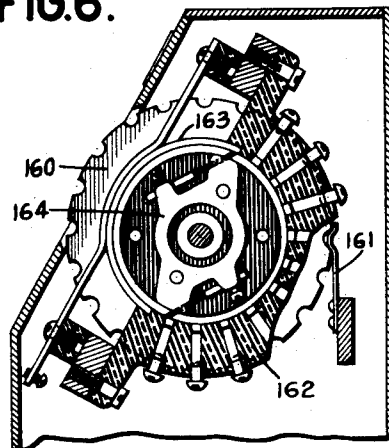


FIG.5.

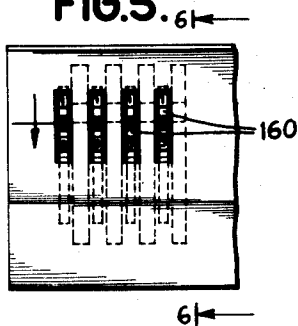


FIG.8.

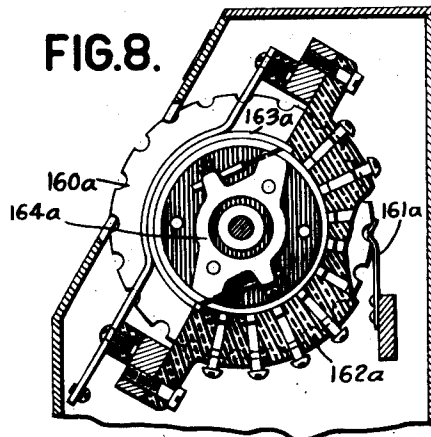


FIG.7

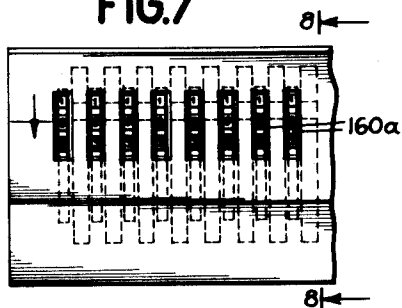


FIG.3.

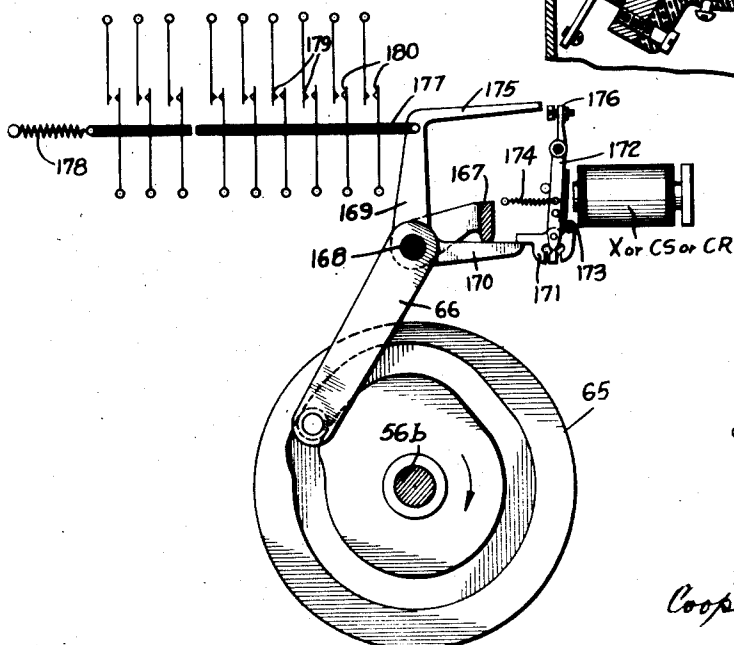
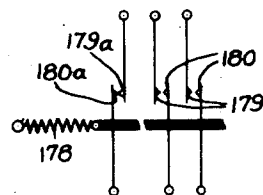


FIG.4.



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FIG.9.

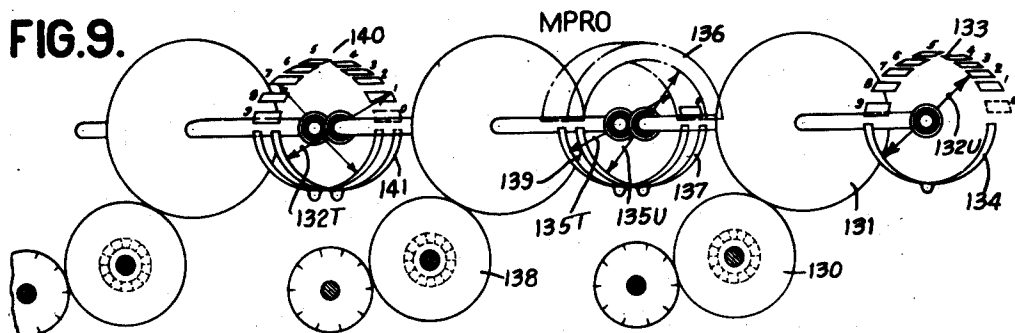


FIG.11.

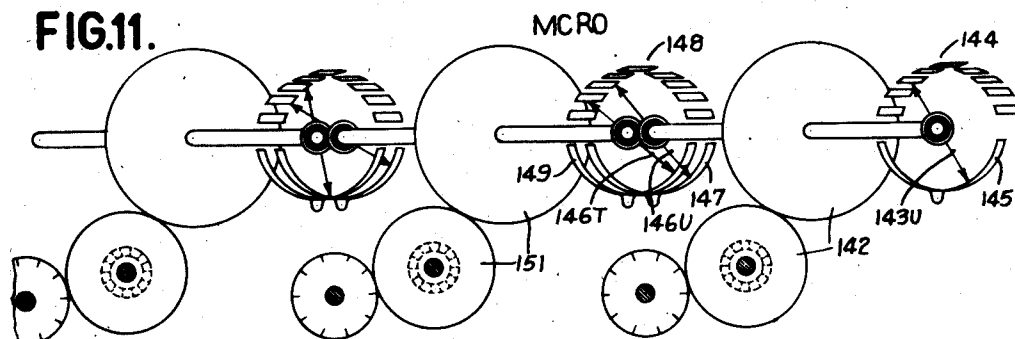


FIG.13.

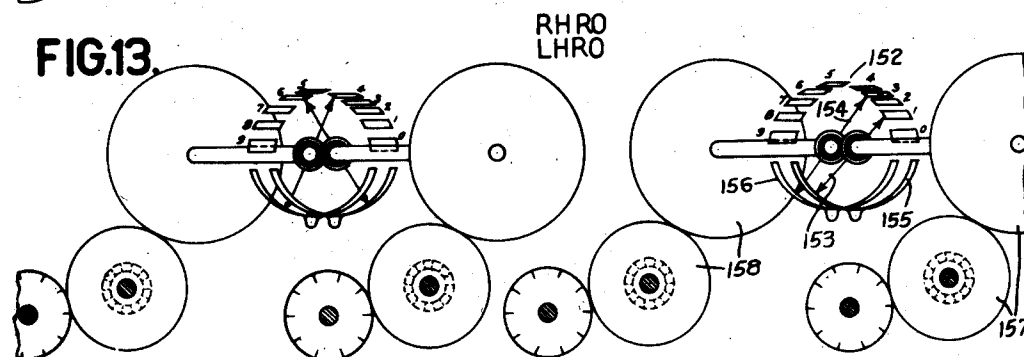


FIG.10.

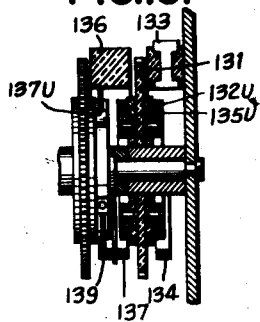


FIG.12.

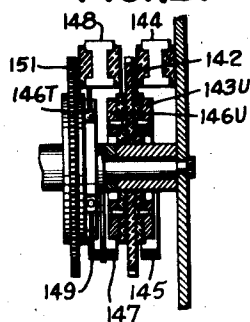
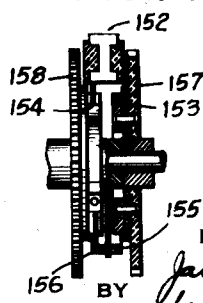


FIG.14.



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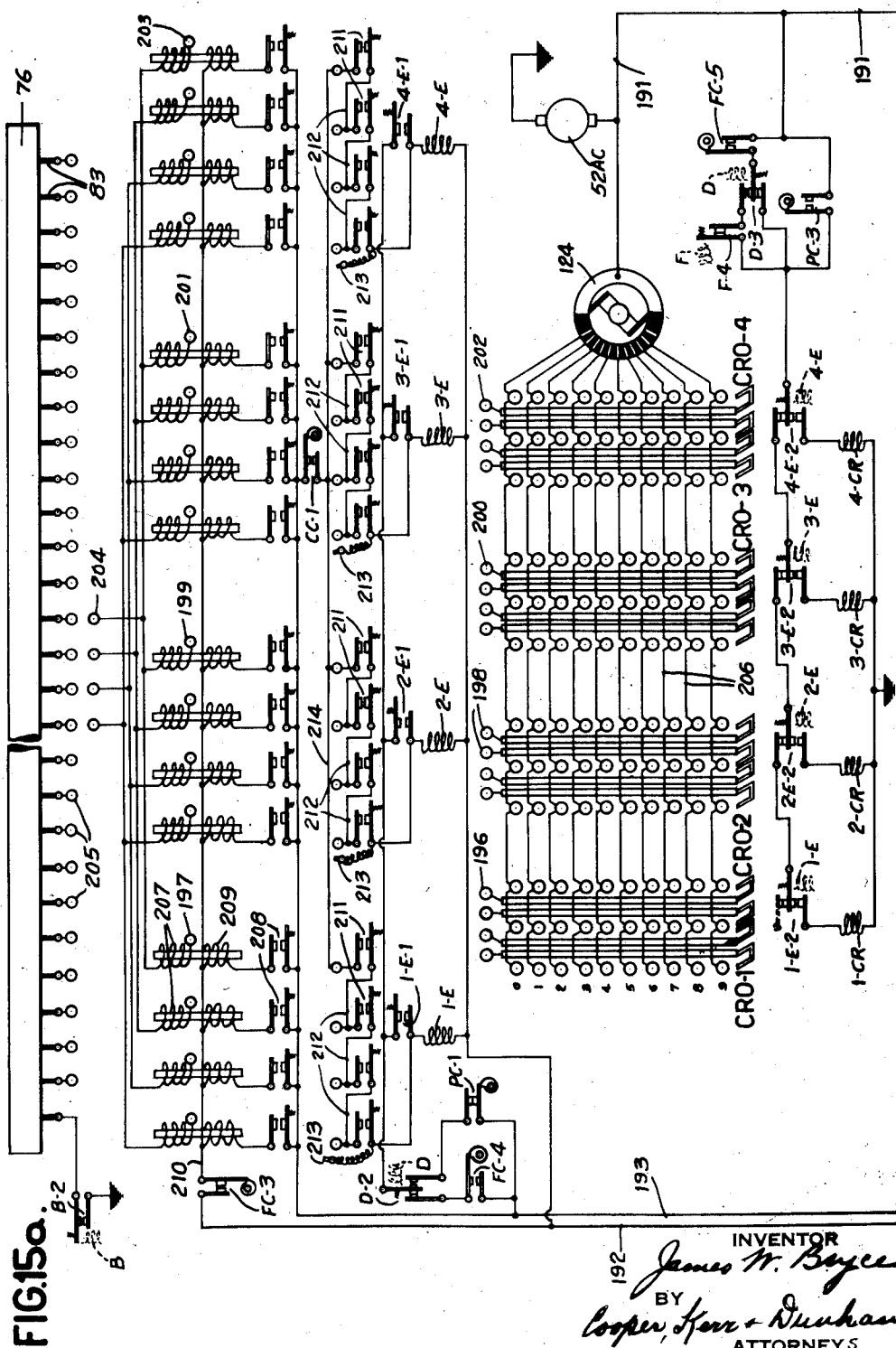
J. W. BRYCE

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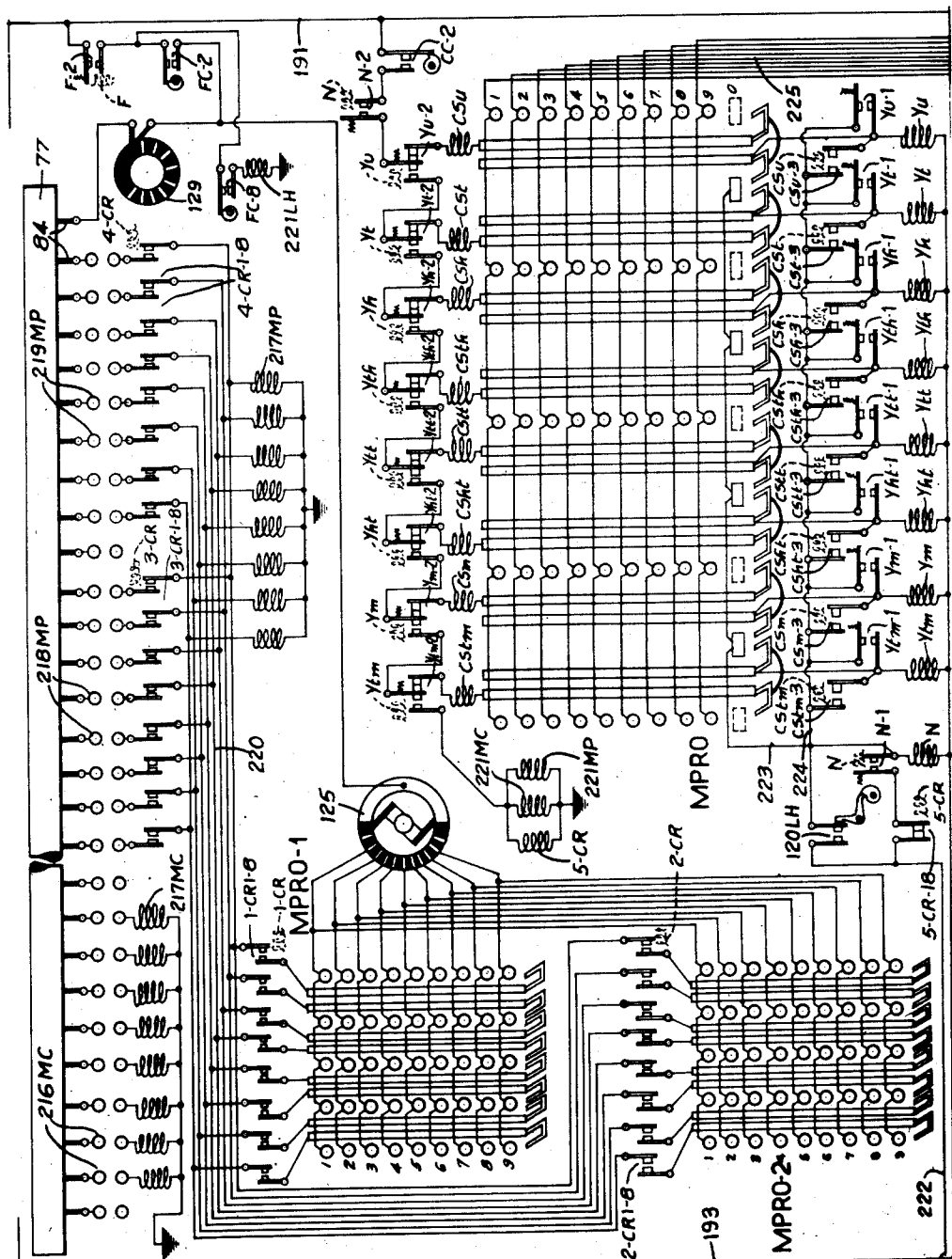
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MULTIPLYING DEVICE

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MULTIPLYING DEVICE

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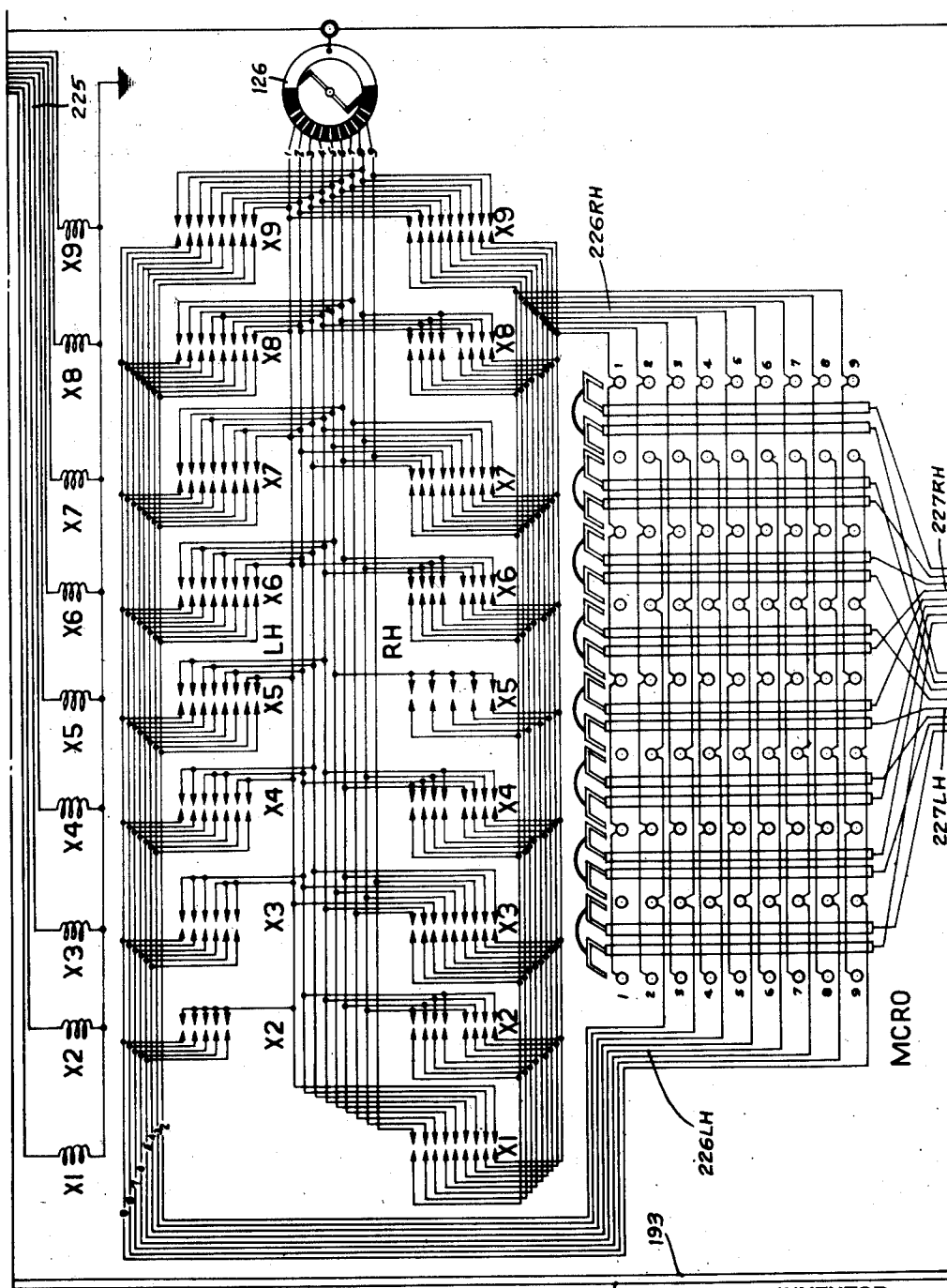


FIG. 15c.

192
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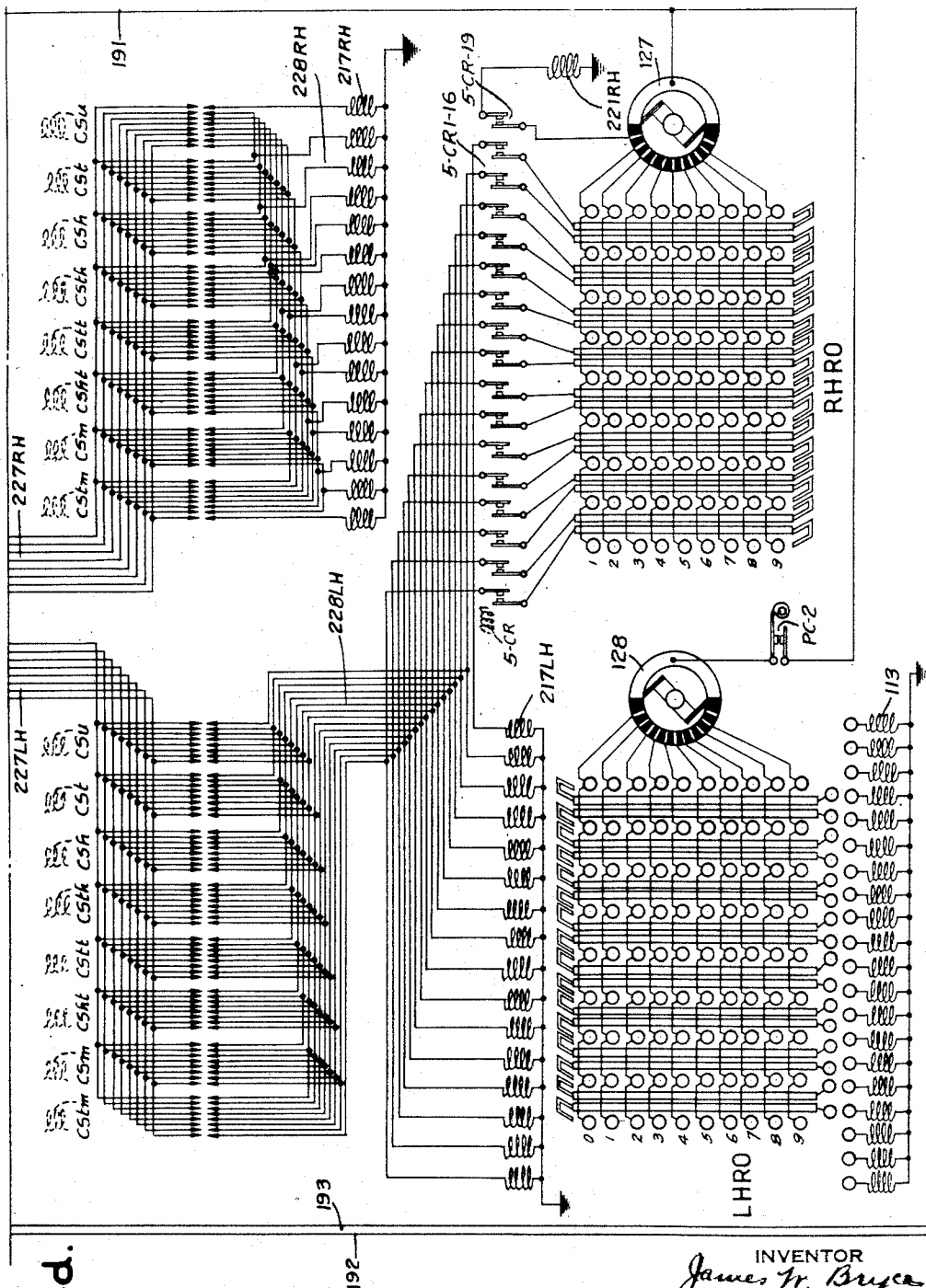


FIG. 15d.

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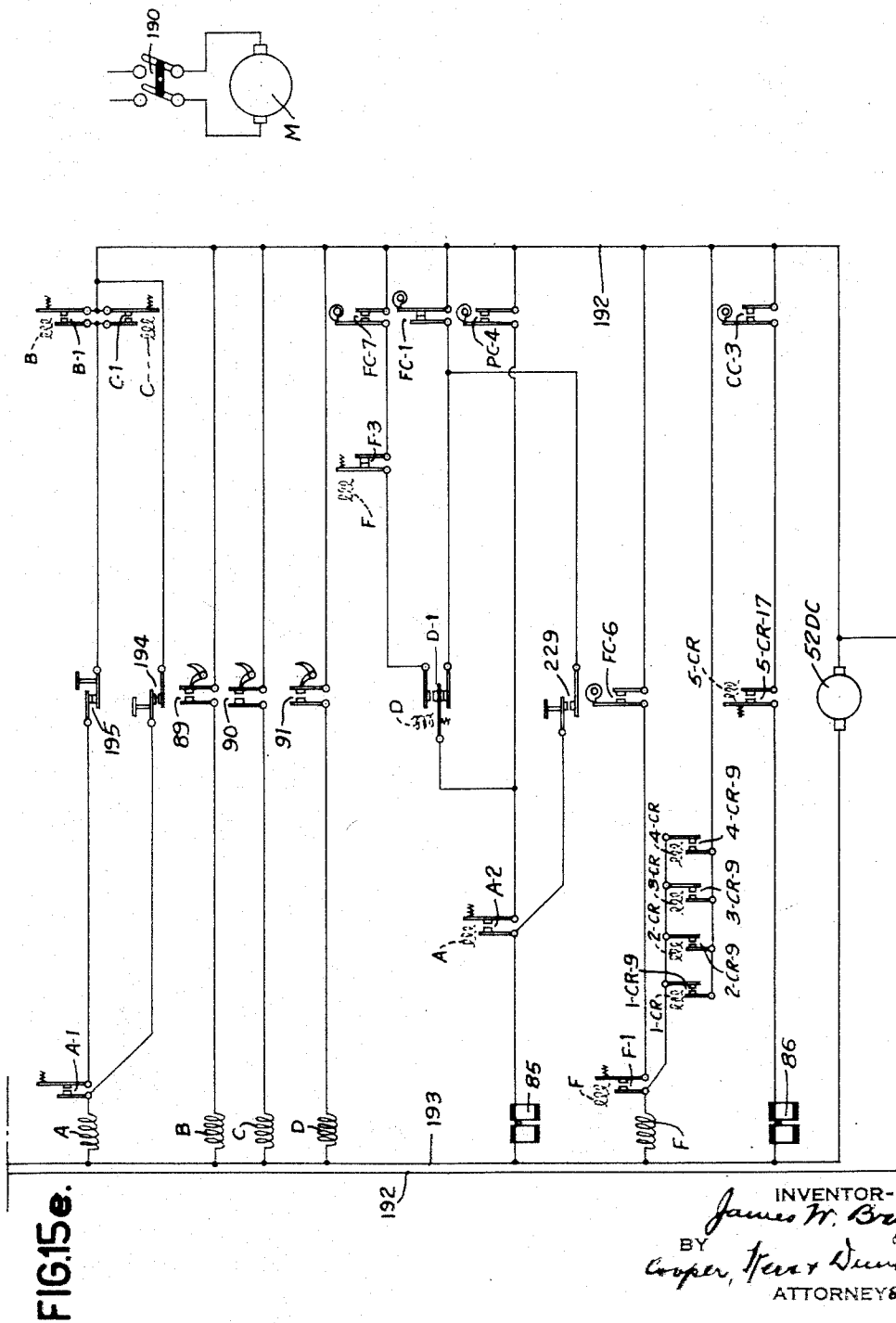
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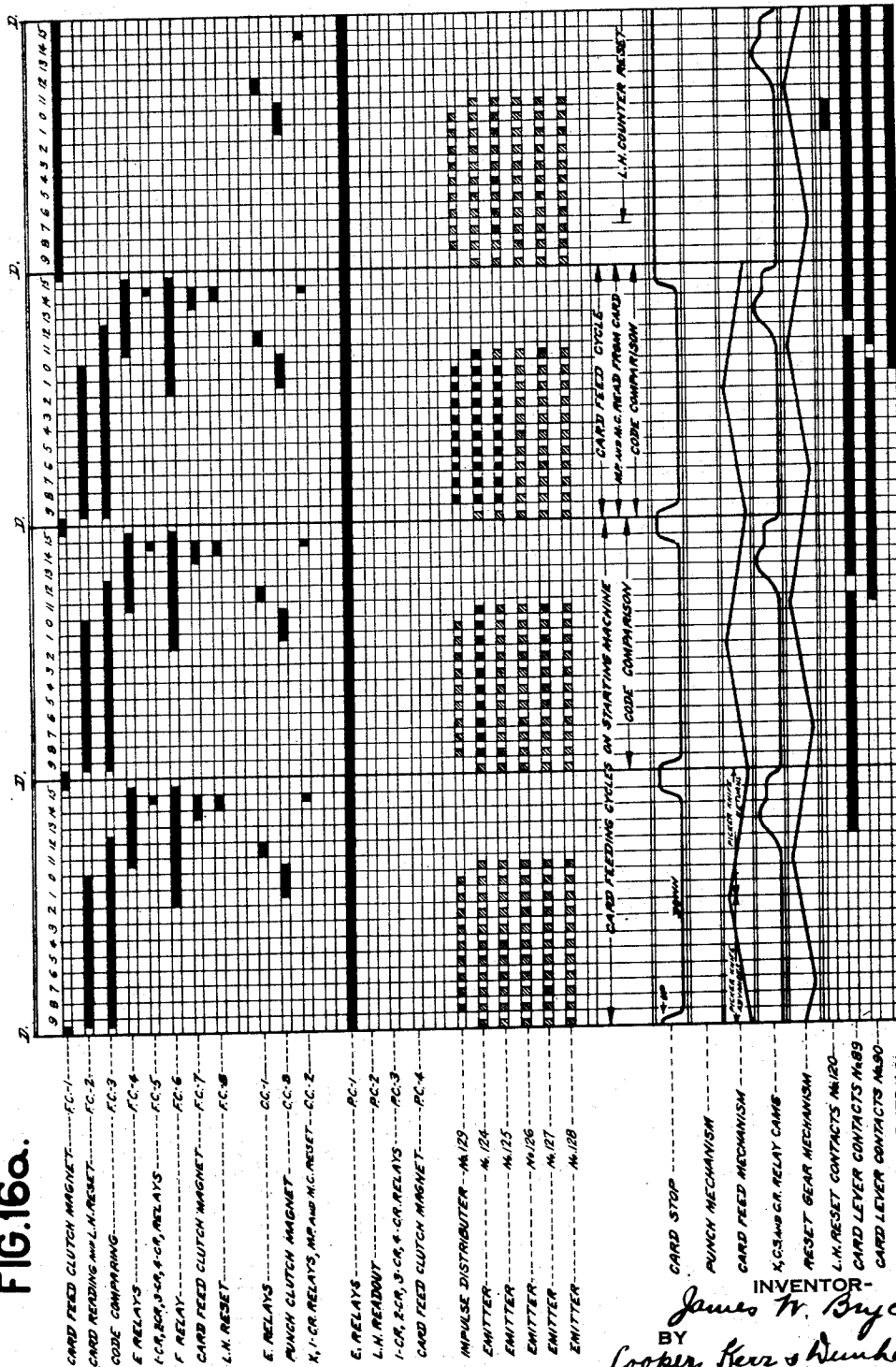
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FIG. 16a.



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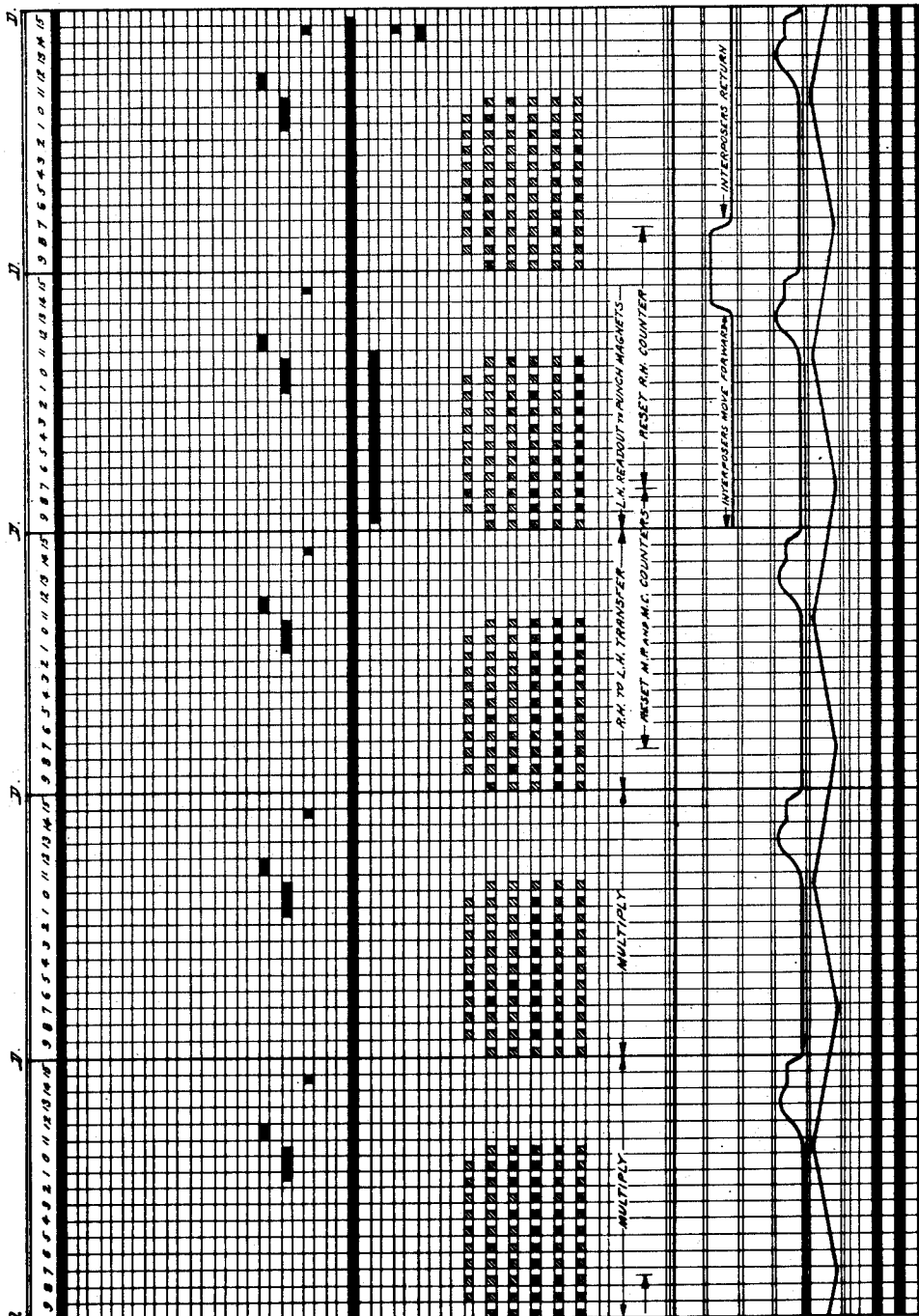


FIG. 16b.

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UNITED STATES PATENT OFFICE

2,113,229

MULTIPLYING DEVICE

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 Machines Corporation, New York, N. Y., a cor-
 poration of New York

Application March 25, 1933, Serial No. 662,687

14 Claims. (Cl. 235—61.6)

This invention relates to improvements in multiplying machines and more particularly has for one of its objects the provision of an automatic machine for multiplying each of a series of multiplicands by selected multipliers under code or control number control.

A further object of the present invention resides in the provision of a multiplying machine with a code number control to enable the machine to perform multiplying computations in a selected manner including the automatic selection and reading out of the multiplier from a plurality of hand setup devices upon which a plurality of multipliers are preset by the operator.

A further object of the present invention resides in the provision of a multiplying machine with a code number control to enable the machine to perform multiplying computations in a selected manner with selective deriving of the multiplier to be used in the computation from a plurality of multipliers upon the record from which the multiplicand is derived.

A further object of the present invention resides in the provision of a multiplying machine with an improved code number control therefor to enable the machine under code number control to automatically effect and select multiplications of multiplicand amounts by selected multipliers derived selectively from multiplier data on controlling records and/or from hand setup multiplier devices.

A further object of the present invention resides in the provision of improved controls for an automatic multiplying machine to enable the machine to function with a minimum number of cycles and in particular to provide improved means for elimination of idle cycles upon the presentation of records which require no computations to be performed.

A further object of the present invention resides in the provision of an improved automatic control for a multiplying machine for comparing code or control numbers upon the record with set up control or code numbers and for selectively controlling machine operations in accordance with the comparison which is made and/or in accordance with a failure of comparison.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims and shown in the drawings which show by way of illustration a preferred embodiment and the principle thereof and what I now consider to be the best mode in which I have contemplated of applying that principle. Other embodiments of the in-

vention employing the same or equivalent principle may be used and structural changes made as desired by those skilled in the art without departing from the present invention and within the scope of the appended claims.

In the drawings:

Figures 1 and 1a, taken together show a diagrammatic view of the various units of the machine and also show the driving devices for the various units;

Fig. 2 is a central transverse sectional view of the card handling, reading and punching section of the machine. This section is taken substantially on line 2—2 of Fig. 1a;

Fig. 3 is a side elevational and positional view of one of the multi-contact electromagnetic relay devices which are used in the machine;

Fig. 4 is a view of a modified contact arrangement showing certain pairs of contacts adapted for closure and another contact pair adapted to be opened upon the operation of the relay device;

Fig. 5 is a front elevational view of one of the hand setup devices used in the machine for setting up a control number;

Fig. 6 is an enlarged detail sectional view, the section being taken substantially on line 6—6 of Fig. 5;

Figs. 7 and 8 respectively are similar views of another of the hand setup devices used in the machine for setting up multiplier amounts by hand; Fig. 8 being a sectional view taken on line 8—8 of Fig. 7;

Fig. 9 shows somewhat diagrammatically the arrangement of the MPRO (multiplier) readout device and the driving train therefor;

Fig. 10 is a fragmentary sectional view of the MPRO readout device;

Fig. 11 shows somewhat diagrammatically the arrangement of the MCRO (multiplicand) readout device and the driving train therefor;

Fig. 12 is a fragmentary sectional view of this MCRO readout device;

Fig. 13 shows somewhat diagrammatically the arrangement of the RHRO (right hand partial product) readout device and the LHRO (left hand partial product) readout device. These readout devices are substantially the same in construction except for the number of segment spots provided;

Fig. 14 is a fragmentary sectional view of one of the readout devices shown in Fig. 13;

Figs. 15a, 15b, 15c, 15d, and 15e taken together and arranged vertically in the order named, show the circuit diagram of the machine; and

Figs. 16a and 16b taken together and arranged

horizontally with Fig. 16a to the left, show the timing diagram of the machine.

Before describing the details of the various parts of the machine, a general description will be given of the various units and their location in the machine. The machine embodies a card feed, card handling and a punching section which are shown in the upper right hand section of Fig. 1a and also shown in cross-transverse section in Fig. 2. This part of the machine is arranged to feed cards, derive readings therefrom and afterwards pass each card into a punching mechanism where such card is punched. This punching mechanism is preferably of the gang punch type wherein there is a preliminary selection of punches for punching and a subsequent concurrent displacement of the selected punches through the card.

The machine also includes a number of counters and receiving devices which may be enumerated as follows. In the upper part of the machine there is shown the usual RH accumulator and an LH accumulator designated RH and LH on Fig. 1. Also disposed in the upper part of the machine are two hand setup devices for multipliers which are respectively designated MP-1 and MP-2. Also disposed in the upper part of the machine are four hand setup devices for control numbers respectively designated C-1, C-2, C-3, C-4. The setup device for the control numbers and the setup devices of the multipliers are connected by cables to the other sections of the machine as will be shown in the wiring diagram. In the lower part of the machine there are two counters used as multiplicand and multiplier entry devices and such counters are respectively designated MC and MP.

The machine also includes a multi-contact multiplying relay unit which is in the lower part of the machine (see Fig. 1a) and generally designated MPR. In the lower part of the machine there is also provided in the column shift relay unit generally designated CS. Certain additional electromagnetic multi-contact relays generally designated CR, are also located in the CS section of the machine.

The machine also includes a number of emitter mechanisms and cam contact devices which will be subsequently described.

Machine drive

The machine is adapted to be driven by a constantly running motor M (Fig. 1). This motor, through a belt and pulley and ratchet drive drives a shaft 51, which shaft drives an A. C.-D. C. generator 52. The A. C. end of this generator is adapted to produce the alternating current impulses for actuating various counters and relay magnets and the generator 52 also has a D. C. (direct current) takeoff section. Shaft 51, through worm gear drive 53 drives a vertical shaft 54 which shaft drives the units in the upper and lower sections of the machine. The drive to the upper units is provided as follows. Shaft 54, through worm gearing 55 drives the counter drive shaft 56. The various counters in the upper section are driven from this drive shaft in the customary manner. Reset drive for the upper counters is provided as follows. Shaft 56 is provided with a spur gear 57 driving a gear 58 with a four to one drive ratio. Gear 58 has extending from it four Geneva pins cooperating with the cross-element of the Geneva designated 60. Secured to 60 is an internal gear 61 which gear has cooperating

with it a spur gear 62 mounted on the end of the reset shaft 63. Electromagnetically actuated one revolution clutches are provided for effecting selective reset of the various counters.

The drive for the units in the lower part of the machine is substantially the same as previously described for the upper units, that is, shaft 54, through worm gearing 55b drives a shaft 55b. A similar Geneva drive 57b, 58b, and 60b is adapted to drive an internal gear 61b which in turn drives the pinion 62b mounted on the end of the lower reset shaft 63b. Electromagnetic one revolution clutches are also provided for resetting the lower counter units. The lower drive shaft 55b also extends to the right (see Fig. 1a) and drives operating cams 65, which cams are adapted to operate bell crank follower members 66 and drive the operating mechanism for the multi-contact relay devices.

Card feed, card handling and reading and card punching unit drive

Referring to Figs. 1a and 2, the shaft 56 near its extreme right hand end is provided with a gear 68 which drives a gear 69 freely rotatable upon a shaft 70 but having fast to it the notched element 71 of a one revolution clutch. The complementary part of this clutch comprises a pawl 72 carried by an arm 73 which is fixed to shaft 70. This one revolution clutch is engaged by the energization of the usual clutch magnet 85. With the clutch engaged, shaft 70 will rotate in unison with gears 69 and 68 and in unison with the counter drive shaft 56. With the clutch disengaged, shaft 70 will be stationary while shaft 56 will continue its rotation of movement. Shaft 70 through spiral gearing generally designated 74, drives the lower of a series of pairs of card feed rolls designated 75, 75a, and 75b (see Fig. 2). The shaft 70 also drives two gears on contact rolls 76 and 77 by gearing extending to certain of the rolls 75 (see Fig. 1a). Cooperating with the lower feed rolls 75 are upper feed rolls 78 of the usual construction. These rolls 78 are preferably gear driven in unison with the lower feed rolls. An upper roll 87a is also provided, which roll is frictionally driven. A roll 78b is also provided, which roll may be positively driven in unison with the cooperating lower roll 75b. Preferably rolls 75a and 75b are arranged to have a slightly higher peripheral speed than rolls 75 and 78 and 75b and 78b. This may be secured by proper proportioning of the roll diameter or by the gear drive to rolls 75a and 78a. The purpose of providing the greater peripheral velocity is to ensure that a card in the punching die is fully advanced to abut against the card stop.

The machine is provided with the card supply magazine 79 and the usual discharge hopper 80. A picker 81 of conventional construction and crank operated is driven in any suitable manner from the driving shaft 70 as by the driving train 82 shown in Fig. 1a.

The machine is provided with advance sensing brushes 83 and a second set of sensing brushes 84 which respectively cooperate with the contact rolls 76 and 77. As before stated contact rolls 76 and 77 are driven from the shaft 70 and preferably the drive is such that these contact rolls slip slightly relatively to the card to cause a slight slipping or creeping action of the contact rolls. The usual card lever operated contacts 89 and 90 are provided which are adapted to be closed upon the passage of cards thereunder and

open up upon the failure of a card to cooperate with each respective card lever. Another card lever with associated contacts 91 is provided in the punching section of the machine. A card leaving the right hand pair of rolls 76 and 75 enters a punching die comprising upper and lower die plates 92 and 93. Sets of rows of punches 94 are provided suitably supported in a punch-operating frame generally designated 95. A series of interposer selector bars 96 are provided, one interposer selector being provided for each row of punches and each selector bar carries on its end a punch operating plunger 97, which plunger slides over the tops of the punches 94 and below the top of the punch operating frame 95.

The drive for the punching section of the machine is provided as follows. Referring again to Fig. 1a the shaft 56 is provided with a gear 98 which in turn drives a gear 99 freely rotatable on a punch operating drive shaft 100. Gear 99 has fast to it the notched element 101 of a one revolution clutch. The complementary part of this clutch comprises a pawl 102 carried by an arm 103 which is fixed to shaft 100. This one revolution clutch is of the electromagnetically controlled type and when engaged by the energization of the punch clutch magnet 86, shaft 100 is turned through one complete revolution upon two complete revolutions of the main counter drive shaft 56. On account of the two to one driving ratio the notched element 101 is provided with two notches to receive the pawl 102 in either of two positions. Shaft 100, near its right hand end, through spiral gearing generally designated 104 (see Fig. 1a) drives cams revolvably mounted on a stud shaft 105. The gearing drives an interposer cam 106 and punch operating cam 107. The interposer cam 106 is adapted to shift a crank follower 108 to rock a rock shaft 108a and through arms 108b to shift a cross-bail 109 (see Fig. 2) back and forth on slide rods 110. The interposers 96 are impositively driven from this cross-member 109 in any suitable manner as by spring pressed pawls 111. The interposers are selectively controlled for position over the punches by means of pawls 112, which engage ratchet teeth in the top of the interposer bars in the usual manner. Pawls 112 are electromagnetically tripped by punch selector magnets 113. After a given interposer bar or bars have been selectively positioned under the control of the punch selector magnets the punches which are under the ends of the punch operating plungers 97 will positively be forced through the cards by the punch operating cam 107 (Fig. 1a), which cam through its follower rocks a rock shaft 114 (Figs. 1a and 2) which through arms and links 115 operates a suitable operating means for the punch frame 95, such operating means being here shown as a toggle 116.

It will be understood that cards will be picked one by one from the supply magazine 79 (Fig. 2) and in one counter cycle the leading card will be passed to a position in which it is about to be read by the set of brushes 83. The card on the next countercycle will pass to the next reading station under brushes 84 and on the following countercycle it will pass into the punching die. Each card is arrested in the punching die by a card stop 117 (see Fig. 2) which card stop co-operates with a pivoted arm 118 coacting with a cam 119 disposed on shaft 70 (see Fig. 1a). With the card stop 117 elevated, the card will be

arrested in proper position for punching in the punching die. The feed rolls 76a and 76b urge the card into cooperation with the card stop and after the card has been intercepted by the card stop, these rolls slip relatively thereto before their rotational movement terminates. Upon withdrawal of the card stop after punching, the card will be ejected from the punching die by the rolls 76a and 76b and delivered to the discharge stack by rolls 78b and 78c.

It will be understood that a card is removed from the die plates 92 and 93 during the card feed cycle in which a new card is being introduced into the die and being sensed and that the one revolution card feed clutch permits a card to be advanced through one station and then arrested for an indefinite number of cycles and the one revolution punch clutch permits the punch to be called into operation after the requisite number of computing cycles. Upon the completion of punching, a new card feed and reading cycle may ensue.

Emitters and cam contacts

The main counter drive shaft 56 is adapted to drive the cams of certain CC cam contact devices, such cams being correspondingly numbered on Fig. 1 as CC-1 to CC-3 inclusive. Upon the shaft 70 (Fig. 1a) there are provided the cams of a number of PC cam contacts. Such cams are correspondingly designated PC-1 to PC-3 inclusive on Fig. 1a. The punch operating drive shaft 100 also drives the cams of a PC group of cam contacts. Such cams are designated PC-1 to PC-4.

The machine is provided with a series of emitters which are of conventional construction and which are driven from the main counter drive shaft 56 (see Fig. 1). Five of such emitters are provided which are designated 124, 125, 126, 127, and 128. An impulse distributor 129 is also provided which is driven in unison with the cam contacts CC-1 to CC-3. Referring to Fig. 1 the reset gear of the LH accumulator is shown as provided with a cam adapted upon the reset of this accumulator to cause closure of contacts 120LH.

The foregoing description has described the manner in which the cards are drawn in succession from the supply magazine and the manner in which the cards are passed from the various sensing brushes and delivered into the punching section of the machine. With the traverse of each card past the sensing brushes 83, the code or control number is read from each card and compared with a pre-setup control number. With the traverse of the card past the brushes 84, amounts are read from the card and entered into the receiving devices of the machine.

The receiving devices and counters are of the usual type as customarily used in tabulating machines (see Lake Patent No. 1,307,740) and are provided with electromagnetically actuated clutches. The various counters and receiving devices have commutator type readout devices which will now be described.

MP readout

Referring now to Figs. 9 and 10, 130 is a clutch gear pertaining to the units order of the MP (multiplier) receiving device. Gear 131 is driven from this clutch gear and this gear in turn drives two brush assemblies, one designated 132U, which traverses a set of segments 133 and also a current supply segment 134. There is

another brush assemblage 135U driven by gear 131 which brush traverses a segment generally designated 136 and which segment is provided with a single conducting spot at the zero position. Brush 135U also traverses a common supply segment 137. There is a similar brush 135T which is positioned from the tens order clutch wheel 138 and which also traverses the segment 136 which contains only the single conducting spot at the zero position. Brush 135T also traverses a common supply segment 139. Similarly there is a brush 132T driven in unison with brush 135T which traverses the segment spots 140 and which receives current from the common current supply segment 141. This arrangement of brushes and segments is repeated for higher orders in MP readout device, i. e. each alternate segment is like 136 with only a single spot in the zero position. Alternating with these segments are other segments similar to 133 and 140 with a multiplicity of spots on each segment. The detail construction of this readout with its brush assemblages is shown in the cross-sectional view Fig. 10. The wiring of the readout will be more fully set forth in connection with the circuit diagram (see Fig. 15b).

MC readout

Referring now to Figs. 11 and 12, in Fig. 11 is shown the brush driving arrangement for the MC readout. In this embodiment the units clutch gear train 142 drives a units brush assemblage 143U which cooperates with a set of segments 144 which receives current from a common conductor segment 145. Similarly units driving train 142 drives a brush assemblage 146U, receiving current from a conductor segment 147 and cooperating with segments 148. Also cooperating with segments 148 is another brush assemblage 146T receiving current from a conductor segment 149 and which brush assemblage is driven from the tens order clutch train 151. This arrangement is repeated for relatively higher orders.

The detailed mechanical construction of this MCRO readout is shown in Fig. 12.

RH and LH readouts

Fig. 13 shows the general arrangement of the readouts for the RH accumulator and the LH accumulator. With a readout of this sort it will be noted that the segment spots 152 are common to two sets of brush assemblages designated 153 and 154 respectively and which brushes cooperate respectively with conducting segments 155 and 156. Brush 153 as shown in Fig. 13 is driven from the units order clutch gear train 157. Brush 154 on the other hand is driven from the tens order clutch train 158 by the gearing diagrammatically illustrated.

A similar arrangement of brushes and readout spots is provided for the relatively higher orders of these accumulators and the wiring of these readouts is shown on the circuit diagram (see Fig. 15d). Fig. 14 shows the details of construction.

It may be explained that with an RH readout there are nine spots on the segment 152 and with an LH readout there are ten such spots provided. The zero spot is the extra spot for the LH readout.

Hand setup devices

In the present machine provision is made for at times using a fixed multiplier or multipliers. Hand setup readout devices are provided for these

fixed multipliers. Provision is also made for using fixed control numbers and hand setup readout devices are also used for such control numbers. These hand setup devices are substantially the same in construction as the readouts heretofore described. They differ in providing means whereby the brush elements may be positioned manually. There is a knurled wheel provided for each brush assemblage, which knurled wheel can be positioned and turned by hand. Referring to Figs. 5 to 8 inclusive, the knurled wheel is shown at 160. The periphery of this wheel may be provided with suitable designating indicia (see Figs. 5 and 7). The wheel may be impositively held in any set position by a spring detent 161. In the control number readout shown in Fig. 6, a segment generally designated 162 with ten conducting spots, is provided and there is a single common conducting segment 163. The brush assemblage is generally designated 164 and such assemblage may be positioned by turning the knurled wheel 160. The wiring of the fixed control number readout will be shown and explained in connection with the description of the circuit diagram (see Fig. 15a). As shown in Fig. 1 four sets of control number setup devices are provided, each set being of a four-wheel type for a four order control number.

The hand setup readout devices for the two fixed multipliers is substantially the same construction except that the segment 162a is provided with nine spots instead of ten as in the other arrangement. In other respects the construction is similar and similar reference characters will be applied with the suffix a.

As shown in Fig. 1 there are two hand setup readout devices for multipliers, each setup device being an eight-wheel type for an eight-order multiplier.

Multi-contact relays

The electromagnetically tripped multi-contact relays which are used in the machine multiplying relay section and in the column shift relay section and control section (see Fig. 1a) are those of the type customarily used in multiplying machines. The shaft 56b drives operating cams 65. Cooperating with each cam 65 is a follower 66 which is adapted to rock a bail 167 (see also Fig. 3). Loosely mounted on a shaft 168 which supports the bail 167 are a number of U-shaped members 169, each provided with an arm portion 170 extending under the bail 167 and cooperating with a latch member 171, which is pivotally mounted on the armature member 172 and spring urged in an anti-clockwise direction by the spring 173. The armature is normally rocked clockwise by a spring 174. Each member 169 has an armature knockoff arm 175 adapted to cooperate with a knockoff extension 176 of the armature. Also fixed to each member 169 is an insulated operating contact part 177 which is normally drawn to the left by a spring 178. The contacts 175 and 180 are provided, the latter 180 being fixed to the member 177. Upon the full movement of 177 to the left the contacts 179 and 180 will close.

In the operation of this multi-contact relay, the bail 167 is first displaced to the position shown in Fig. 3 and the arm 170 is slightly depressed to relieve the strain from the latch point where 170 cooperates with 171. A relay magnet X, CS or CR may then be energized, swinging the armature 172 to the right causing the latch 171 to clear 170 and snap down under spring action by the spring 173 to a position opposite the end of

member 170. Thereafter upon further motion of the cam 65 in the direction indicated by the arrow, the ball 167 is elevated allowing an anti-clockwise motion of member 169 and permitting the contacts to close under their own spring action and under the influence of spring 178. Subsequently a further movement of the cam 65 causes the ball 167 to be again depressed to reopen the contacts and to thrust 175 to the right to a supplemental extent to knock off any previously attracted armature. At this time there is a re-latching of the latch member 171 with the member 170. If a given armature is not energized the latch 171 will not be tripped and such latch will prevent the anti-clockwise motion of member 169 and the closing of the contacts upon the elevation of the ball 167. Fig. 4 shows normally closed contacts 179a and 180a which open up instead of becoming closed upon the relay operation.

In the subsequent description of the wiring diagram the contacts of the multi-contact relay which have been designated 178 and 180 and 179a and 180a will be given designating reference numerals related to their associated control magnets.

General use of the machine

Before giving in detail a description of the circuit diagram and details of operation of the machine, a brief description will be given of the type of accounting operations which the machine is intended to handle.

In certain computing and accounting operations occasions arise where multiplicand amounts are to be multiplied by a multiplier amount which is to be selected from one of several multipliers, depending upon controlling classifications which are related to the multipliers to be used. For example in billing operations to wholesale and retail customers, a wholesale customer coming under a wholesale classification would be billed at one rate according to one multiplier and a retail customer coming under a retail classification would be billed at a different rate and according to another multiplier. Similar practices would be followed in billing for commodities sold in bulk, or in packages or broken lots. Also in computations involving loans and discounts, one loan of one classification might have one interest rate to be used as the multiplier and a loan of a different classification would call for a different interest rate as a multiplier.

In all of these classes of transactions a code or control number would signify that a corresponding and related multiplier should be used in the computation and another code or control number would signify that a different related multiplier should be used. In some cases several multipliers to be used in the computation remain fixed throughout a large number of computations and in this case such multipliers can be set up by hand to be selectively used under code or control number control. In other cases, for example on loan transactions it may be desirable to place several multiplier factors on a card and selectively use such several multipliers under code number control. In practice the code or control numbers may conveniently be perforated upon the record cards which contain perforated data representative of the multiplicand amounts which are to enter into the computations and in certain cases some of such records may also be provided with a number of multiplier amounts. Thus records may be passed through the ma-

chine, each record having thereon a code or control number, and a multiplicand amount, and other or some records may have in addition to the code or control number and the multiplicand amount several separate multiplier factors. When computations are to be performed, a card with a code or control number "one" thereon would call for a multiplication by a certain multiplier which might be termed a "number one" multiplier and a card with a number 2 code or control number thereon would call for a multiplication by a different multiplier, say by a number two multiplier and so on.

For the purpose of carrying out the foregoing type of computations the machine may be conveniently provided with four hand setup devices for four separate code or control numbers. Other hand setup devices may be provided for setting up different multipliers corresponding to or related with certain of the setup control numbers. In practice, control number setup devices C-1 and C-2 could cause computing operations by the multiplier on the multiplier setup devices MP-1 and MP-2 respectively and the other code or control number setup devices C-3 and C-4 would call into the computation one or more of the several multipliers derived from the record card.

After the cards are perforated with the control numbers, the multiplicand amounts and after other cards are perforated with code numbers, multiplicand amounts and several multiplier amounts, the cards are introduced into the machine. The code number setup devices are set up for the desired control numbers to be used in controlling the computation and the multiplier setup devices are set up with multipliers related to certain control numbers. The machine is then plugged up and then set into operation.

It will be assumed that the code numbers are 1, 2, 3, and 4 and that the first card entering into the machine is one, having control number one thereon. Such control number one will match with the control number one setup on the first hand setup control number device and will call into the computation the first multiplier. If the next card entering in the machine is one with code number two thereon, such code number upon matching with the same code number on the number two control number setup device would cause multiplication by the second multiplier amount. Likewise if the card contains a number three control number which matches with the same control number on the number three setup device the machine would then derive a selected multiplier from the card. Likewise if the control number was number four and this number read from the card matched with the same control number on the number four control number setup device another multiplier amount would be read from the card. In short the machine reads a control number amount from each card. It then compares this control number reading derived from the card with the various setup control numbers and upon the control number which is read from the card matching with the control number on any of the setup devices this matching will cause a corresponding selection of multipliers and will automatically effect multiplication of the multiplicand amount which is also read from the card by such selected multiplier.

Otherwise stated, the machine provides for multiplier selection from a plurality of multipliers, such plurality of multipliers may be upon

hand setup devices, or they may be upon the record cards, or some may be upon the hand setup devices and others may be upon the record cards. The selection of the multipliers is under code number control and is brought about upon the matching of a code or control number read from the card with the same control code number upon one of the hand setup devices, which latter devices are correlated with the different multipliers to be selected.

If there is a non-matching of control numbers as read from the card with the control numbers of the hand setup devices, the machine passes the card or cards which contain such non-matching control number or numbers and does not effect any computations whatsoever. The machine furthermore passes such card or cards without going through idle cycles and without effecting any recording on the card. Such card with a non-matching control number would be immediately passed by the machine to the discharge stack.

The other records where there was a matching of control numbers would be perforated with the result of the computation in the punching section of the machine.

Accounting operations of this general class are useful in record control accounting machines where it is desired to run cards through multiplying machines without disturbing the order of the cards in the pack. The present machine provides means whereby such operations can be handled without requiring that there be a preliminary sorting operation prior to computing.

Before describing the circuit diagram it will be assumed that the control number hand setup devices C-1 to C-4 inclusive have been set up as follows: 1234 is set up on C-1, 2345 is set up on C-2, 3456 is set up on C-3, 7890 is set up on C-4.

It will also be assumed that the hand setup devices for the multiplier are set up as follows: 204 is set up upon MP-1, 305 is set up upon MP-2. The cards which are used in the computation will be punched up with their respective control numbers and with the amount of the multiplicand upon every card and on certain cards which are perforated with control numbers 3456 (corresponding with the set up on C-3) a multiplier amount will be punched on the card. Such multiplier can be assumed to be 278. On cards having the number 4 control number, i. e. 7890 thereon, a different multiplier field will be perforated with a different multiplier amount for example 297. The cards are introduced into the supply magazine and the machine is ready to be set in operation.

Circuit diagram

Main line switch 190 (Fig. 15e) is first closed providing a source of current for driving motor M, setting this motor in operation and causing the A. C.-D. C. generator to supply alternating current impulses from the 52AC end (see Fig. 15a) to bus 191 and to ground. Direct current supply is also provided by the 52DC end of the generator (see Fig. 15e) to the D. C. buses 192 and 193.

The start key (see Fig. 15e) is now depressed closing start key contacts 194 and energizing relay coil A. Energization of relay coil A will close relay contacts A-2 and current will then be supplied to energize card feed clutch magnet 85 through the circuit path traced as follows: From 193, through 85, through relay contacts A-2, through relay contacts D-1 now in the position shown, through cam contacts FC-1 to

the other side of the line 192. The first card is withdrawn from the supply magazine and advanced to a position where it is about to be read by the brushes 83. For first card operations on starting up the machine the start key is again depressed or maintained depressed for two card feed cycles. Late in the first card feed cycle card lever contacts 89 close and establish a circuit to energize relay coil B. The energization of relay coil B closes relay contacts B-1 and establishes a circuit to maintain relay coil A energized through the stick contacts A-1 now closed and through the stop key contacts 195 now closed. The first card is now in position in which the code or control number is about to be read therefrom by brushes 83. The energization of relay coil B in the manner previously explained has caused the closure of relay contacts B-2 (Fig. 15a) and has established a circuit to ground from the contact roll 76. Before starting up the machine the operator will have plugged up the control number readouts designated CRO-1 to CRO-4 (Fig. 15a) in the following manner. From plug sockets 196 plug connections will be made to plug sockets 197, from plug sockets 198 plug connections will be made to sockets 199, from sockets 200 to 201 and from 202 to 203. Plug connections will also be made from sockets 204 to the selected sockets of the 205 set which pertain to the control number field of the card.

During the second card feed cycle, brought about by the maintained depression of the start key, the control number will be read from the card by the brushes 83. Concurrently with the reading of such control number from the card emitter 124 is in operation and this emitter has its segment spots wired to transverse bus wiring 206 which extends across the various control number readout devices as shown in the wiring diagram (Fig. 15a). It will be assumed that the card which is passing the brushes 83 is perforated with the control number 1234 which amount is set up on the C-1 control number setup device and upon the associated CRO-1 read out device. With this amount set up there will be, during the comparing cycle at some time in such cycle, an energization of all four of the control unit pickup relay coils 207. The energization of each of the relay coils 207 will have caused its corresponding contacts 208 to become closed and the closure of contacts 208 will energize a stick relay coil 209 to maintain 208 closed after the pickup coil 207 becomes de-energized. The circuit for energizing any of the 209 coils is as follows. From 193, through contacts 208, through 209 back through a wire 210, through cam contacts FC-3 which are closed during the comparing portion of a card feed cycle and back to the other side of the line 192. With the closure of contacts 208, in the manner previously referred to, there is also a closure of the related comparing contacts 211. Such comparing contacts are disposed in a series comparing circuit 212. As is usual in automatic control devices (see United States Patents Nos. 1,600,413 and 1,822,594) one or more of the comparing contacts 211 can be plugged out by plug 213. If the control number read from the card matches the control number set up on the first control device C-1 the contacts 211 will all be closed at the time of current flow through the series circuit 212. Current is permitted to flow through this series circuit 212 upon closure of cam contacts CC-1 which supply current to a cross line 214 thence through the contacts 211 in series circuit 212 back through relay coil 1-E 75

and back to the other 192 side of the D. C. line. The other control relays are similarly associated with the other control number setup readout devices. It is sufficient to here state that if the control number read from the card compares with the control number set up on the C-1 device and on control number readout CRO-1 that there will be an energization of relay coil 1-E and that if the control number from the card compares with the control number set up on the C-2 device and on CRO-2 there will be an energization of 2-E, and similarly there will be an energization of 3-E or 4-E depending upon which set up control number compares with the control number read from the card. Likewise if the control number read from the card fails to compare with any of the control numbers on any of the hand setup control devices there will be no energization of any of the relay coils 1-E, 2-E, 3-E, or 4-E. In short, the control number which is read from the card is concurrently compared with four set up control numbers and if there is a matching comparison with any one of these set up control numbers a corresponding selected relay will be energized. With relay coil 1-E energized through the control device in the manner previously explained there will be brought about a closure of relay contacts 1-E-1 and closure of such contacts will maintain relay coil 1-E energized through a circuit which extends back to the other side of the D. C. line, through three-blade contacts D-2 now in the position shown, through cam contacts FC-4 and back to the other side of the line. Late in the card feed cycle in which the control number is read from the card, card lever contacts 88 (Fig. 15e) close and energize relay coil C. The energization of relay coil C closes contacts C-f to maintain A energized. There is an overlap in the time of closure of contacts 88 and 90 as shown in the timing diagram. The third card feed cycle now ensues. It has been explained before that it was during the second card feed cycle that relay coil 1-E (Fig. 15a) became energized. The energization of this relay causes the shift of three-blade contacts 1-E-2 to reverse position from that shown in the diagram. During the second card feed cycle cam contacts FC-5 close, current now flows from the 191 side of the A. C. line through FC-5, through three-blade relay contacts D-3 now in the position shown over through contacts 4-E-2, 3-E-2, and 2-E-2, and through the now shifted 1-E-2 contacts to the 1-CR relay magnet and back to ground.

It may be mentioned that if the second control number compared relay coil 2-CR would have been energized at this time. If the third control number compared 3-CR would be energized, if the fourth control number compared 4-CR would have become energized.

At the beginning of the third card feed cycle the first card will be in the position just about to be traversed by the sensing brushes 84. During the third card feed cycle brushes 84 traverse the card and read therefrom the amount of the multiplicand. The multiplicand amount is entered into the multiplicand counter, the multiplicand entry circuits being from the brushes, through sockets 216MC to the multiplicand counter magnets 217MC.

It may be explained that if multipliers are being read from the card upon comparison of the number 3 or number 4 control numbers, such multipliers would be entered into the multiplier counter by plug connections at sockets 218MP

and 219MP. The multiplier entry circuits are to multiplier counter magnets 217MP and are alternatively through relay contacts 3-CR-1 to 8 or through relay contacts 4-CR-1 to 8.

For the present explanation it will be assumed that the multiplier amount is not read from the card, but is to be derived from the MP-1 hand setup device.

While the 1-CR relay coil becomes energized during the second card feed cycle the multi-contacts of this relay are arranged to remain closed during the ensuing third card feed cycle. Such multi-contacts are shown on Fig. 15b and are designated 1-CR-1 to 8. There is an additional contact pair controlled by relay coil 1-CR which contact pair is designated 1-CR-9 and shown on Fig. 15e. Closure of this relay contact causes energization of relay coil F and relay coil F is retained energized by the closure of stick contacts F-1, through a stick circuit which extends back through contacts FC-6 now closed. The energization of relay coil F also closes relay contacts F-2 (Fig. 15b) and establishes a circuit from the 191 side of the A. C. line, through cam contacts FC-2 now closed to the impulse distributor 120 to provide current supply to the contact roll 77 and permit the reading out of the multiplicand amount from the card. Current supply is also provided to an emitter 125 which emitter emits impulses through the MPRO-1 readout device and back through the 1-CR-1 to 8 relay contacts to a set of multiplier entry lines 220 which extend over to the multiplier counter magnets 217MP. The amount of the multiplier is accordingly read out from the MP-1 hand setup device and entered into the multiplicand counter. This multiplier amount in the example under consideration is the amount of 204.

It may be here explained that during the cycle in which the multiplier amount is being entered into the MP counter, that a following comparison is made between the control or code number upon the following card with the control number setup devices. Such comparison ultimately results in a new set up or re-energization of one of the relays 1-E, 2-E, 3-E or 4-E and there is a later energization of 1-CR, 2-CR, 3-CR or 4-CR. Such re-energization does not however, occur immediately but is delayed to permit the previously described reading out cycle to occur followed by the subsequent computing cycle pertaining to the first card.

Late in the third card feed cycle in which the amounts are being entered into the MC and MP counters, current is supplied through cam contacts FC-8 to the LH reset magnet designated 221LH. Reset of the LH accumulator then occurs and such reset brings about closure of the reset contacts 120LH (Fig. 15b). Such contacts when closed establish a setup circuit for the cycle controller, through the following path, from line 192, wire 222, through contacts 120LH, back through relay coil N to the other side of the D. C. line 193. Energization of relay coil N closes relay contacts N-1 to maintain N energized. The stick circuit is completed through contacts 5-CR-18 now closed.

Column skip and cycle controller

The cycle controller and column skipping arrangement are the form customarily used in these multiplying machines. The cycle controller comprises relay coils Yu, Yt, Yh, etc. with stick relay contacts Yu-1, Yt-1, etc. and column

transfer relay contacts Yu—2, Yt—2, etc. The CS relays on Fig. 15b are designated CSu, CSt, etc. Such relays have additional control contact pairs CSu—3, etc. As is customary with these cycle controllers if any brush of the multiplier readout MPRO stands on zero its corresponding Y magnet will be energized, current being supplied through line 223, through the zero spots of the MP readout device, then via the corresponding brush or brushes on a zero spot or spots to the respective Y magnets and back to the other side 193 of the D. C. line. A line 224 also extends over and connects with one side of each of the CSu—3 to CStm—3 group of contacts. The other side of these contacts are wired back to their respective Y magnets. When any Y magnet becomes energized, the corresponding Y—1 stick contacts will be closed and the Y magnet will remain energized. With the problem under consideration, zero is in the tens order of the multiplier and accordingly, Yt will become energized and contacts Yt—2 will be shifted to reverse position from that shown.

The machine is now ready to multiply by the amount in the units order of the multiplier or by 4. Upon the energization of relay coil N in the manner previously explained relay contacts N—2 will close. When cam contacts CC—2 close, current will flow from the 191 side of the A. C. line through cam contacts CC—2, relay contacts N—2, through Yu—2 now in the position shown, through the CSu column shift relay magnet down through the MPRO readout and out via the brush which is standing on the 4th spot of the units order of this readout, to the 4th line of the group of lines generally designated 225 to the X—4 relay magnet (see Fig. 15c). The energization of the multiplier relay magnet, in this instance the X—4 magnet, establishes related contacts pertaining thereto (see Fig. 15c) and at the proper time in the operation of the machine current impulses flow from the emitter 126, through the multiplying relay contacts. Such impulses flow out over the lines generally designated 226LH and 226RH to the LH and RH sections of the multiplicand readout MCRO. The multiplicand readout device allows selected impulses to flow to the LH component lines 227LH and to the RH component lines designated 227RH. The lines 227LH and 227RH (see Fig. 15d) extend down to the various contacts of the CS relays, being wired as shown in Fig. 15d and the other contacts of these relays connect to the LH and RH lines 228LH and 228RH. The 228LH lines connect to the 217 LH counter magnets and the 228RH lines connect to the 217RH counter magnets.

By the foregoing operation partial products are entered into the LH and RH accumulators and as successive multiplying cycles ensue there is a selected energization of the CS magnets to direct the proper entries into the proper and shifted over orders of the accumulators.

Upon the completion of the multiplying computation, all of the Y—2 set of contacts will have been shifted to reverse position from that shown and upon closure of cam contacts CC—2 there is a circuit path from the 191 side of the A. C. line, through CC—2, N—2, through all of the shifted Y—2 set of contacts to three coils, one a relay coil designated 5—CR and the other coils being reset clutch magnet coils 221MC and 221MP for initiating reset of the MC and MP counters. When the multiplying computation is complete for a given problem, the amount in the RH accumulator is transferred over into the LH ac-

cumulator. This transfer over operation is initiated by the energization of multi-contact control relay 5—CR (Fig. 15b). Energization of this relay permits closure of the related contacts 5—CR—1 to 16 and contacts 5—CR—19 (Fig. 15d) and 5—CR—17 (Fig. 15e) and also allows contacts 5—CR—18 (Fig. 15b) to open. The opening of contacts 5—CR—18 (Fig. 15b) breaks down the previously established setup of the cycle controller by causing deenergization of the relay coil N and all of the Y magnets. The closure of relay contacts 5—CR—1 to 16 (Fig. 15d) connects the RHRO readout with the lines leading to the 217LH counter magnets so that upon the operation of the emitter 127, impulses are emitted through the RHRO readout, through the 5—CR—1 to 16 contacts, to the LH accumulator magnets 217LH. The amount previously standing on the RH accumulator is entered into the LH accumulator in proper columnar order therein. At the completion of such emission of impulses by emitter 127, the emitter brush on encountering the extra spot, supplies current through 5—CR—19 now closed to the RH reset magnet 221RH. Energization of this magnet initiates reset of the RH accumulator.

It may be explained that the reset of the MC and MP counters occurs concurrently with the RH and LH transfer.

Punching of product

Upon closure of contacts 5—CR—17 in the manner previously explained and upon closure of cam contacts CC—3 (Fig. 15e) the punch clutch magnet 86 is energized. In the cycle following the LH to RH transfer the punching section of the machine is called into operation and upon closure of cam contacts PC—2 (Fig. 15d) current is supplied to the 128 emitter which emits impulses through the LHRO readout device to the punch selector magnets 113. These selector magnets properly control the position of the punches and in proper time in the cycle of operation of the punching section of the machine the product amount is punched upon the card. The complete computation has now been made pertaining to the first card. The second card will have had its control number read out at the time the multiplicand was being read out from the preceding card. When computation and punching of the first card is completed the machine is ready to proceed with the computation pertaining to the second card.

It will be assumed that the control number read from the second card matched with the control number set up on the number 2 hand setup control device. Accordingly, on the first read out cycle pertaining to the second card, relay coil 2—E becomes energized (Fig. 15a). At such time, however, the first card has been advanced into the punching section of the machine and will have closed card lever contacts 91 (Figs. 2 and 15e). Closure of these card lever contacts effects energization of relay coil D and the energization of relay coil D shifts the three-blade contacts D—2 (Fig. 15a) to reverse position from that shown in the circuit diagram. The stick circuit for relay coil 2—E is maintained through the shifted D—2 contacts and through normally closed PC—1 contacts which contacts remain closed until late in the punching cycle. The energization of relay coil D will have also shifted relay contacts D—3 (Fig. 15a) to reverse position from that shown so that upon the closure of cam contacts FC—5 current cannot flow over

to the 2-CR magnet, through the shifted 2-E-2 contacts because the circuit will be interrupted at relay contacts F-4 which are now open. Later in the punching cycle, however, and towards the end of the punching operation on the first card cam contacts PC-3 will close and it is the closure of these contacts which brings about the energization of relay coil 2-CR and such energization is timed to occur to permit the reading in of the new multiplier amount on the next following counter cycle when a new comparison is being made with respect to the third card of the series.

It may be also explained that immediately following the energization of 2-CR when the circuit is set up through cam contacts PC-3, cam contacts PC-1 are reopened to break the holding circuit for any of the E relay magnets which have been energized, in this case the 2-E magnet.

It may be here explained that the resumption of card feed follows the punching operation, being initiated by the closure of cam contacts PC-4 (Fig. 15e) which contacts when closed re-energize the card feed clutch magnet provided the contacts A-2 are still closed.

The operations now follow pertaining to the second card of the series, that is the amount of the multiplier is read out from the MP-2 hand set up device, this multiplier amount is the multiplier for the multiplicand amount which is derived from the card and the product is finally punched back on the card.

It will now be assumed that the third card of the series contains a control number which matches with the control number set up on the C-3 hand setup control device. Under such conditions in place of reading out the multiplier from the hand setup device, the multiplier is read out from a selected multiplier zone of the card. The comparison of the control number read from the card with the number upon the C-3 control devices causes energization of relay coil 3-E and such relay coil remains energized during the computations on the second card. When punching operations on the second card are about completed, relay coil 3-CR becomes energized in the manner previously explained. Energization of this relay causes closure of contacts 3-CR-1 to 3 (Fig. 15b) and when such contacts close the multiplier amount can be read from one and the selected multiplier field of the card at the time the multiplicand amount is read from this same card. Likewise if the control number from the card matched with the control number set up on the C-4 hand control setup device there would be an ultimate energization of 4-CR and a closure of contacts 4-CR-1 to 3 so the other multiplier amount would be read from the other field of the card.

The foregoing description has described the manner of comparison and control for various operations where there was a matching of the control number. The operations will now be explained which occur when there is a failure or non-matching of the control number. Under these conditions it is desired that the card be immediately passed out of the machine and that all idle multiplying cycles, and punching cycles, be dispensed with. As explained before, when comparisons are made between the control number from the card with the control number on any of the hand setup devices, one of the magnets 1-CR, 2-CR, 3-CR or 4-CR will be en-

ergized. The energization of these magnets selectively controls the closure of contacts 1-CR-9, 2-CR-9, 3-CR-9, 4-CR-9 (Fig. 15e) and brings about the energization of relay coil F. If there is a failure of comparison there will be no energization of any of the CR magnets and there will accordingly be no closure of contacts 1-CR-9, 2-CR-9, 3-CR-9 and 4-CR-9. Accordingly, the relay coil F will not become energized and with relay coil F not energized relay contacts F-3 (Fig. 15e) will not become open. Accordingly upon closure of cam contacts FC-7 and with D-1 in shifted position there will be an immediate re-energization of card feed clutch magnet 85 so that as long as there is no comparison the card feed will be continued without interruption and the cards will feed directly through the punch to the discharge magazine. It will also be appreciated that without any energization of relay coil F, relay contacts F-2 (Fig. 15b) remain open and with these contacts F-2 remaining open there will be no read in of factors from the card or from the fixed setup devices, and there will be no reset of the LH accumulator and consequently there will be no setup of the cycle controller. If there is a failure of comparison on a series or a number of cards this direct and continued card feed of cards through the machine will continue until a comparison again is made. Upon such comparison being made there is a reinitiation of the operations which are attendant upon comparison.

In explanation of the feature just described, it may be explained that in previous multiplying machines, while provision was made for passing cards through the machine which did not directly bring about multiplying computations, such machines as heretofore constructed, did require that certain idle and unnecessary cycles of the machine should ensue for such cards. For example, in some machines where blank cards were presented there were required an LH to RH transfer and a reset of the LH accumulator. Such cycles may be aptly termed "dummy multiplying cycles". The present machine by the construction described dispenses with such dummy multiplying cycles. With the present machine when there is a failure of comparison punching operations are likewise automatically suspended. With the failure of comparison there will not be a closure of contacts 5-CR-17 and accordingly there is no energization of the punch clutch magnet 86. This control suppresses idle punching operations.

Last card removal

When the last card of a run of cards is punched relay contacts A-2 open up and accordingly energization of the card feed clutch magnet in the normal manner is prevented. Under these conditions to get the last card out of the machine the operator depresses the auxiliary start key 229 to reenergize the card feed clutch magnet and get the last card out.

In the foregoing description the operations have been described with the assumption that in a run of cards some cards contain control or code numbers to select a multiplier from the preset multiplier setup devices and that other records contained control or code numbers which selected multipliers from the multiplier factor data appearing on the records themselves. It will be understood, however, that the machine is also capable of effecting multiplier selection

on card runs where the multipliers are wholly selectively derived from the pre-setup devices for the plurality of multipliers. The machine may also be operated on card runs under code number control to effect multiplier selection where the multipliers are wholly selected from multiplier data on the cards. The machine likewise may be operated in the manner described where some code number multiplier selection is effected from the fixed setup devices and other code number selection of multipliers is effected from the multiplier data appearing on the cards. In short, the machine may be used either on fixed set up multiplier runs or with multiplier selection from cards or with mixed card runs where some multiplier selection is made from cards and other multiplier selection is made from the fixed setup devices. While four code number setup devices are shown, it will be appreciated that a greater or less number may be provided as desired and while multiplier selection is shown from two fields on a card a greater number of fields can be selected from by duplication of controls.

Timing diagram

Only brief reference need here be made to the timing diagram. In Fig. 16a the first three counter cycles delineated are the counter cycles in starting up the machine. On continuous card runs, after starting up, the operation begins with the third counter cycle on Fig. 16a and proceeds through the balance of the counter cycles delineated on Figs. 16a and 16b and then resumes on the third counter cycle on Fig. 16a. When control numbers do not compare the machine will operate with a succession of card cycles similar to the third counter cycle delineated in Fig. 16a, until a card comes along which does compare whereupon the operations shown on the following counter cycles on Figs. 16a and 16b will take place.

In some cases it may be desirable to use the machine without employing the auto-control feature and when the machine is used in this manner provision is made whereby the multiplier amount may be read from the record from which the multiplicand amount is derived or if desired the multiplier amount can be read from one of the fixed multiplier setup devices. If the multiplier amount is to be read from the card the shunt plug 213, pertaining to one of the sets of auto-control series comparing contacts related with the multiplier field, for example the shunt plug associated with the set of 211 contacts which control the relay coil 4—E, can be placed in the extreme right hand plug socket related with the right hand contact 211 and with this shunt plug in this position all of the 211 contacts will be completely shunted out of circuit. The relay coil 4—E will then become energized upon closure of cam contacts CC—1 and this will provide for the ultimate energization of relay coil 4—CR so that the entry of the multiplier amount can be effected into the multiplier counter. It will be understood, of course, that the shunt plug 213 related with the 3—E relay coil can also be used depending upon which field of the card is being read to derive the multiplier amount therefrom. The machine can be permanently plugged up, plug connections being made from sockets 218MP to the sockets wired to the 3—CR 1 to 8 contacts and plug connections made from sockets 219MP to the sockets wired to the 4—CR 1 to 8 contacts.

With such dual multiplier entries circuits, selected multiplier entries into the multiplier counter may be made by selectively plugging up the shunt plug 213 pertaining to the 4—E relay coil or the shunt plug 213 pertaining to the 3—E relay coil. When the multiplier amount is to be read from one of the fixed multiplier setup devices the 213 shunt plugs pertaining to relay coils 3—E and 4—E would be removed and left in the position shown in the circuit diagram. One or the other of the shunt plugs 213 pertaining to either relay coil 1—E or 2—E would then be inserted in position in the extreme right hand socket and operating under this condition the machine would derive a fixed multiplier alternatively either from the MPRO—1 hand setup readout or from the MPRO—2 hand setup readout device. Operating under these conditions a multiplier would be entered into the machine from one of the fixed multiplier setup devices for each record card handled.

With the foregoing construction it will be appreciated that the machine can operate to derive the multiplicand amount from each card passing through the machine and to derive the multiplier amount from a fixed multiplier setup device. Accordingly, a multi-denominational multiplier may be set up permanently and utilized for each of a series of separate multiplying computations.

What I claim is:

1. A record controlled multiplying machine including multiplying devices, record controlled multiplier and multiplicand entry receiving devices for controlling said multiplying devices, means for selecting which of a plurality of multipliers on a record is to be used to control said multiplier entry receiving means, means for reading code number data from records, means upon which a plurality of different groups of predetermined code numbers are available for comparison, means to compare read code number data with said predetermined plurality of groups of code numbers, and means controlled by said comparing means for controlling the operation of said selecting means selectively in accordance with which code number of a plurality of predetermined code numbers is read from the records which contain the factor data.

2. A record controlled multiplying machine with multiplying devices, factor manifesting means for controlling said multiplying devices and which receive data from records which pass through the machine, means for selectively entering into the factor manifesting means for the multiplier factor one of a plurality of multipliers which may be read from a common record, and code number control means controlled by predetermined code number designations upon the record containing the multipliers for selectively controlling which multiplier is to be used in a multiplying computation by selectively controlling the selective entering means for the multiplier factor, said code number control means including means affording a plurality of different groups of control numbers and means to compare a read code number with available code numbers and to correspondingly effect multiplier selection according to the matching of one code number group or another with the code number read from the record.

3. A multiplying machine, with code number reading means and code number matching means including means upon which a plurality of different groups of code numbers are set up, means upon which a plurality of multipliers are poten-

tially available, multiplying devices and means for controlling the same, multiplier selector means for selecting which of a plurality of potentially available multipliers is to control the means which controls the multiplying devices, and means for controlling the multiplier selector means by the code number matching means to correspondingly effect multiplier selection according to a matching of one or another groups of code numbers with the code number read from the record.

4. A record controlled multiplying accounting machine including means upon which a plurality of multi-denominational multipliers are potentially available, multiplying devices, means for controlling the operation thereof by a multi-denominational multiplier which is selected from the plurality of potentially available multipliers, multiplicand factor means for controlling the multiplying devices, means for controlling the selection of a particular multiplier from said plurality of potentially available multipliers, said last named means comprising code number reading means which read code number data from records, set up means for setting up control code number data which comprises a plurality of code groups, means operating upon a matching of code number data read from a record with one of the set up code number groups for automatically effecting a corresponding multiplier selection and means for entering the selected multiplier into the means for controlling the operation of the multiplying devices.

5. A record controlled multiplying accounting machine with factor entry receiving means for both factors, multiplying devices controlled therefrom, means directing the entry of multiplicand data from a record into its related receiving means, means providing a plurality of potentially available multipliers for entry into a receiving means for the multiplier factor, means upon which a plurality of different groups of control numbers may be set, multiplier selecting means cooperating with entry causing means for causing one of the plurality of potentially available multipliers to be received by the corresponding receiving means whereby the multiplying devices may multiply the received multiplicand by such multiplier, means for reading code numbers from records containing factor data, means for comparing read in control numbers with the plurality of groups of set up control code numbers and means controlled from said last named means upon a matching comparison with predetermined code numbers of the plurality of groups of code numbers for controlling the multiplier selecting means to cause a correspondingly related multiplier selection to be effected thereby.

6. A record controlled multiplying accounting machine with multiplier devices, factor receiving means for controlling said devices, means affording a plurality of potentially available multipliers for control of the receiving means for the multiplier factor and means for entering the multiplicand factor into its corresponding receiving means, set up means for a number of groups of control numbers, means for reading control numbers one from each record, means for comparing the read in control number with the set up groups of control numbers and means operable upon a matching comparison of the read in control number with one of the predetermined set up groups of control numbers for effecting a corresponding multiplier selecting operation and a deriving of a corresponding multiplier from the means upon which the plurality of multipliers are potentially

available and providing for the entry of the selecting multiplier into the multiplying receiving means.

7. A record controlled accounting machine with multiplying devices which compute with a multiplier which is selected from a plurality of potentially available multipliers, means upon which said plurality of multipliers are potentially available, a multiplier receiving means for the multiplier to be used in effecting computation by the multiplying devices, setup means for a plurality of code numbers, means for reading code numbers from each record, means for comparing code numbers as they are read one from each record with the plurality of set up code numbers and means controlled by said last mentioned means for effecting multiplier selection from the plurality of potentially available multipliers for control of the multiplier receiving means in accordance with the matching of code numbers and means for passing records through the machine without computation upon the complete non-matching of code numbers.

8. A record controlled multiplying accounting machine with multiplying means, factor entry controlled receiving means, means for causing the entry of the factors thereinto, setup means for multiplier data, means to derive multiplier data from a record, means upon which a plurality of groups of code numbers may be pre-set, means to read code numbers from records, code number matching means controlled by code numbers read one from each record and by the preset groups of code numbers, multiplier selector means for selecting multiplier data for entry into the multiplier factor entry receiving means and for controlling the entry of such selected factor by the entry causing means, said selector means being controlled by the code number matching means and being effective upon the matching of a read in code number with one or another of the predetermined preset groups of code numbers to select corresponding multiplier data from a record or to select other corresponding multiplier data from preset multiplier set up means.

9. A record controlled multiplying accounting machine with multiplying devices, means for controlling the same, including factor receiving means at least one of which derives a factor from a record, means upon which code members may be set up, means for reading in code numbers one from each record, means for matching such read in code numbers with set up code numbers to determine whether the read in number corresponds with the set up code numbers, initiating means for the multiplying devices for initiating multiplying operations, control means therefor controlled by the matching means for allowing operations of the multiplying devices upon matching of code numbers and preventing operations upon non-matching of code numbers.

10. In a multiplying machine for multiplying a multiplicand amount derived from each record by a multiplier amount including multiplying devices and means for controlling the same, said means including a record controlled multiplicand entry receiving means and receiving means for the multiplier factor and means for controlling the multiplier factor receiving means and thereby controlling the multiplying device, said last mentioned means including manually presettable means adapted to set up a multi-denominational multiplier which is to be used for each of a series of computations involving multiplicand amounts derived from each of a series of records.

11. A multiplying machine including multiplying devices for multiplying a multiplicand amount derived from each record handled by the machine by a multiplier amount, record controlled
 5 multiplicand entry receiving means and multiplier factor entry receiving means for controlling the operation of the multiplying devices, manually
 10 presettable means upon which a multi-denominational multiplier may be set up for controlling the multiplier factor entry receiving means and
 thereby controlling the multiplying devices, means for also controlling the multiplier factor receiving means and thereby controlling the multiplying
 15 devices by a record entered multiplier and means for selectively controlling which of the last two mentioned means is to be effective so that
 a multiplier may be derived from the aforesaid set up means or from each record.

12. A record controlled multiplying accounting machine, including multiplying devices, means
 20 controlling the operation thereof including multiplier receiving means, means upon which a plurality of multi-denominational multipliers are
 potentially available, means for selecting a particular multiplier from said plurality of potentially
 25 available multipliers for entry into the multiplier receiving means, said last mentioned means comprising code number reading means which
 read code numbers from records, means upon
 30 which a plurality of groups of predetermined code numbers are available, matching means for matching the read code numbers with the plurality
 of groups of code numbers, and means controlled by the matching means upon matching of
 35 the read in code numbers with one or another of the different groups of predetermined code numbers for automatically effecting related multiplier
 selection.

13. A record controlled accounting machine, including means for reading factor amount data
 40 and means for reading control number data from each record, setup means upon which a plurality of multipliers may be set up and from which said
 multipliers may be potentially available, receiving means for the multiplier and multiplicand, said
 45 multiplicand receiving means receiving the multiplicand amount from a record under the control of the factor amount reading means, said receiving
 means for the multiplier being adapted to receive an entry of a multiplier selectively derived
 50 from the plurality of multipliers potentially avail-

able upon the setup means therefor, multiplying devices controlled by the multiplier and multiplicand receiving means, selecting means for
 selecting which multiplier is to be entered into the multiplier receiving means from the setup means,
 5 means for causing entry of the selected multiplier, means controlling the aforesaid selecting means comprising code number control means including
 hand setup means for a plurality of sets of control number data, comparing means co-
 10 operating with said last mentioned means and with the means for reading control numbers from a record for comparing read in control number
 data with hand setup control data and for making a corresponding multiplier selection and for
 15 determining which multiplier setup means is to be effective, the aforesaid code number control means including cooperating initiating control
 means to automatically initiate selection and entry of a multiplier after a comparison has been
 20 made.

14. A record controlled multiplying accounting machine, including record reading means for
 factor amount data and for code number data, data receiving means for both factors, multiplying
 25 devices controlled by said receiving means, one receiving means for one factor receiving an amount from a record under the control of record reading
 means therefor, hand setup means in the machine for a plurality of multipliers, means including
 30 selecting means and entry causing means for controlling the receiving means for the other factor so that multiplications may be effected with
 a selected one of a plurality of multipliers derived from the setup means for such plurality of multi-
 35 pliers, and code number control means comprising means upon which a plurality of groups of pre-determined code numbers are available,
 means cooperating with said last mentioned means and with the code number data reading
 40 means for matching read control data with available control data and control means under the control of the last mentioned means and co-
 operating with the aforesaid selecting means so that a selected multiplier setup means, related
 45 to the matched code number group will be rendered effective for controlling the multiplier receiving means and thereby the operation of the
 multiplying devices.

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