Oct. 18, 1938. E. M. LA BOITEAUX 2,133,865

MECHANICAL TABULATOR ALPHABETICAL INDEXING MECHANISM

Filed Jan. 8, 1936 3 Sheets-Sheet 1

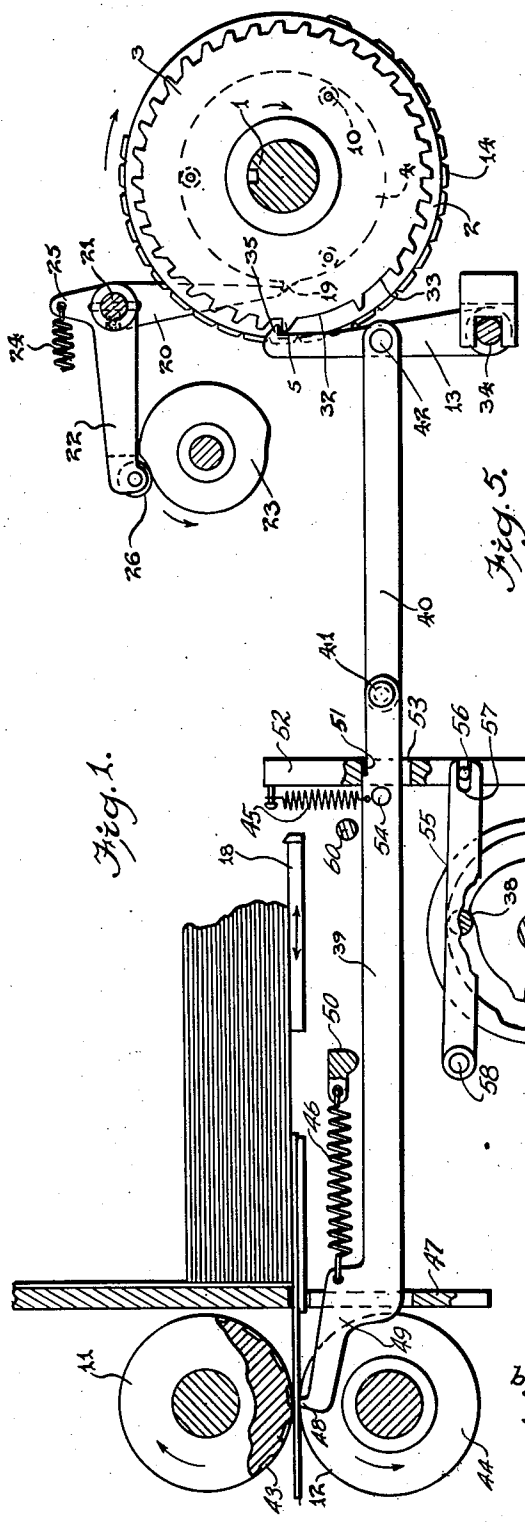


Fig. 1.

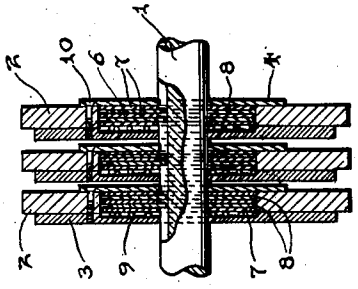


Fig. 5.

Inventor
E. M. LaBoiteaux,
by Mary F. Riley
Attorney

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MECHANICAL TABULATOR ALPHABETICAL INDEXING MECHANISM

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Fig. 3.

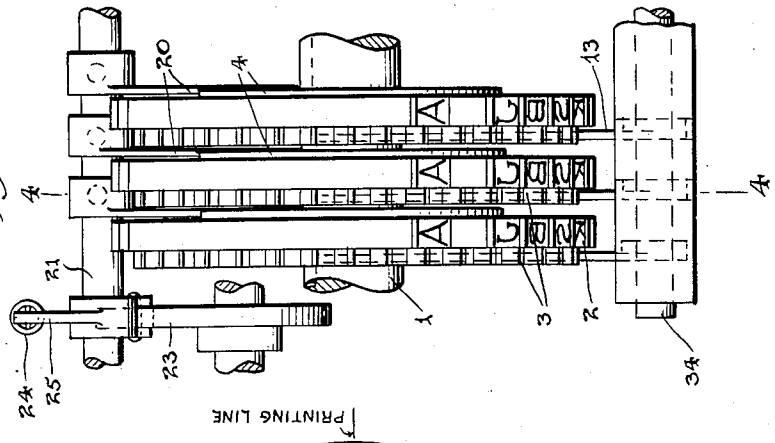


Fig. 4.

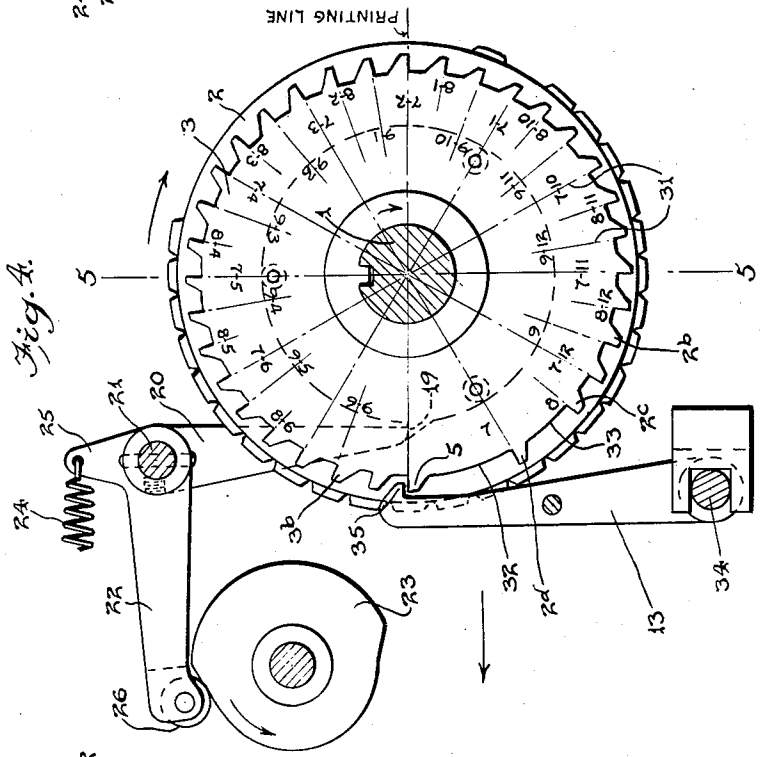
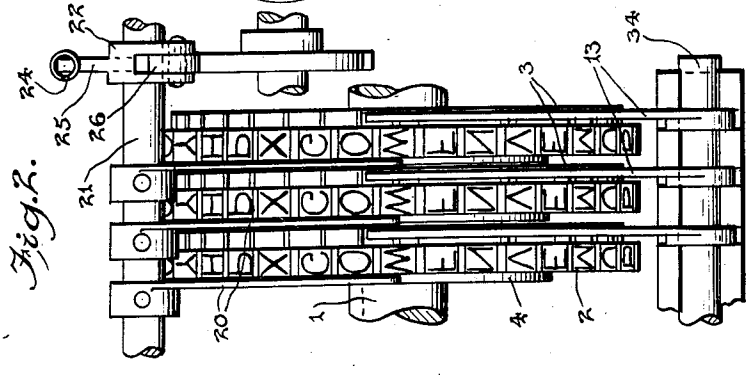


Fig. 2.



Inventor
E. M. LaBoiteaux,
By
Harry J. Riley
Attorney

Oct. 18, 1938. E. M. LA BOITEAUX 2,133,865

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Fig. 6.

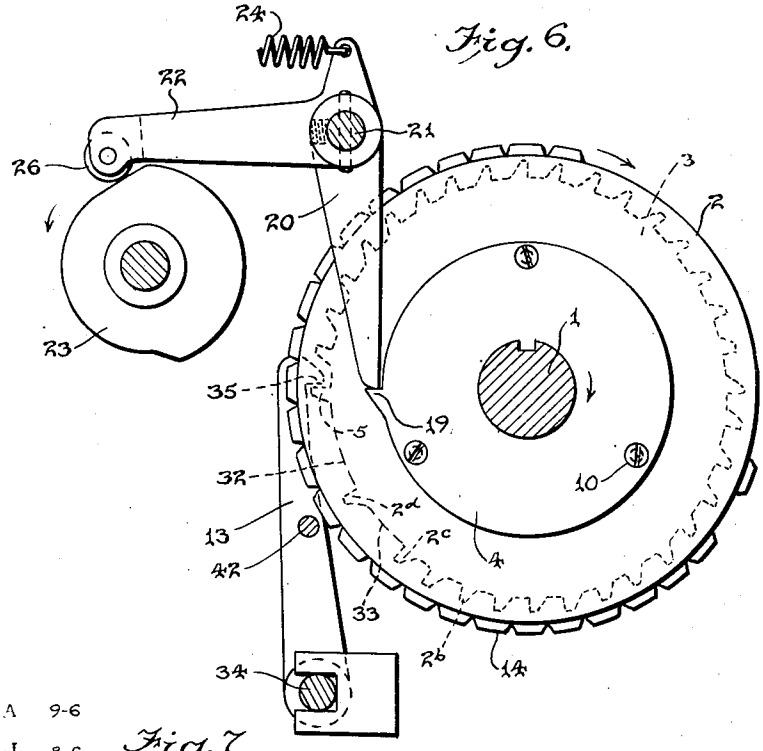
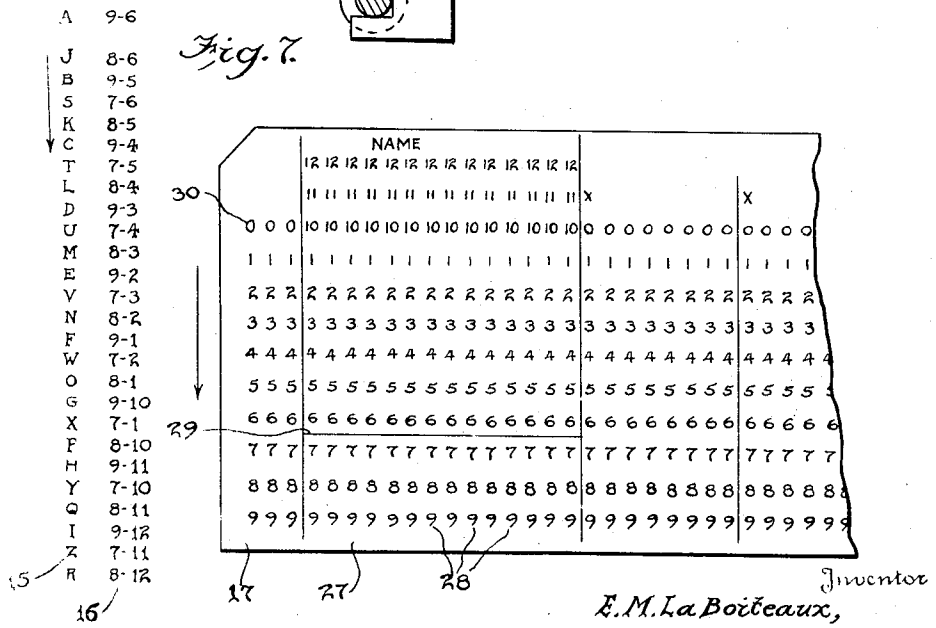


Fig. 7.



Inventor
E. M. La Boiteaux,

By Harry F. Riley
Attorney

Patented Oct. 18, 1938 2,133,865

UNITED STATES PATENT OFFICE

2,133,865

MECHANICAL TABULATOR ALPHABETICAL INDEXING MECHANISM

Eugene M. La Boiteaux, Washington, D. C.

Application January 8, 1936, Serial No. 58,191

11 Claims. (Cl. 101—93)

This invention relates to apparatus for mechanically recording statistical data translated from a perforated record card, the same being used in a well known system of mechanical tabulation.

Listing or a recording of the names of persons, places or things simultaneously with correlative numerical data is often desirable or even necessary to further the scope of usefulness of the apparatus by an incorporation of this function, and to reduce mechanical complications through the adoption of simple and direct means to this end are the primary objects of this invention.

With these and other objects in view, the invention consists in the construction and novel combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings and pointed out in the claims hereto appended, it being understood that various changes in the form, proportion and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings—

Fig. 1 is a longitudinal sectional view of a mechanical tabulator alaphabetical indexing mechanism embodying the features of the present invention, parts of the machine being omitted.

Fig. 2 is a front elevation of the alphabetical type wheel units and associated parts.

Fig. 3 is a rear elevation of the same.

Fig. 4 is a vertical sectional view on the line 4—4 of Fig. 3, one of the type wheel units being shown in elevation.

Fig. 5 is a transverse sectional view taken substantially on the line 5—5 of Fig. 4.

Fig. 6 is a detail view of the unit side plate illustrating the arrangement of the reset stop lug.

Fig. 7 is a diagrammatic view showing a portion of a record punch card and the sequence of the letters on the printing type wheel and their corresponding punch symbols.

In the accompanying drawings in which is illustrated the preferred embodiment of the invention 1 designates a continuously rotating shaft carrying a plurality of alphabetical type wheel units in any number required. Each type wheel unit comprises an alphabetical printing type wheel proper 2, a ratchet escapement disk 3 and a unit side plate 4 provided with a reset stop lug 19. The type wheel 2 together with the escapement ratchet disk 3 and the side plate 4 constitute a housing for a multiple friction disk assembly 6 which completes the alphabetical type wheel unit. The friction disk assembly 6 preferably consists of interleaved fiber and metallic disks 7 and 8 and a compressed initially conically coiled spring 9. The fiber disks are keyed to the alphabetical type wheel and the metal disks are splined or keyed to the continuously rotating shaft 1 while the compressed conical spring maintains the interleaved disks in the desired frictional engagement. As the friction disk assembly is well known in the art and is fully disclosed in Patent No. 1,516,772, granted to me November 25, 1924, further description of the same and detail illustration thereof are deemed unnecessary. The ratchet escapement disk 3 and the side plate 4 are secured to the type wheel by suitable fastening devices 10.

The continuously rotating shaft 1 which rotates in synchronism with main indexing feed rolls 11 and 12 of the indexing and control device is connected with the main feed rolls 11 and 12 by suitable gearing (not shown). The alphabetical type wheels are normally restrained against rotary movement with the shaft 1 by stop pawls 13 and they are individually released to permit a certain amount of rotative movement with the shaft by the indexing and control device shown in Fig. 1 of the drawings and forming the subject matter of a copending application filed by me August 7, 1935, Serial No. 35,217.

The alphabetical type wheel 2 is provided at its periphery with projecting type 14 and in Fig. 7 of the drawings is illustrated in tabular form at 15 the sequence of the type designations upon the periphery of the alphabetical type wheel and their corresponding record symbols or perforation code numbers 16. The record punch card 17 a portion of which is illustrated in Fig. 7 of the drawings illustrates the record card form or layout.

It will be understood, of course, that all rotating elements are geared together in proper ratio and in timed relation with the passage of a record card through the indexing and control device. Also it will be understood by those familiar with the art that in listing or recording individual record card data, the output, owing to necessary allowance for printing and clearing time intervals in the case of each successively presented record card, is less than is the case where the data are accumulated and finally listed as group totals. To provide for the allotment of said time intervals the usual reciprocating ratchet record card feeding mechanism 18 is driven by connecting gearing in reduced ratio to that of the main indexing feed rolls 11 and 12. In other

words, while maintaining a constant over all speed of operation and synchronization of the main indexing feed rolls and the alphabetical type wheels 2 or rather the constantly rotating shaft 1, said constant overhead speed of operation being normal for both listing and totalizing operations, in case of combined listing and totalizing operations a reduced ratio, that is one cycle of the ratchet feed 14 to two cycles or rotations of the feed rolls 11 and 12 is employed and halves the output, and therefore permits the allocation of the time interval of the idle cycle of the main feed rolls 11 and 12 to printing and clearing operations of the alphabetical type wheels. The one to one ratio of the reciprocating record card feeding mechanism and the main indexing feed rolls 11 and 12 is used for tabulating alone, and in practice it is only necessary to substitute one set of gears for another to change the ratio of the reciprocating ratchet record card feeding mechanism to the main feed rolls 11 and 12. Means whereby the change in the gear ratio aforesaid may be effected are so well known in the art that it is believed unnecessary to illustrate or further describe the same.

Each unit side plate 4 consists of a disk and is provided at its periphery with a projecting reset stop lug 19 which is engaged in the resetting operation by a reset stop arm 20 of a rock shaft 21 having an operating arm 22 controlled by a cam 23 assisted by a coiled spring 24 connected at one end with a fixed portion of the machine and at its other end to a short arm 25 preferably projecting from the inner portion of the operating arm at right angles thereto and adapted to maintain the operating arm 22 in engagement with the cam 23. The operating arm is provided with an antifriction roller 26 which rides on the periphery of the cam 22. The cam rotates in synchronism with the reciprocating ratchet record card feeding mechanism at the reduced speed or ratio heretofore explained.

The record punch card 17 is provided with a field or area 27 having fourteen vertical columns 28 of numerals consisting of the consecutive numbers 9 to 1 and 10 to 12 and having a horizontal rule or line at 29 between the numerals 6 and 7. In this instance it is used merely to indicate an isolation of the functioning of the index positions 9, 8, 7 which constitute key positions to those index positions located above, namely 6, 5, 4, etc. It will also be seen that beginning with the usual 0 index position 30 they are consecutively numbered 10, 11 and 12 in the said field or area 27. These numerical values have no particular significance except as code designations and assist in following a step by step description of the process of listing or recording the names of persons, places or things.

In the present instance the alphabet is divided into three series, the index position 9 of the said key positions determining any letter in the series beginning with A through the series consecutively to I, inclusive, and the index position 8 determining any letter in the series beginning with the letter J and extending to the letter R, inclusive, and the index position 7 determining any letter in the series from the letter S to the letter Z, inclusive. A single perforation, therefore, in any one of the said key positions determines any letter indication within its particular series. While it is preferable to employ the indexing and control device illustrated in Fig. 1 of the drawings and forming the subject matter of the aforesaid application the mechanism of the present invention may of course be employed in conjunction with any suitable indexing and control device. In any indexing device adaptable for use in conjunction with the mechanism thus far described, it is necessary that immediately following the completion of the analyzation of the key positions, 9, 8 and 7 of the successively presented index positions on the record card in its progress through the indexing and control device, namely immediately following the numeral 7 index position, the completion of the primary or key cycle be effected, thereby, through control of stop pawl 13, by interference therewith of escape wheel 3, to define the beginning of what may be termed the secondary cycle. Said secondary cycle embraces the remaining index positions of the record card, that is, positions from the numerals 6 to 12, inclusive, and upon completion of the analyzation of all possible index positions, that is in all instances index position 12, the indexing and control device operates to check, through stop pawl 13, any type wheel then under rotation.

The ratchet escape wheel 3 as illustrated in Fig. 4 of the drawings is divided into twelve divisions 31 of three teeth each. The twelve divisions 31 constitute what may be termed unit spacing and include of course angles of 30 degrees each. The alphabet being divided into the said groups A to I, J to R and S to Z, and these groups being assigned to the index positions 6 to 1, inclusive, and 10 to 12, inclusive, of the columns 28, the alphabetical type is therefore placed around the periphery of the type wheel in a corresponding manner, thus A, J, B, S, K, C, T, L, D, etc. as shown at 15 in Fig. 7 of the drawings. To secure differentiation in the beginning of each alphabetical series or groups before mentioned the ratchet escapement wheel 3 has two intermediate teeth removed in the first unit spacing of 30 degrees providing an open space 32 and in the second unit of the same angle one tooth is removed to provide an open space 33.

As previously explained the completion of the primary cycle through the indexing and control device by interference with continued rotation of the ratchet escape wheel 3 by the stop pawl 13 occurs immediately and definitely after the first tooth defining the so-called unit spacing of 30 degrees has passed beyond the control stop pawl 13; that is, it drops just behind the tooth aforesaid. Such in fact being the case, if a perforation occurs in the numeral 9 index position, type wheel 2 being withdrawn from interference of the stop pawl 13 will rotate through an angle of 70 degrees and will be intercepted by the stop pawl 13 at tooth 2^b thereby defining the initial or starting position of the secondary cycle. Following this process through to its conclusion, if a perforation in the same vertical column also occurs in the numeral 6 index position stop pawl 13 controlled by the indexing and control device will be withdrawn from interference with and permit said type wheel to rotate nine unit spacings or through an angle of 270 degrees when it will be intercepted by the stop pawl 13 at the tooth 3^b marking the completion of the secondary cycle and thereby setting up the letter A at the printing line. Should index positions 9 and 5 be perforated the operation just described will be repeated with the exception that the type wheel in this event will rotate through eight unit spacings or 240 degrees

and the completion of the cycle will register or set up the letter B at the printing line and follow on throughout the entire first group or series of letters.

Beginning with the second series, the key position of which is the numeral 8 index position on the record card, a perforation occurring in the said index position permits the type wheel to rotate 50 degrees when it will be arrested by the tooth 2c thus establishing a different starting point for the second cycle; at the completion of which assuming a perforation occurs at the 6 index position on the record card the letter J will be presented at the printing line, etc. throughout the remainder of the second series of the letters of the alphabet.

In the third or final series or groups of letters, that of key index position 7 the type wheel will continue to rotate until checked by the tooth 2d, thereby establishing still another starting point for the beginning of the third or final series denoted by the letter S. The teeth of the escapement wheel corresponding to the type on the periphery of the type wheel are indicated in Fig. 4 of the drawings by the code designations 16. It is thought that the foregoing description of the operation has made clear the setting up of the type of the alphabetical type wheels as controlled by the record card for printing. The printing or recording of the type set up necessarily follows closely the completion of the second cycle and as the methods which may be employed for printing are so well known in the art it is believed unnecessary to illustrate or describe the same in detail as any suitable printing means may be employed.

Clearing or resetting of the type wheel is accomplished in the following manner. The cam 23 rotating at half the speed of the continuously rotating shaft which as previously explained is so timed that immediately following the printing operation the reset stop arms 20 will be deflected to intercept the stop lugs 19 on the side plates 4 and will be retained in this position by said cam until near the end of the idle cycle of the main indexing feed rolls 11 and 12. During this so-called idle cycle and so far as concerns the functioning of the alphabetical feature of the machine the indexing and control device in the absence of a record card functions on the first index positions of both the primary and secondary cycles aforesaid thereby withdrawing the stop pawls 13 from interference with the ratchet escape disks 3 of the type wheels permitting freedom of rotation thereof until restrained at the initial or reset position by the reset stop arms 20.

Just prior to the beginning of the active cycle the cam 23 acts to withdraw the reset stop arms 20 from interference with the reset stop lugs 19, the duty of type wheel restraint then devolving upon stop pawls 13. It is to be noted at this point that the freedom of action permitting the index device during the so-called idle cycle of the main feed rolls 11 and 12 applies solely to those indexing and control units engaged upon the field set aside for alphabetical purposes.

The stop pawl 13 is shown in Fig. 1 of the drawings in an upright position and is pivoted at its lower end at 34 and is provided at its upper end with a tooth 35 for engaging the teeth of the ratchet escapement wheel 3. The indexing and control device is constructed substantially the same as that shown in the aforesaid application with the exception that the cam 36 is provided with two cam portions 37 and 38 for operating the index and control device twice during each rotation of the main feed rolls 11 and 12. Also the analyzing bar 39 is connected by a link 40 with the stop arm 13 to provide the necessary play the link being pivoted at one end at 41 to the analyzing bar 39 and at the other end at 42 to the stop pawl 13. The particular construction of the analyzing and control device shown in Fig. 1 forms the subject matter of a separate application and while it is preferred to use the same various index and control devices may be employed for controlling the operation of the stop pawls 13. The upper feed roll 11 rotates in the direction of the arrow in Figure 1 of the drawings and is provided with spaced grooves or slots 43, while the lower feed roll 12 is provided with a channel 44 for each analyzing bar 39. The analyzing bar 39 is suspended by springs 45 and 46 and is guided at its forward end by a comb 47. The forward end of the analyzing bar terminates in a dog tooth 48 capable of freely entering any groove or recess 43 in the upper indexing or analyzing feed roll 11 when a perforation in a record card coincides with said groove or recess 43, the analyzing bar being actuated in such movement by the spring 46. The front portion 49 of the analyzing bar is preferably upwardly offset from the body portion of the analyzing bar 39 and is connected to the forward end of the spring 46, which may be disposed at a slight inclination when the analyzing bar is in analyzing contact with a record card as illustrated in Figure 1 of the drawings.

The rear end of the spring 46 is attached to a fixed transversely arranged fulcrum bar 50 located above the analyzing bar 39 and adapted to be engaged by the same for causing a rocking movement of the analyzing bar 39 to withdraw the dog tooth 48 from the groove or recess 43 of the upper indexing feed roll 11 and from the hole in the record card. The rear spring 45 is arranged vertically and the lower end of the spring 45 is connected to the analyzing bar 39. The analyzing bar 39 is provided at its rear end with a latch shoulder 51 located at the upper edge of the analyzing bar and adapted to be lifted into latching engagement with the cam actuated slide 52 for holding the analyzing bar in its forward position after it has been lineally moved by the indexing feed roll 11. The detent slide 52 is provided with a slot 53 in which is arranged the rear portion of the analyzing bar 39, which is provided with an individual bar stop 54 for engaging the detent slide 52 to limit the backward movement of the analyzing bar and define its backward position.

The detent slide 52, which is mounted in slidable guides (not shown), is connected to one end of a cam actuated lever 55 by a pin 56 arranged in a slot 57 in one end of the lever 55. The other end of the lever 55 is pivoted at 58, and the lever 55 is provided at a point intermediate of its ends with a roller 38 or other suitable means for operating in a cam groove 59 having the aforesaid cam portion 37 and 38 for operating the latch mechanism of the analyzing bar twice during each rotation of the feed rolls 11 and 12.

The record cards are advanced by said reciprocating ratchet feed mechanism 18 to the feeding grip between the upper and lower rolls 11 and 12. When a perforation in the record card has reached its corresponding groove or recess in the upper feed roll, the dog tooth 48 of the analyzing bar will be projected into engagement

with the feed roll 11. In this projection movement the analyzing bar 39 rocks on the stop 54 and thereby secures a maximum working freedom of said analyzing bar 39. The continued rotation of the feed roll 11 through its positive engagement with the tooth of the analyzing bar pulls the analyzing bar forward until the latch shoulder passes the face of the detent slide 52, when the rear end of the bar 39 is pulled upwardly by the spring 45 and is latched in its forward position. In the beginning of the latching or upward movement of the analyzing bar 39, its upper edge comes in contact with the fixed fulcrum bar 50, thus deflecting downwardly the forward end of the bar 39 and thereby its instant disengagement from the upper roll 11. In the operation just explained, the analyzing bar 39 through its connection with the pawl 13 withdraws the latter from the escapement ratchet disk 3. The operation of the cam 36 before explained moves the detent slide 52 upwardly and releases the analyzing bar 39, which is disengaged from the detent slide and released by a fixed stop 60. The spring 46 now functions in a retractile capacity and moves the analyzing bar 39 rearwardly and carries the pawl 13 into engagement with the ratchet disk.

The counter wheels of the accumulator mechanism which in practice will be associated with the index points ranging from 9 to 0 on the record punch card 17 for recording correlative numerical data are not illustrated as any suitable mechanism may be employed for this purpose, the preferred construction being that disclosed in a copending application filed by me December 2, 1935, Serial No. 52,604.

What is claimed is:

1. In an alphabetical tabulator indexing mechanism, a shaft adapted to be continuously rotated, a plurality of type wheel units carried by the shaft and each comprising an alphabetical type wheel and a ratchet escapement wheel, the type wheel being provided with a plurality of groups of type, stop pawls normally engaging the ratchet wheels for holding the type wheels against rotation of the shaft, and means controlled by record cards having index points for individually releasing the type wheels to permit certain rotative movements of the type wheels by the shaft to present type for printing.

2. In an alphabetical tabulator indexing mechanism, a shaft adapted to be continuously rotated, a plurality of type wheel units carried by the shaft and each comprising an alphabetical type wheel and a ratchet escapement wheel, the type wheel being provided with a plurality of groups of type, stop pawls normally engaging the ratchet wheels for holding the type wheels against rotation of the shaft, means controlled by record cards having index points for individually releasing the type wheels to permit certain rotative movements of the type wheels by the shaft to present type for printing, said means being also operable to release the type wheels to permit the same to be carried by the continuously rotating shaft to their initial positions, and reset mechanism having means for stopping the alphabetical type wheels in their initial position.

3. In an alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated, a plurality of type wheel units carried by the shaft and each comprising an alphabetical type wheel provided with a plurality of groups of type, an escapement wheel and a reset lug, stop pawls for engaging the escapement wheels for normally restraining the type wheels against rotation with the shaft, means controlled by record cards having index points for releasing the type wheels to permit certain rotative movements of the type wheels by the shafts to present type for printing, and reset mechanism having reset stop arms movable into and out of the path of the reset lugs and adapted to intercept the same for stopping the type wheels in their initial position.

4. In an alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated, a plurality of type wheel units carried by the shaft and each comprising an alphabetical type wheel provided with a plurality of groups of type, the type of one group being arranged intermediate the type of another group, and an escapement wheel having teeth corresponding with the type of the type wheel and also provided with teeth corresponding with the groups of type and arranged for a preliminary operation of the type wheel unit to permit a certain rotative movement of the type wheel by the shaft to select one of the groups of type, a stop pawl arranged to engage the teeth of the escapement wheel for normally holding the same against rotative movement with the shaft, and means controlled by records having index points for releasing the type wheel units in two successive operations to present type for printing.

5. In an alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated, a plurality of type wheel units carried by the shaft and each comprising an alphabetical type wheel provided with a plurality of groups of type, the type of one group being arranged intermediate the type of another group, and an escapement wheel having teeth corresponding with the type of the type wheel and also provided with teeth corresponding with the groups of type and arranged for a preliminary operation of the type wheel unit and spaced apart different distances to produce different rotative movements of the type wheel when the same is released for selecting a group of type, a stop pawl arranged to engage the teeth of the escapement wheel for normally holding the same against rotative movement with the shaft, and means controlled by records having index points for releasing the type wheel units in two successive operations to present type for printing.

6. An alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated in one direction, a plurality of normally stationary type wheels mounted on the shaft and rotatable only in the direction of the rotation of the shaft, a plurality of type on each of said type wheels divided into separate groups, the individual type of each group being arranged between individual type of another group, and means controlled by record cards having index points for releasing the type wheels for first selecting one of said groups and for permitting rotative movement of the type wheels by the shaft and for again releasing the type wheels for permitting a second rotative movement of the same in the same direction as the first rotative movement to present the selected type for printing.

7. An alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated in one direction, a plurality of normally stationary type wheels mounted on the shaft and rotatable only in the direction of the rotation of the shaft, a plurality of type on each of said type

wheels divided into separate groups, the individual type of each group being arranged between individual type of another group, means controlled by record cards having index points for releasing the type wheels for permitting rotative movement of the type wheels by the shaft for first selecting one of said groups and for again releasing the type wheels for permitting a second rotative movement of the same in the same direction as the first rotative movement to present the selected type for printing, said record card controlled means being also operable to release the type wheels to permit the same to be carried by the continuously rotating shaft to their initial positions, and reset mechanism having means for stopping the alphabetical type wheels in their initial position.

8. An alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated in one direction, a plurality of normally stationary type wheels mounted on the shaft and rotatable only in the direction of the rotation of the shaft, a plurality of type on each of said type wheels divided into separate groups of nine type, the individual type of each group being arranged between individual type of another group, means controlled by record cards having index points for releasing the type wheels for permitting rotation of the type wheels by said shaft for first selecting one of said groups and for again releasing the type wheels to permit a second rotative movement of the same by said shaft in the same direction as the first rotative movement of the type wheels to present the selected type for printing.

9. An alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated in one direction, a plurality of normally stationary type wheels mounted on the shaft and rotatable only in the direction of the rotation of the shaft, a plurality of type on each of said type wheels divided into separate groups of nine type, the individual type of each group being arranged between individual type of another group, means controlled by record cards having index points for releasing the type wheels for permitting rotative movement of the type wheels by the shaft for first selecting one of said groups and for again releasing the type wheels for permitting a second rotative movement of the same in the same direction as the first rotative movement to present the selected type for printing, said record card controlled means being also operable to release the type wheels to permit the same to be carried by the continuously rotating shaft to their initial positions, and reset mechanism having means for stopping the alphabetical type wheels in their initial position.

10. An alphabetical tabulator indexing mechanism including a shaft adapted to be continuously rotated in one direction, a plurality of normally stationary type wheels mounted on the shaft and rotatable only in the direction of the rotation of the shaft, a plurality of type on each of said type wheels divided into separate groups of nine type and collectively constituting a complete alphabet, the individual type of each group being arranged between individual type of another group, and means controlled by record cards having index points for releasing the type wheels for permitting rotative movement of the type wheels by the shaft for first selecting one of said groups and for again releasing the type wheels for permitting a second rotative movement of the same in the same direction as the first rotative movement to present the selected type for printing.

11. An alphabetical tabulator indexing mechanism including a shaft continuously rotating in one direction, a plurality of normally stationary type wheels mounted on the shaft and rotatable only in the direction of the rotation of the shaft, a plurality of type on each of said type wheels divided into separate groups of nine type and collectively constituting a complete alphabet, the individual type of each group being arranged between individual type of another group, means controlled by record cards having index points for leasing the type wheels for permitting rotative movement of the type wheels by the shaft for first selecting one of said groups and for again releasing the type wheels for permitting a second rotative movement of the same in the same direction as the first rotative movement to present the selected type for printing, said record card controlled means being also operable to release the type wheels to permit the same to be carried by the continuously rotating shaft to their initial positions, and reset mechanism having means for stopping the alphabetical type wheels in their initial position.

EUGENE M. LA BOITEAUX.