

March 10, 1942.

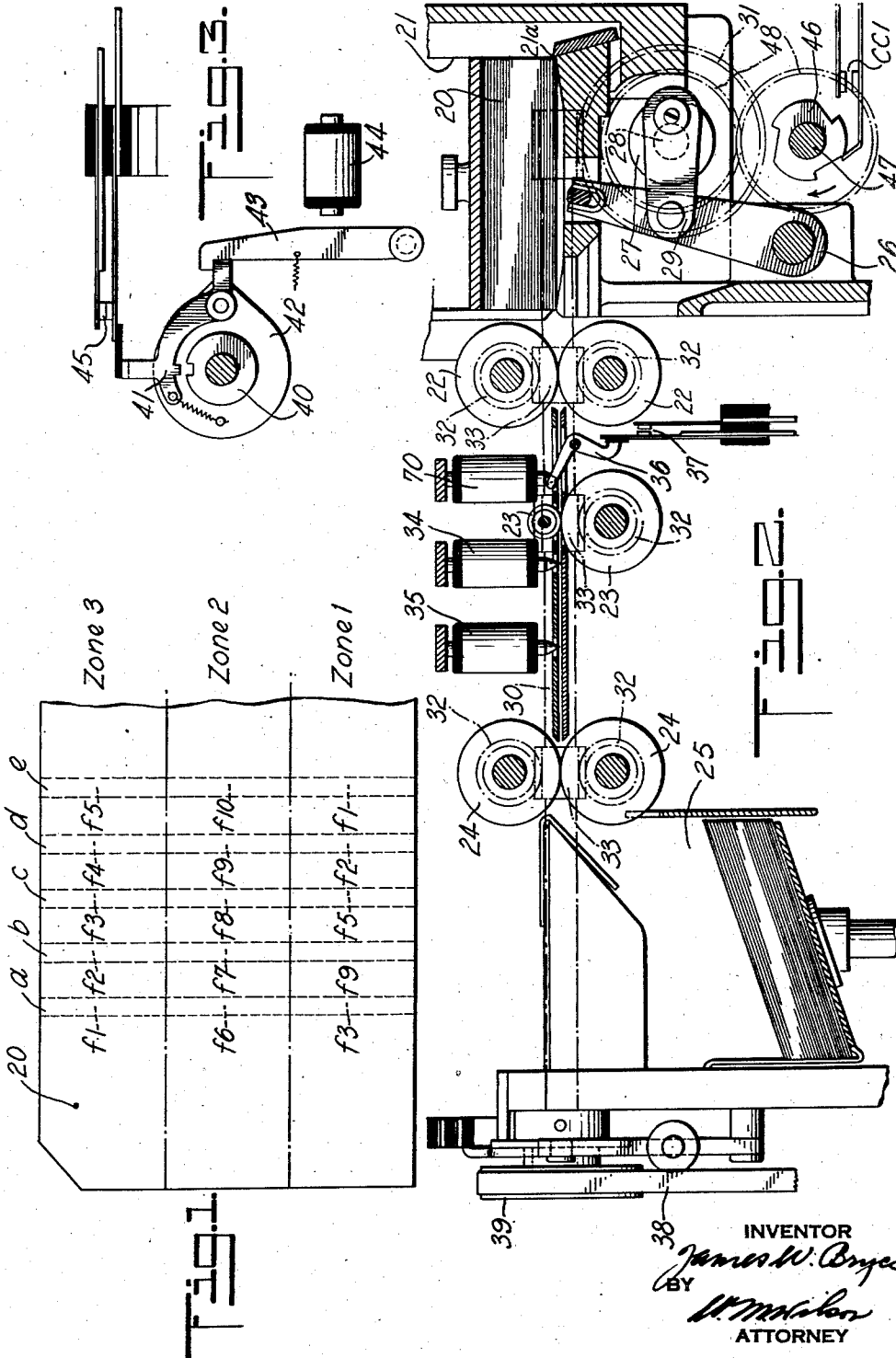
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2,275,609

APPARATUS FOR VERIFYING STATISTICAL DATA

Filed July 25, 1939

9 Sheets-Sheet 1



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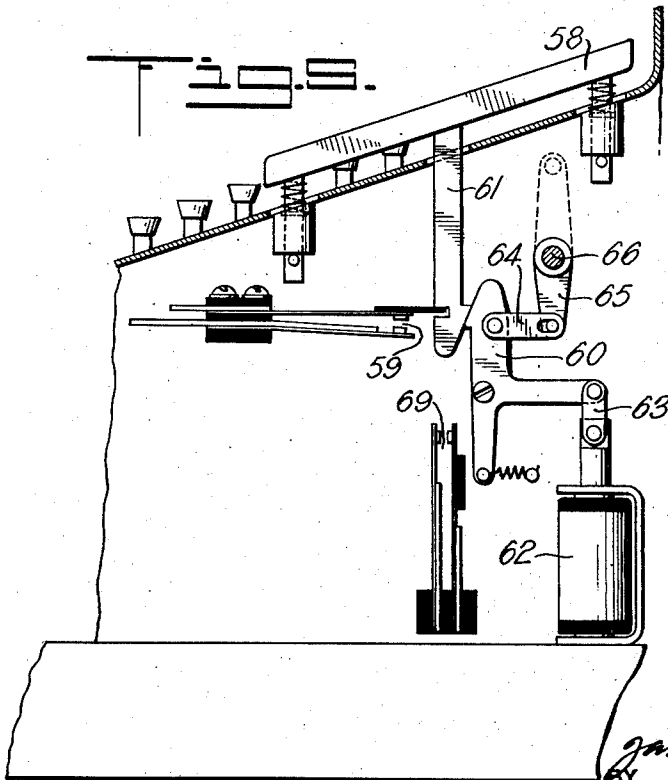
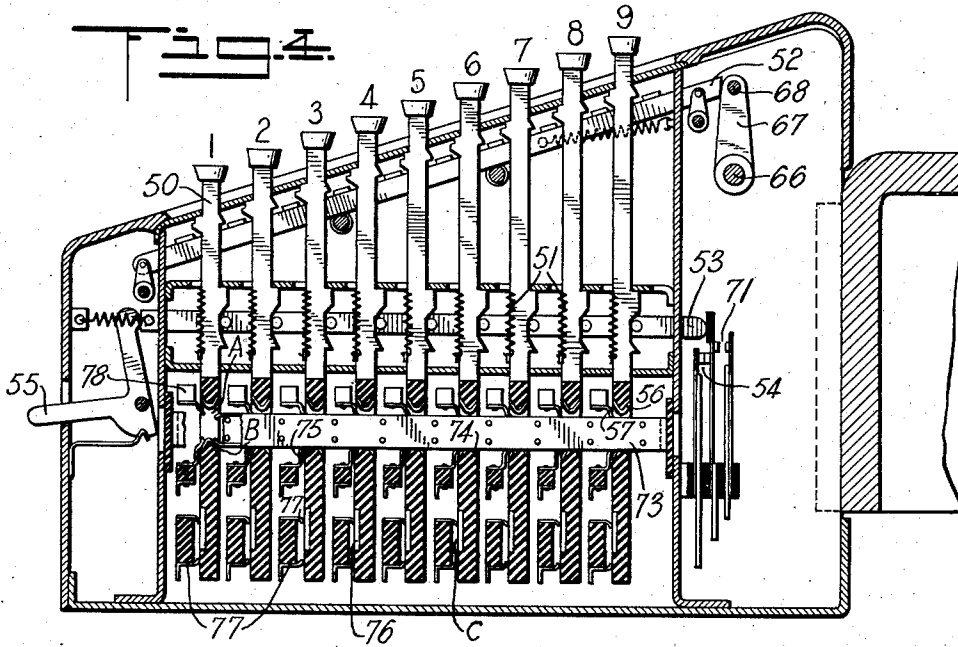
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9 Sheets-Sheet 2



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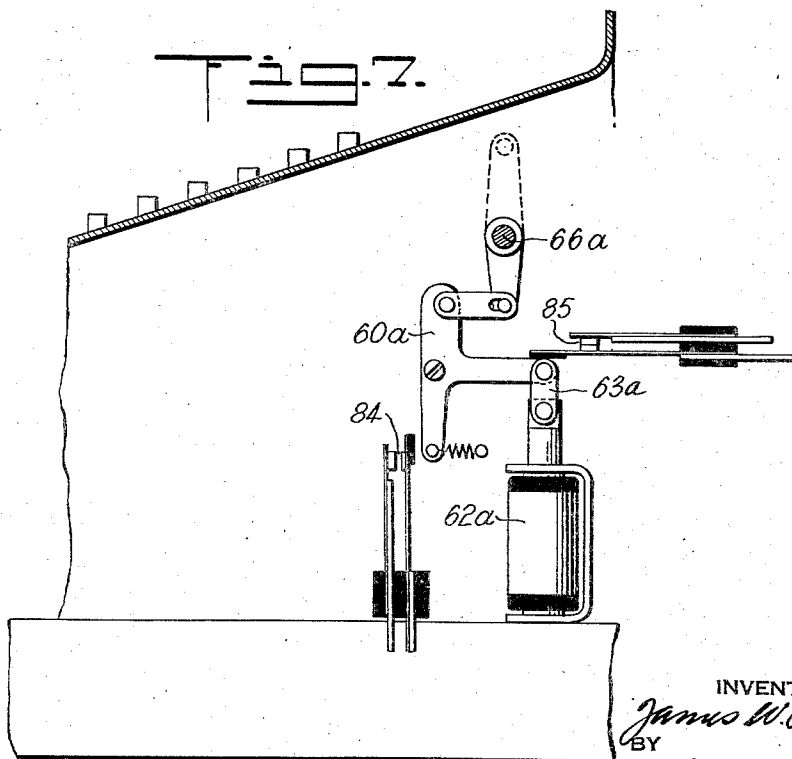
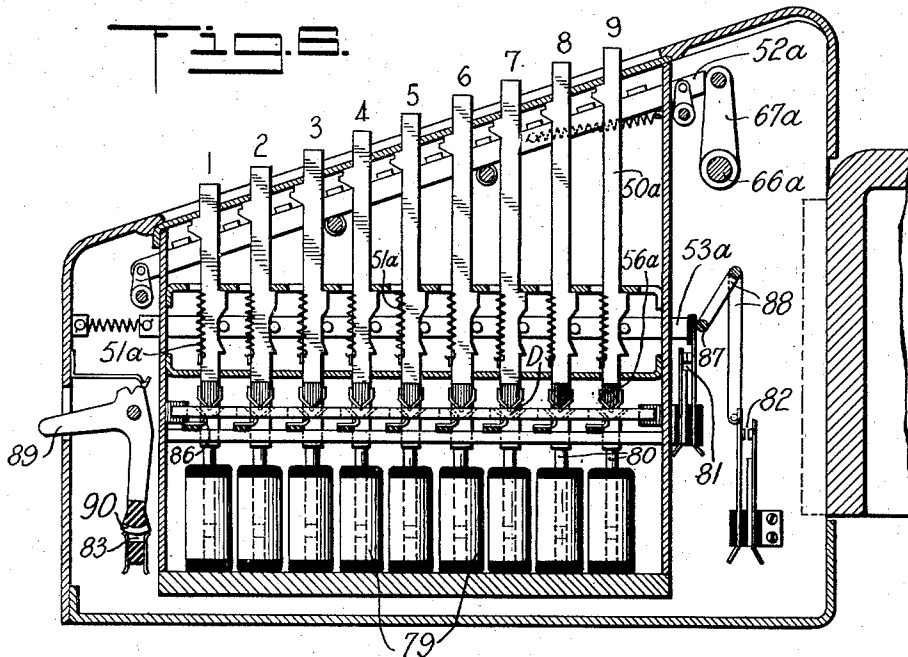
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APPARATUS FOR VERIFYING STATISTICAL DATA

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9 Sheets-Sheet 3



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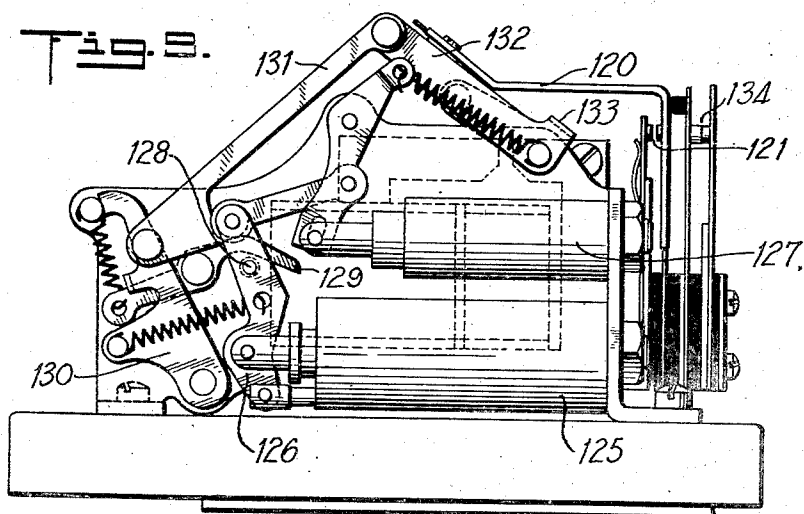
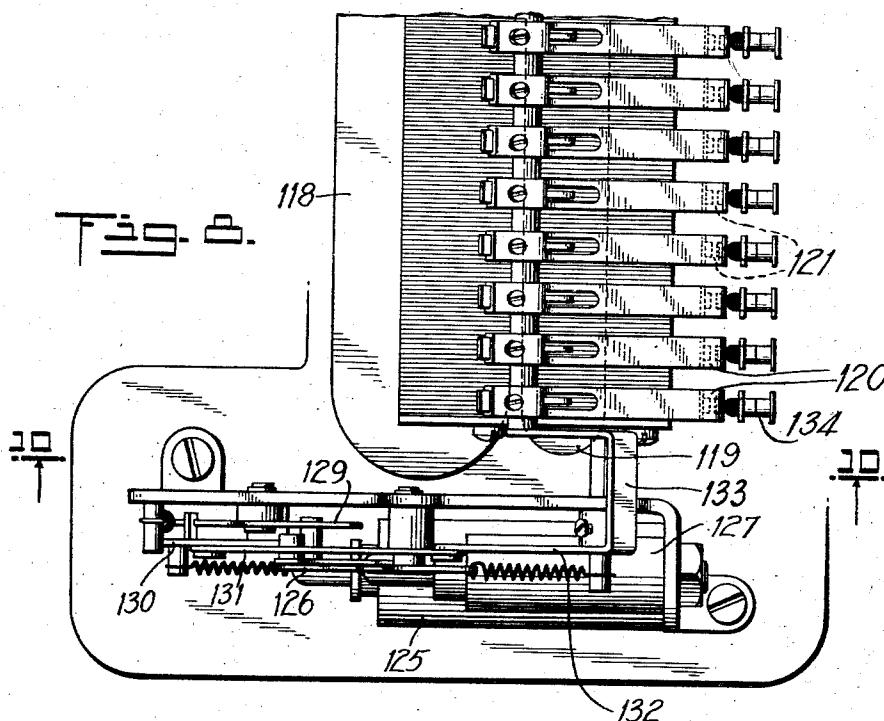
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APPARATUS FOR VERIFYING STATISTICAL DATA

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Fig. 10.

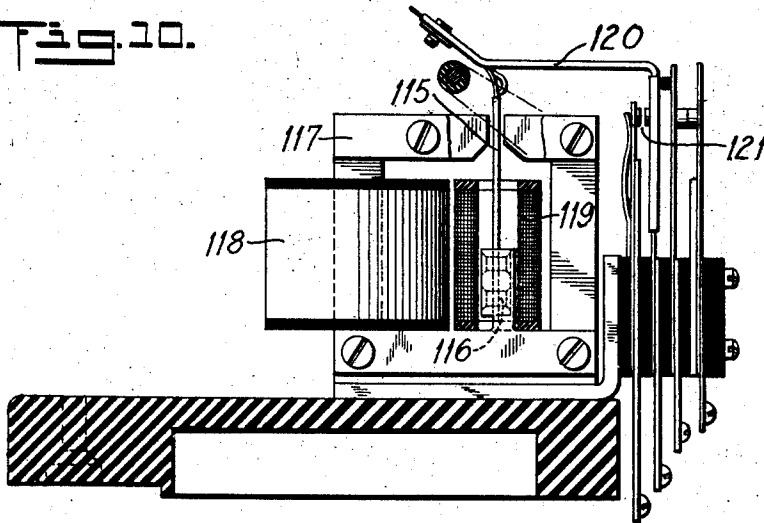
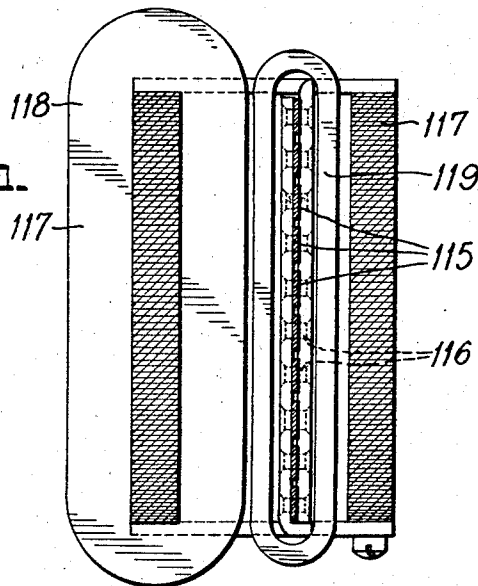


Fig. 11.



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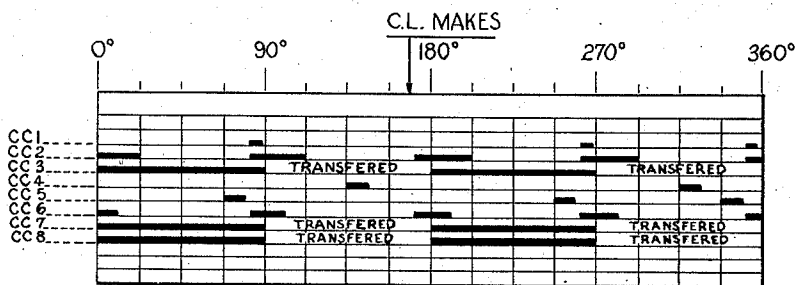
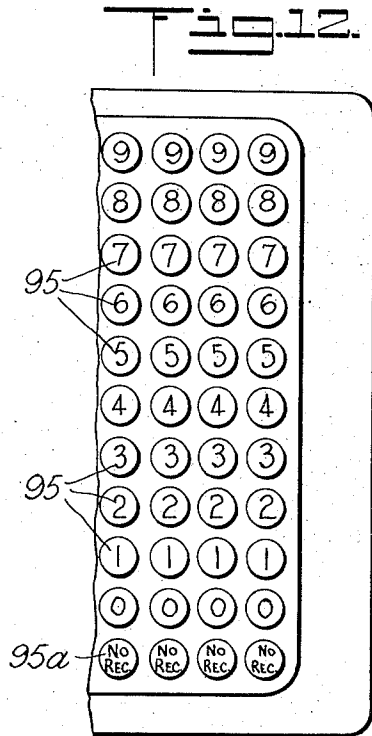


Fig. 13.

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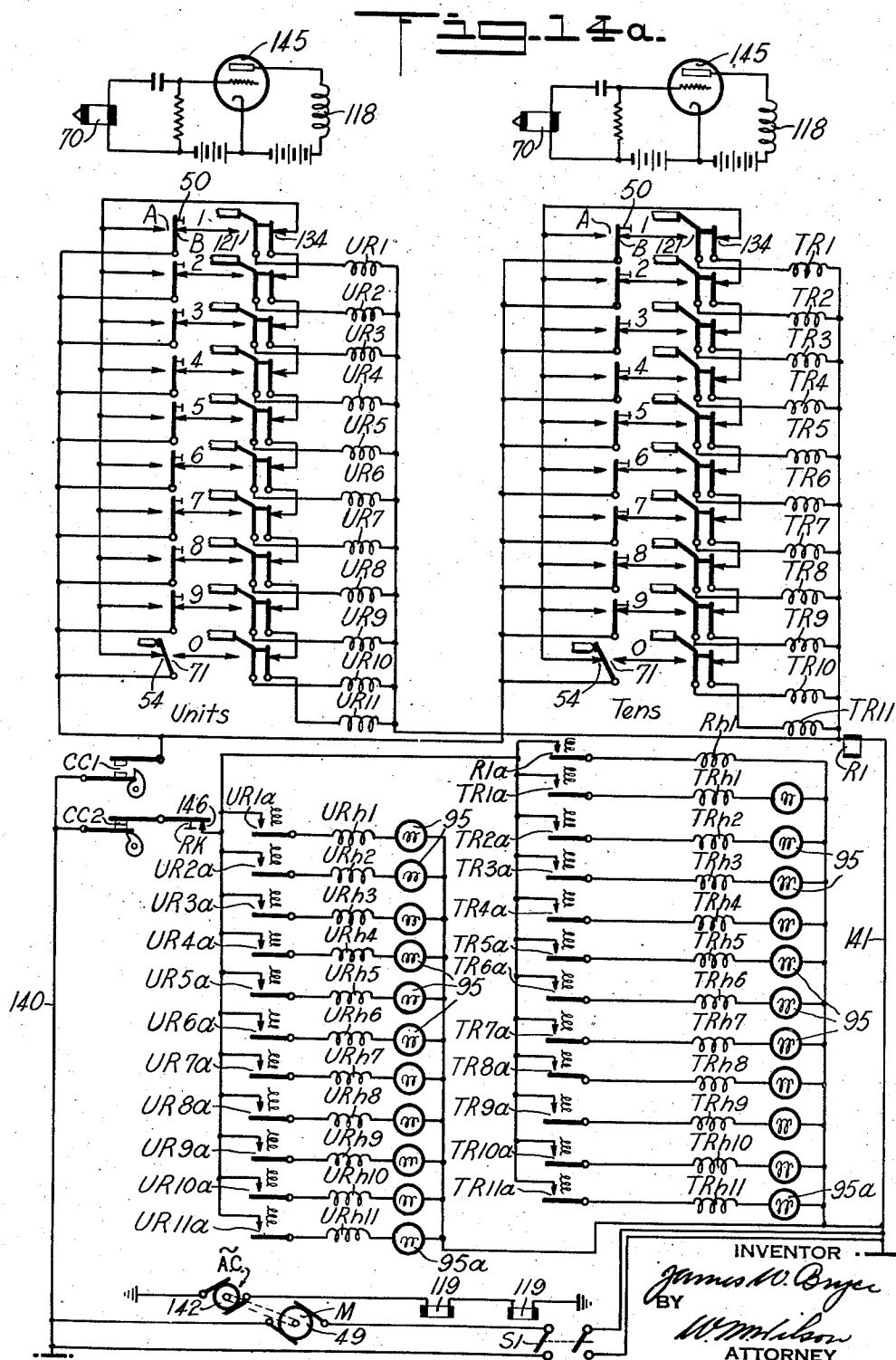
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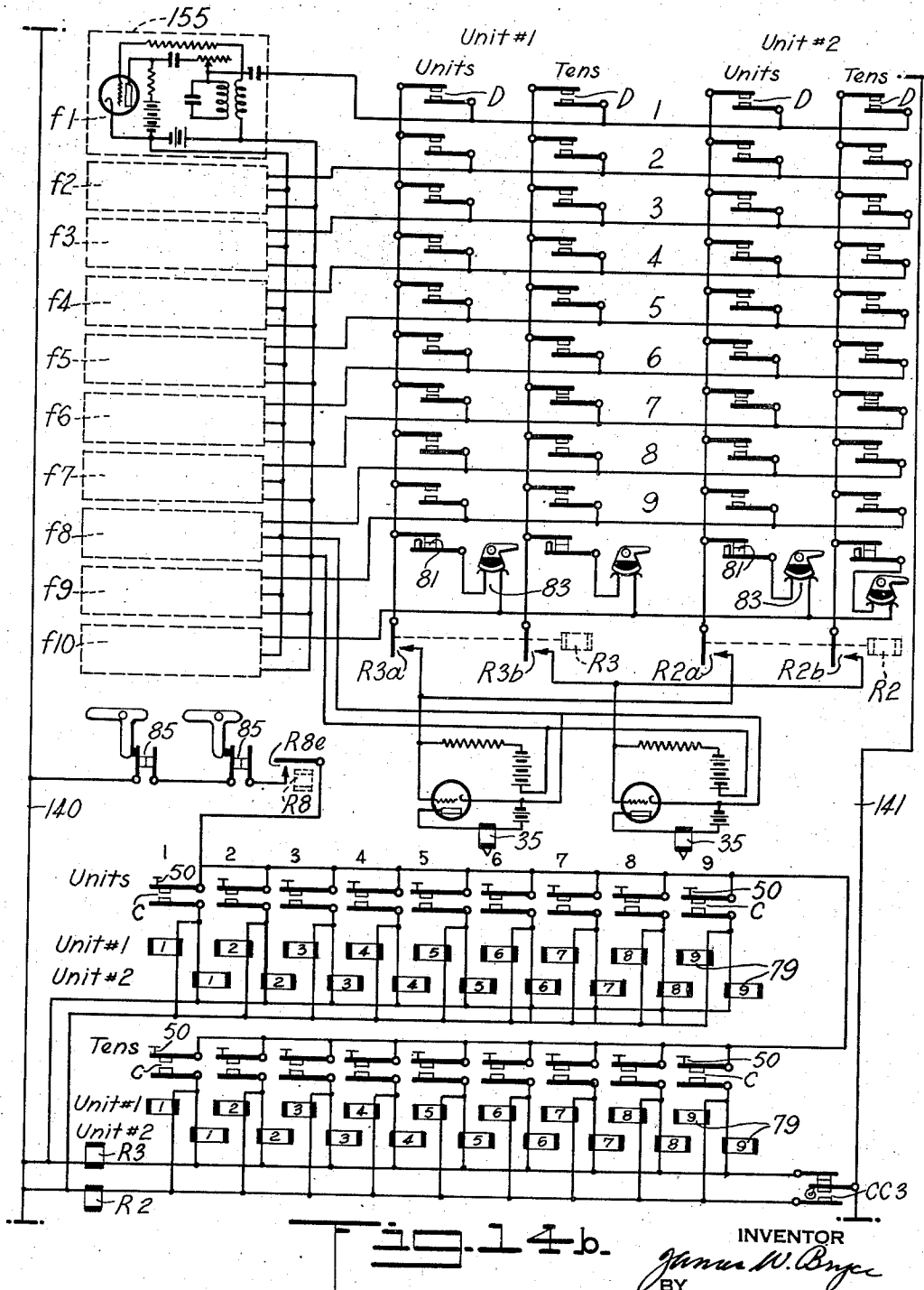
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9 Sheets-Sheet 8



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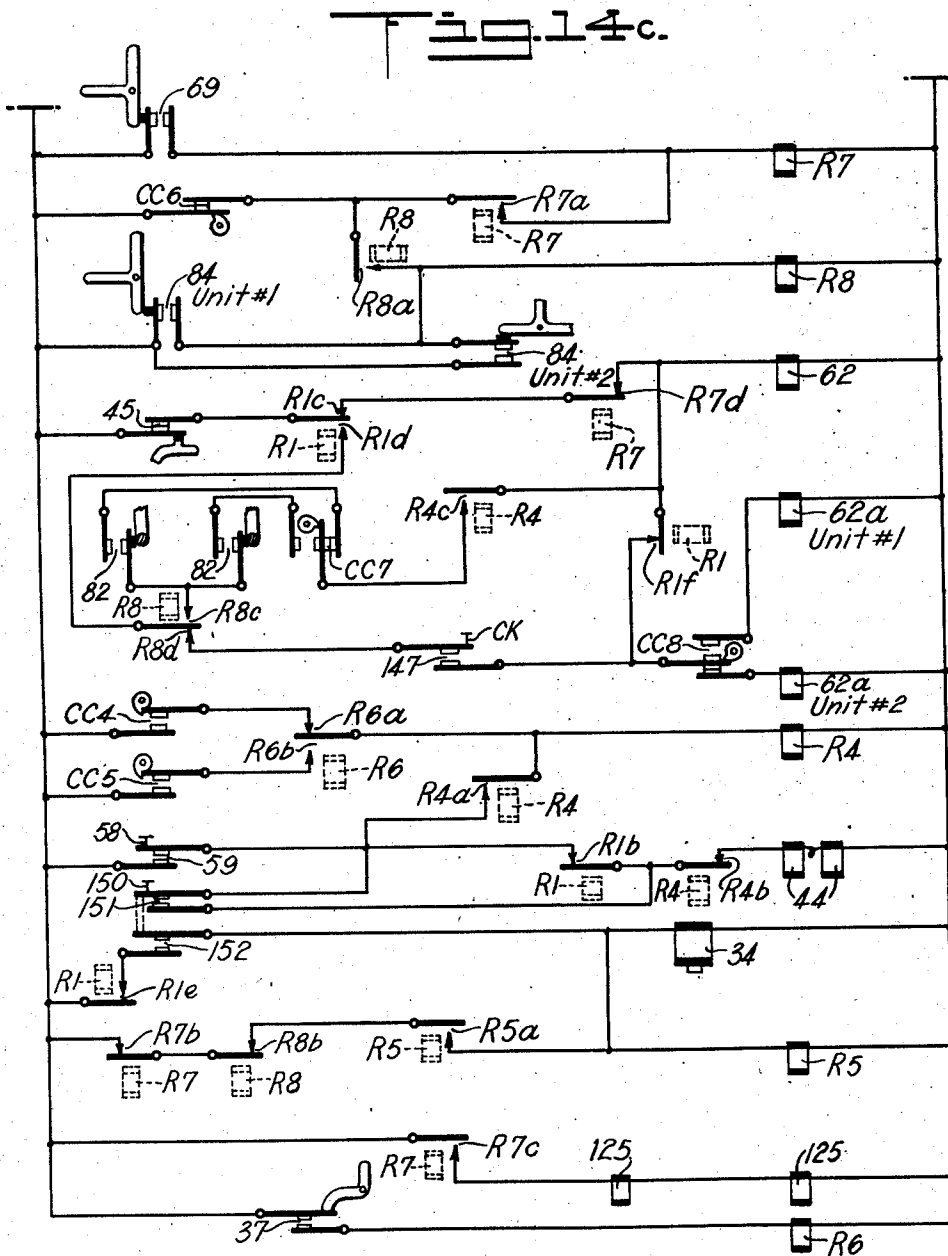
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2,275,609

APPARATUS FOR VERIFYING STATISTICAL DATA

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Application July 25, 1939, Serial No. 286,442

5 Claims. (Cl. 73—51)

This invention pertains broadly to statistical systems and relates more particularly to improvements in machines for verifying statistical data formed on records which data is represented by magnetic recordings.

It is now suggested to provide the control records with magnetic impressions for representing the data, which impressions are formed by subjecting the records to magnetic fields of varying intensities. Due to the characteristics of the records, which are formed from suitable magnetizable materials, the magnetic impressions formed thereon can be retained for any desired period and utilized for controlling the statistical operations of the machines.

In the present application disclosure is made of records adapted for controlling the statistical operations of machines in accordance with the magnetic impressions on the records, which impressions are not differentially located on the records in various index point positions but instead are formed magnetically by being subjected to magnetic fields, the lines of force of which are varied at different frequency rates; thus, the impressions retained therein are formed in different frequency ranges for representing the different data. The magnetic impressions are similarly positioned on the records with respect to each other so that in the statistical systems differentiation of the data designations is not made by the disposition thereof at different positions on the record.

In order to illustrate and describe the invention briefly, provision is made whereby recordings of the impressions in different frequencies are designated to represent the different data values. For example, a magnetic recording in a frequency of the order of "f1" may represent the numerical data "one," a recording in frequency "f2" represents the number "two," etc.

Provision must be made in such systems employing the type of records just referred to whereby verification of the data recorded upon the records can be made. The subject matter of the instant application relates solely to a machine for verifying the data on the records which is in the form of magnetic recordings of different frequency values.

Accordingly an object of the present invention resides in the provision of means whereby data represented by the sensed magnetic recordings is compared with preselected data to determine whether or not the compared data is in conformity.

To accomplish this object and other objects to

be set forth later provision is made whereby the different frequency values of the recordings are sensed to select individual control circuits which are representative of the sensed data. A plurality

of these control circuits are provided for each order or columns of data sensed. A plurality of tuned reed relays are provided, one for each order, which are subjected to the oscillations of different frequencies initiated by the sensing means. Upon selection of the individual control circuits provision is made to control these circuits in accordance with the preselected or comparing data; that is, a plurality of operable keys are provided for setting up the selected verifying data to which the sensed data should conform. The selected keys are effective to open those said control circuits which represent the selected data and in the event the selected and sensed data are not in agreement these control circuits are effective to control a non-verifying control mechanism.

In such cases where the compared data is in disagreement provision is made to transfer the said setting of selected data to data storage units for purposes to be set forth. The non-verifying control mechanism upon operation calls into action control means for wiping out the erroneous magnetic recordings and then during the following cycle automatically effects recording of the correct data on the record where the previous erroneous recording was formed.

It will be seen that while one record is being verified, operations are being effected to wipe out the erroneous recordings on the preceding record, and effecting correct recording on a record sensed two cycles earlier. For this reason, a plurality of data storage units are provided. Transfer of the correct data is made in one of the units while the erroneous data is erased, and recording is effected upon a record at the same time in accordance with the data stored in another one of the said units.

Therefore, another object of the present invention resides in the provision of means for automatically sensing the recorded data, checking it with preselected data and erasing the said data a cycle later whenever the said data is in error.

Another object of the invention is the provision of means for automatically recording the correct data upon the records after the erroneous data has been deleted.

Another object is the provision of means for effecting the sensing operations, the verifying operations, the deleting operations and recording operations concurrently on different records.

Still another object is the provision of means

for verifying the data recordings and automatically transferring the verifying data to storage means which is then later effective to control the data recording operations.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a detail view of a fragmentary section of a control record.

Fig. 2 is a section showing the record feeding means and record sensing, erasing, and recording means.

Fig. 3 is a detail of the control clutch of the feeding means.

Fig. 4 is a section of the data verifying keyboard section.

Fig. 5 is a detail of the start key and reset means of the keyboard section shown in Fig. 4.

Fig. 6 is a section of a data storage unit.

Fig. 7 is a detail of the keybar reset means of the unit shown in Fig. 6.

Fig. 8 is a plan view of a tuned reed relay unit.

Fig. 9 is a front elevation of the relay unit shown in Fig. 8.

Fig. 10 is a section along the lines 10-10 of Fig. 8.

Fig. 11 is a detail of the unit shown in Fig. 10.

Fig. 12 is a diagrammatic view of the error indicating lampbank.

Fig. 13 is a timing chart of certain control elements of the machine.

Figs. 14a, 14b, and 14c when taken together in the order named form a wiring diagram of the machine showing the circuit connections of the control elements.

Control records

Referring now to Fig. 1, a preferred type of control record is shown to comprise a record card 20 which is similar to the well known type of record cards adapted for use in the Hollerith statistical system. The record card may comprise a sheet of suitable non-magnetic material, such as paper, which is impregnated with granular magnetic material such as iron filings; or, if preferred the record card can be made by depositing finely divided metal powder in the paper pulp so as to be incorporated therein before the manufacture of the magnetizable paper stock. Another type of record card which can be used is one which comprises a multi-ply card having a wafer or foil of magnetic material formed between two layers or plies of suitable paper stock.

The record card shown in the instant application is a three zone record so that the data designations can be formed in any of the zones desired. The individual zones are indicated in Fig. 1. Each zone is sub-divided into individual fields or columns which are designated by the reference characters *a*, *b*, *c*, etc. It is noted that the said fields or columns extend vertically across the entire zone. During recording operations the magnetic fields are directed to the desired fields to subject these portions of the zones to the varying lines of force initiated by the recording magnets. The different magnetic impressions or recordings formed on the records are then retained in the particular fields designated in Fig. 1. In order to represent different data the recordings are formed in different frequencies, for example, for the numerical data "1 to 9" the record-

ings in the individual fields are formed in individual frequencies *f*₁ to *f*₉ to extend vertically across the zone to represent the different numerical values. The different data designations are indicated generally in the figure by the representations *f*₁ to *f*₁₀ which allude to the frequencies of the recordings or impressions formed in the related columns. The number represented in zone 1 by the magnetic recordings indicated is 39521, in zone 2 the number represented is 67890, and in zone 3 the number is 12345, thus it is seen that a record card is provided with three individual records or groups of recordings.

Record feeding and recording means

Referring now to Fig. 2 the record card feeding means shown is similar to well known types of card feeding mechanisms. For this reason the abbreviated disclosure and description is believed sufficient. For detailed structural disclosure reference may be made to U. S. Patents Nos. 1,741,985 and 1,741,992. The record cards 20, disposed in the magazine 21, are fed singly from the stack by the card picker 21a to be advanced successively to suitably disposed pairs of feed rolls 22, 23, and 24 respectively and thence to the discharge hopper 25. The card picker is actuated by the reciprocating arm 26 which is positioned by the disk 27 (secured to shaft 28) by means of the connecting link 29, one end of which is eccentrically mounted on the disk. The shaft 28 is driven by the main shaft 30 by means of worm gearing secured to both the said shafts and indicated generally by the reference character 31. The said pairs of feed rolls 22, 23 and 24 are also rotated by the main shaft 30 by means of the individual worm gears 32 secured to the individual feed rolls and individual worm drives 33 secured to shaft 30. In this manner the cards are advanced from the magazine past the sensing magnets 70, wipe-out magnet 34 and recording magnets 35 at a constant rate of speed and in the order named. It is seen as the cards are fed from the magazine to the feed rolls they first pass under the individual sensing or reading magnets 70. A single reading magnet is provided for each column on the record to be sensed so that whenever the records are passed under the reading magnets the magnetic recordings are effective to influence the said magnets in accordance with the frequencies of the recordings. Next, the cards are advanced past the wipe-out magnet 34 (which is sufficient in length to extend along the full length of the card). The said wipe-out magnet is provided for the purpose of conditioning the card for recording purposes and for erasing or neutralizing any previous unwanted recording on the record cards. As the cards are advanced they are fed past the recording station whereat the recording magnets 35 are disposed, one magnet for each columnar position to be recorded. It should be noted that just before the cards pass under the reading magnets they are effective to actuate the card lever 36 and cause the contacts 37 to be closed. It should be stated that the spacings of the said magnets is equivalent to one zone of the described records.

Means for driving the main shaft 30 is shown in the form of the drive belt 38 and pulley 39 adapted to be driven by the motor 49 (Fig. 14a). Electromagnetically controlled clutch means are provided to control the driving of the main shaft and comprises a well known type having a clutch drive disk 40 (see Fig. 3) which is secured to the

drive pulley 39. A pawl member 41 pivotally mounted on the drive plate 42 (which plate is secured to shaft 30) is held out of engagement with the disk 40 by means of the latch lever 43 which is shown as an integral part of the armature of control magnet 44. Upon energization of the said magnet the latch lever is displaced to release the pawl and drive plate thus permitting the pawl and drive disk to be engaged and rotated by the drive pulley thereby rotating the main shaft to which the drive plate is secured. Contacts 45 are arranged and suitably disposed so that they are closed by the pawl member 41 when in the position shown in Fig. 3, and opened when the pawl and drive disk are engaged.

It should be stated that a group of cam controlled contacts CCI to CC8 are provided (see wiring diagram) one of which is shown suitably positioned so that the operation thereof is controlled by the associated cam 46 which is secured to shaft 47 and rotated by shaft 28 by means of the gearing generally designated 48.

Keyboard section

Referring now to Figs. 4 and 5 the data verifying keyboard section which is a well known type and illustrated in U. S. Patent No. 2,147,626 will be described briefly. The purpose of the data verifying keyboard is to provide means for storing or setting up selectively by means of the manually operated keys the data which is to be compared with the recordings formed on the records. The keyboard is of the typical 81 key type having nine keys in each denominational order. The keyboard need not be limited to nine orders of keys but is provided with as many orders as there are columnar positions on the record cards. Provision is made (as is usual in the 81 key type) whereby upon depression of the individual keys 50 against the action of the associated springs 51 they are held latched in the depressed positions by the related latch bars 52 (of which one for each order of keys is provided). In addition thereto an individual control or zero bar 53 is provided for each order of keys so that upon depression of any key in the selected denominational order the related bar 53 is cammed to the right as viewed in Fig. 4 by suitable camming edges provided on the key shanks to open the associated contacts 54. For each zero bar an auxiliary positionable control lever 55 is provided for the purpose of opening the related zero contacts 54 and closing the contacts 71 in the order or column desired, the reason for which will be understood as the description progresses. Each keybar is provided with a V-shaped conducting portion 56 adapted to engage, upon depression of the associated key, the related contact strip 57. In this manner the contact strip 57 is connected to a common bus bar 73 by means of the conducting portion 56. Provision can be made in the machine to mount the corresponding digital contact strips 57 to a common bus bar 78. Each keybar is also provided with a second V conducting portion 74 which normally connects the conducting strip 75 to the common bus bar 73 but upon depression of the keybar conducting portion 74 breaks the said connection. The conducting elements described in effect are transfer contacts using the bus bar 73 as the common connection. In connection with the wiring diagram these connections will be referred to as contacts A and B, the former representing the make contacts and the latter the break contacts. In addition thereto each keybar is pro-

vided with an elongated conducting strip 76 which is effective, when the keybar is depressed to bridge the conducting strips 77 and thus close the circuit connected to the said strips 66, these connections will be referred to as contacts C in the wiring diagram.

The verifying operations of the machine are initiated by the manual operation of a motor bar 58, the depression of which causes the contacts 59 to be closed. By means of a latch lever 60 the depressed bar is maintained so, due to the engagement of the stem 61 of the bar with the said latch lever, upon completion of the verifying cycle means are provided, such as solenoid 62, to be energized to restore the motor bar to its normal position. It is seen that energization of the solenoid causes pivoted latch member 60 to be partially rotated in a clockwise direction upon displacement of the solenoid plunger by means of the link 63 thereby releasing the latched stem 61 of the motor bar.

During the said rotation of latch member 60 and after the release of the motor bar the link 64 causes lever 65 to be partially rotated and in turn to rotate the shaft 66 in a counterclockwise direction. Rotation of shaft 66 effects displacement of the arm 67 (secured to said shaft) and transverse bail 68, which bail, upon being rocked, thrusts the latch bars 52 forwardly (to the left as viewed in Fig. 4) releasing any depressed keys which have been latched down. Also during the latter movement of latch member 60 the associated contacts 69 are closed for purposes to be described presently.

Referring now to Figs. 6 and 7, a keybar storing unit is shown which is similar to the keyboard section just described, however, in the present unit the keybars are depressed by electromagnetic means, such as solenoids 79 instead of being manually depressed. The purpose of this unit of which there are two will be understood when the circuit diagram is described, therefore, for the present it will suffice to state that the unit shown in the said figures comprises a data storing unit for purposes of substituting correct recordings on the records when it is determined during comparing operations that the data previously recorded on the records is in error.

The keybars 50a are adapted to be depressed upon energization of the related solenoids, the plungers 80 of which are suitably secured or linked to the said keybars. Upon depression thereof the related latch bars 52a are effective to hold them depressed causing the V conducting portions 56a to engage the individual conducting strips 86 which connection will be referred to as contacts D in the wiring diagram. The positioned keybars are also effective to open the associated zero contacts 81 whenever one of the keybars of each order is depressed. The zero bars 53a are also effective in this unit to engage a common bail 87 to displace the bail to the right as viewed in Fig. 6 for effecting closure of the contacts 82 by means of the cooperating arms 88. An additional set of zero contacts 83 are provided for each column or order of keybars and can be open or closed as desired by positioning the related lever 89 which is provided with a conducting segment 90 adapted to bridge the contacts 83 when in the position shown in Fig. 6. The purpose of these additional zero contacts are for suppressing the recording of zeros in undesired columns.

The depressed keybars are released whenever the solenoid 82a is energized causing the latch

bar 52a to release all the depressed keys similarly as described above. Upon energization of the said solenoid and the lowering of the link 63a suitably disposed contacts 85 are opened, and contacts 84 are closed due to the rotation of latch member 60a.

Tuned reed relays

Referring now to Figs. 8 to 11, the tuned reed relays will be explained briefly, if desired, a more detailed description will be found in U. S. Patent No. 2,113,617. A plurality of vibratory reeds 115 are provided to be anchored individually to extension members 116 of yoke 117 so that the free ends of the reeds can be vibrated in an air gap provided in the yoke. The said extension members engage the reeds at different positions in such a way that each reed has a different but definite period of vibration.

When electrical impulses or oscillations of different frequencies are impressed upon the main coil 118 which surrounds one of the sides of the yoke the reeds tuned to such frequencies are vibrated. A biasing coil 119 is provided to surround the reeds, which coil is constantly energized by a low frequency current for normally holding the reeds in vertical positions so that the free ends thereof are held steady and substantially in the center of the air gap in the yoke.

Individual contact arms 120 are provided for each reed and are arranged so as to be supported by the free ends of the reeds as shown so that the related contacts 121 are normally held open and contacts 134 are normally closed. Upon energization of the main coil 118 and upon vibration of the selected reeds 115, the related contact arms 120 drop from the free ends of the reeds thereby causing the said associated contacts 121 to be closed and contacts 134 to be opened.

Reset means are provided to restore the contact arms from the said displaced positions to the normal positions, resting upon the free ends of the associated reeds as shown, and generally comprises a reset magnet 125 which upon energization causes arm 126 to be partially rotated in a clockwise direction. This action is retarded slightly by the dash pot 127 and associated linkages provided to cooperate with the arm 126. As the said arm approaches its limit of travel in a clockwise direction, the stud 128 which is formed on the arm cams pawl 129 out of a latched position to release the spring urged arm 130. The released arm 130, by means of link 131, causes the arm 132 of a U-shaped bracket 133 to be raised to lift by means of the bracket, the displaced contact arms 120 sufficiently to permit the reeds to be restored to a supporting position for the related arms.

Error indicating means

Referring now to Fig. 12, an error indicating device is shown to comprise a series of lamps 95 with indicating data formed thereon such as the numerical data "0 to 9." If desired the indicating lamps can be disposed beneath translucent figured stencils so as to indicate the selected numbers or data when the lamps are energized. The number of columns of lamps provided is determined by the number of columns of recordings provided on the record cards. In each column, eleven lamps are provided, ten for representing the numerical data and the eleventh to indicate that no recording has been made on the card, the

latter are indicated by the reference character 95a.

Operation of machine

It is necessary to condition certain of the control circuits when starting the verifying machine before the actual verifying control circuits are called into action, for example, it is desired upon initial operation of the machine to clear the settings of the various keyboard sections of the machine and to restore the tuned relay contacts a normal condition. These circuits are as follows: Upon closure of the main switch S1 the machine motor 49 is connected to the power supply conductors 140 and 141 and the biasing coils 119 of the tuned reed relays are energized constantly by the low frequency current generated by a suitable frequency generator 142. A circuit is completed from conductor 140 to contacts 45 (see Fig. 3), contacts R1c, R7d to solenoid 62 and conductor 141 and also from contacts R7d to contacts R1f, normally closed contacts CC8 to solenoid 62a of unit #2 and conductor 141, energizing the said release solenoids associated with the data verifying unit keyboard section and keyboard section of data storing unit #2 to effect the releasing of any depressed keyboards of the said sections.

Energization of solenoid 62 causes the contacts 69 to be closed (see Fig. 5) to complete a circuit from conductor 140 to relay R7 and conductor 141 energizing said relay. A holding circuit is then established from conductor 140 through contacts CC6 (see Fig. 14c), contacts R7a, relay R7 and conductor 141. Opening of contacts R7d causes solenoid 62 to be deenergized and restored to a normal deenergized condition.

Closure of contacts R7c connects the reset solenoids 125 of the tuned reed relays to the power supply conductors to energize these solenoids and effect restoration of the tuned reed relay contact 121 to the normal positions shown in Fig. 9. Closure of contacts 84 of unit #2 (due to energization of the associated solenoid 62a, see Fig. 7) completes a circuit from conductor 140 through the said contacts to relay R8 and conductor 141 energizing said relay. A holding circuit is then established from conductor 140 through contacts CC6, R8a to relay R8 and conductor 141. The operation of the remaining contacts of relays R7 and R8 have no effect on the control circuits at this time and need not be referred to. The restoration of the storing unit #1 is effected at a later time and will be explained as the description progresses.

Assuming now that the record cards which are to be verified are properly placed in the card magazine when the starting key (motor bar 58) is depressed and latched to close the associated contacts 59. Control circuits are now established as follows to effect feeding of the first zone of the first card up to the sensing magnets 70. A circuit is then completed from conductor 140 through the said contacts 59, contacts R1b and R4b to the control magnet 44 and conductor 141 energizing said magnet and causing the card feeding mechanism to function and feed the first card from the magazine to the first pair of feed rolls 22. Shortly after the card feeding mechanism functions contacts CC6 (see Fig. 13) are opened to break the holding circuits for relays R7 and R8 thus effecting deenergization of the said relays. At the time this condition occurs, solenoids 62 and 62a (unit #2) are not reenergized because contacts 45 are opened upon oper-

ation of the described clutch mechanism (see Fig. 3). At approximately the 135° point of the card feed cycle, contacts CC4 are closed completing a circuit from conductor 140 through the said contacts CC4, contacts R6a and relay R4 to conductor 141 energizing said relay. A holding circuit is then established from conductor 140 to contacts 59, contacts R4a and relay R4 to conductor 141. Opening of contacts R4b causes the clutch magnet 44 to be deenergized so that the card feed mechanism is latched up at the 180° point of the cycle. At approximately the 170° point of the cycle the card lever controlled contacts 37 are closed to effect energization of relay R6. Upon operation of contacts R6a and R6b the control circuit for relay R4 is transferred from contacts CC4 to CC5. When the card feed mechanism latches up the contacts 45 are closed to again energize the solenoids 62 and 62a as described before, causing the relays R7 and R8 to be energized (the detailed circuits were traced hereinabove).

The record card is now positioned so that upon operation of the start key again the verifying operations will be effected due to the passage of the first zone of the first card under the sensing magnets. Assume that the verifying or comparing data is set up and stored in the verifying keyboard section, comprising the keys 50 so that the associated contacts A and C are closed and contacts B are opened, when the start key or motor bar 58 is depressed to close contacts 59 and energize the clutch magnet 44 thus causing the card feeding mechanism to function and effect advancement of the first zone of the first card past the sensing magnets 70.

As the magnetic recordings in the first zone of the card are sensed by the corresponding sensing magnets 70, the varying E. M. F.'s impressed upon the magnets cause the associated amplifiers 145 to be conductive so that impulses or oscillations, the frequencies of which correspond to the varying E. M. F.'s are impressed upon the main coils 118 of the tuned reed relays which are connected in the output circuits of the related amplifiers. The corresponding reeds of the relays are set into vibration to effect closure of the associated contacts 121 and opening of the contacts 134. It is understood now that the data represented by the operated contacts A, B, and C of the verifying keyboard section and the data represented by the operated contacts 121 and 134 of the tuned reed relays should correspond and be in agreement. If the data sensed by the sensing magnets and the data set up in the keyboard section agree no circuits can be completed to any of the coils of relays UR1 to UR11, TR1 to TR11 and relay R1 upon closure of the cam controlled contacts CC1 (which occurs approximately at the 260° point of the cycle). In the event the compared data agrees closure of the contacts CC5 at approximately the 250° point in the cycle completes a circuit from conductor 140 through the said contacts R6b to relay R4 and conductor 141 energizing said relay and effecting deenergization of the clutch magnet 44 (due to opening of the contacts R4b which was described in detail before) thus causing the card feed mechanism to be latched up at the 270° point of the cycle. Closure of contacts 45 causes the data set up to be wiped out of the verifying keyboard section, as described in detail before, and conditioning the circuits for another verifying operation upon setting up the new data on the keyboard section and upon depression of the start key 58. Closure

of said contacts 45 also at this time is effective to cause energization of the release solenoid 62a of unit #1 since cam contacts CC8 are transferred at the 270° point of the cycle (see Fig. 13). This circuit is as follows: conductor 140, contacts 45, contacts R1c, R1d, R1f, transferred contacts CC8 and solenoid 62a of unit #1 to conductor 141 energizing the said solenoid. In this manner the associated keyboard section is cleared of any previous setting.

Upon disagreement of the said data circuits would be completed through the coils of the said relays upon closure of contacts CC1, for example, from conductor 140 to contacts CC1, contacts B of the keyboard section, contacts 121 of the tuned relays and the associated pickup coil or coils of the relays UR and/or TR, relay R1 to conductor 141 energizing said relays. The card feed mechanism is latched up in the same manner as described at the 270° point in the cycle due to closure of the said contacts CC5. Holding coils which are indicated URh and TRh are provided for the relays UR and TR so that upon energization of the UR and/or TR relays and closure of the corresponding contacts UR1a to UR11a and/or TR1a to TR11a the corresponding holding coils are energized, for example, one such circuit can be traced as follows: conductor 140 to contacts CC2, contacts 146 of a release key RK, contacts UR1a, holding coil URh1 of relay UR1, associated lamp 95 to conductor 141 energizing said coil and lamp. Another circuit which is completed at this time extends from conductor 140, contacts CC2 and 146 to contacts R1a and holding coil R1h of relay R1 to conductor 141. Opening of contacts R1b prevents further energization of clutch magnet 44 at this time.

From the data indicated by the lampbank section, it can be determined which group of data of the said compared data is in error, and assume now that the data in the zone on the record just verified is found to be in error. For such conditions the correction key CK is depressed to establish a circuit from conductor 140 to contacts 45, contacts R1d, R8d, contacts 147 and transferred CC8 contacts to solenoid 62a of unit #1 energizing said solenoid and clearing the keyboard section of any previous setting. The associated contacts 84 are closed upon energization of the said release solenoid to complete a circuit to relay R8 energizing this relay and establishing a holding circuit therefor through contacts CC6 and R8a. Opening of contacts R8d causes the release solenoid 62a of unit #1 to be deenergized permitting the associated contacts 85 to be closed. Now a circuit is completed from conductor 140 to contacts 85 of both units #1 and #2, contacts R8e, closed contacts C of the verifying keyboard corresponding to the data set up therein, corresponding solenoids 79 of storing unit #1, transferred CC3 contacts to conductor 141, thus energizing the said solenoids to set up the data in the recording storing unit #1 which data corresponds to the data originally set up in the verifying keyboard section.

It will now be necessary to clear the setting of the verifying keyboard so that a new setup can be made for further data comparing and verifying operations. It will be seen presently that during the verifying operations of the data on following zones of the records that the data of the previous zone verified and found to be in error will be erased from the record and a correct recording of the data will be formed on the record. Upon operation of any keybar of the recording

unit #1 the common contacts 82 thereof are closed to complete a circuit from conductor 140 to the series of contacts 45, R1d, R8c, 82, CC7 transferred (see Fig. 13) R4c to solenoid 62 of the verifying keyboard 141 thus energizing the solenoid and clearing the keyboard of its previous setting. Contacts 69 now close to cause the relay R7 to be energized and establish a holding circuit therefor through contacts CC8 and R7a as described hereinabove.

The machine is now conditioned for another verifying operation whereby the data set up in the verifying keyboard is compared with the data sensed on the second zone of the first card. During this verifying cycle the erroneous recording on the record is erased so that during the following cycle the correct data which is stored in recording unit #1 is then recorded upon the first zone of the record.

After setting up the new comparing data in the verifying keyboard section (by depression of the keys 50) the start key or motor bar 58 is depressed and also a second key 150 (Fig. 14c) to close contacts 59, 151 and 152 respectively. Closure of contacts 59 and 151 completes a circuit to the clutch magnet 44 to cause the card feeding mechanism to function. Closure of contacts 152 completes a circuit to the wipe out magnet 34 and relay R5. At the beginning of each cycle contacts CC8 are opened thus effecting deenergization of relays R7 or R8. In view of this a holding circuit is then established for relay R5 and magnet 34 which is as follows: conductor 140, contacts R7b, R8b, R5a to relay R5 and wipe out magnet 34 to conductor 141. At the beginning of this said cycle relay R1 is also deenergized due to the opening of contacts CC2 which break the holding circuit established through the holding coil R1 for this relay. Now the circuits are conditioned again so that in the event the compared data disagrees the described control circuits for this condition can again be established. It is seen now that as zone 1 of the card passes under the wipe out magnet 34 the recording therein is erased due to the neutralizing action of the said magnet and concurrently therewith zone 2 of the card is sensed by the reading magnets 70 so that the sensed data can be compared with the data setup in the verifying keyboard as described.

Now, during the following cycle when zone 3 of the card is sensed by the reading magnets 70 to the correct data stored in the recording unit #1 is recorded in zone 1 of the record. It was mentioned hereinabove that two data storing units #1 and #2 were provided for recording purposes. The reason for two storing devices now is evident for in the event two succeeding zones on the records were in error, it would be necessary to transfer the data from the verifying keyboard to these units successively. Thus, provision is made that while one unit is used during the recording operations on one zone, the data from the verifying keyboard can be transferred to the second data storing unit which then subsequently controls the recording operations. The operation of cam controlled contacts CC3 controls the selection of the recording storing units, and also controls the energization of relays R2 and R3, the contacts of which control the connections of the contacts of the recording units to the frequency generators 155 and the recording magnets 35.

To continue with the chosen example, the erasing of the magnetic recordings in zone 1 of the record card occurred during that portion of

the cycle indicated from the 270° point of the cycle to the 360° point. The recording of the correct data in zone 1 of the card occurs during that portion of the cycle indicated from the 0° to the 90° point. It is seen that during this part of the cycle that contacts CC3 are positioned as shown in Fig. 14b in the untransferred positions. Therefore, at this time, relay R3 is energized to connect the frequency generators 155 to the related recording magnets 35. Now as zone 1 passes under the recording magnets the correct recordings are formed on the card, that is, the recordings are made in frequency values corresponding to the closed contacts D of the recording storing unit #1 which represent the correct data.

The frequency generators per se do not form the subject matter of the instant application, and since they are well known in the art they need not be described in detail. The well known type of electronic oscillation generator is shown, however, it is obvious that any type of oscillation source may be used such as the rotary type of frequency generator. However, it should be stated that each generator 155 is adjusted to generate oscillations of different frequencies and such indications are made by the references /1, /2, etc. It was assumed hereinabove that the numerical data "one" is represented by a recording in frequency /1, "two" in frequency /2, etc. For this reason, the corresponding frequency generators are connected to the corresponding contacts D of the storing units #1 and #2 so that, for example, closure of the "5" contacts of the storing unit is effective to connect the frequency generator /5 to the recording magnets to effect recording of this frequency on the record to represent the data "5." The magnetic recording principle per se is old and well known and requires no further description at this time other than to state that whenever the oscillations are impressed upon the recording magnets the magnetic fields set up thereby are varied at a rate in accordance with frequencies of the oscillations and that consequently the magnetic recordings effected on the records and retained thereby are formed in corresponding frequency values.

It is believed that since the control circuits for each individual operation have been traced in detail that further cycles of operations need not be set forth or repeated since the subsequent operations will be one of the types just described and effected in the manner set forth.

It should be mentioned that provision is also made to detect and indicate unrecorded records which are fed to the machine. Due to the nature of the magnetic recordings visual detection of recorded records is not possible, therefore, the following circuit is provided to detect this condition. Obviously, when a blank record is fed past the sensing magnets 70 the associated tuned reed relays are unaffected and remain inoperative. Due to this fact none of the associated contacts 121 of the said relays are closed and likewise none of the contacts 134 are opened. Thus, when the cam controlled contacts CC1 are closed a circuit is completed from conductor 140 to contacts CC1 to one of the contacts A which are closed to represent a data setting (or if a zero is set up is completed through contacts 54), the series of contacts 134 to relay UR11 and/or TR11 and relay R1 to conductor 141. As mentioned hereinabove the associated holding coils of these relays; namely, R11, UR11 and/or TR11 are

energized to maintain the said relays energized. The condition described is indicated on the error indicating board by the energization of the lamp or lamps 95a.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a machine of the character described for verifying statistical data on records, which records have individual columns of recordings in different frequency values to represent the different data, individual means for sensing the recordings in different columns, means controlled thereby for initiating oscillations of different frequencies in accordance with the frequency values of the sensed recordings, individual groups of control circuits, one group for each column of data sensed, means controlled by the initiated oscillations for selecting predetermined circuits from the said groups in accordance with the frequencies of the oscillations, settable mechanism having means for setting up therein predetermined data with which the sensed data should conform, means controlled by the settable mechanism for controlling the energization of the said selected circuits, including means for preventing energization of the said circuits when the sensed and set up data is in agreement, and indicating means rendered operative by the energized selected circuits whenever the compared data is in disagreement.

2. In a machine of the character described for verifying statistical data on records, which records have individual columns of magnetic recordings in different frequency values to represent the different data, individual sensing magnets for sensing the said recordings in different columns, means controlled thereby for initiating oscillations of different frequencies in accordance with the frequency values of the sensed magnetic recordings, control means having means selectively controlled by the initiated oscillations in accordance with the frequency values thereof, settable means having means for setting up predetermined data with which the sensed data should conform, indicating means and means controlled jointly by the said control and settable means whenever the sensed data and said set up data disagree for rendering the said indicating means operative.

3. In a machine of the character described for verifying statistical data on records, which records have individual columns of magnetic recordings in different frequency values to represent the different data, individual sensing magnets for sensing the said recordings in different columns, means controlled thereby for initiating oscillations of different frequencies in accordance with the frequency values of the sensed magnetic recordings, control means having means selectively controlled by the initiated oscillations in accordance with the frequency values thereof for representing the sensed data, means for verifying the data represented by the said control means to determine if the sensed data is erroneous, and means for indicating whether or not the sensed data is in error.

4. A machine of the character described for verifying statistical data on records comprising data sensing, obliterating and recording means, means for feeding individual records progressively past the said sensing, obliterating, and recording means, means controlled by the sensing means for representing the data sensed on the records, means for verifying the accuracy of the said represented data, means controlled by the verifying means when the data is in error for controlling the obliterating means to obliterate the erroneous data, means for rendering the recording means effective to record the correct data in the columns where the erroneous data appeared on the records, and means for rendering the sensing means and obliterating means effective to sense the data and obliterate the erroneous data on successive records at the times the said recording means is effective to record the said correct data on the preceding records.

5. A machine of the character described controlled by statistical data on records comprising data sensing, obliterating and recording means, means for feeding individual records progressively past the said sensing, obliterating, and recording means, means for rendering the sensing means effective to sense the data, means for controlling the obliterating means to obliterate desired data appearing on the records, means for controlling the recording means to record different data in the columns where the original sensed data appeared on the records, and means under control of the sensing means upon sensing predetermined data on a record for rendering the said obliterating and recording means effective successively to obliterate the sensed data on the said record, and record different data in the columns where the original sensed data appeared, respectively.

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