Oct. 31, 1933. C. D. LAKE 1,933,331

RECORD CONTROLLED MACHINE

Filed Dec. 24, 1931 2 Sheets-Sheet 1

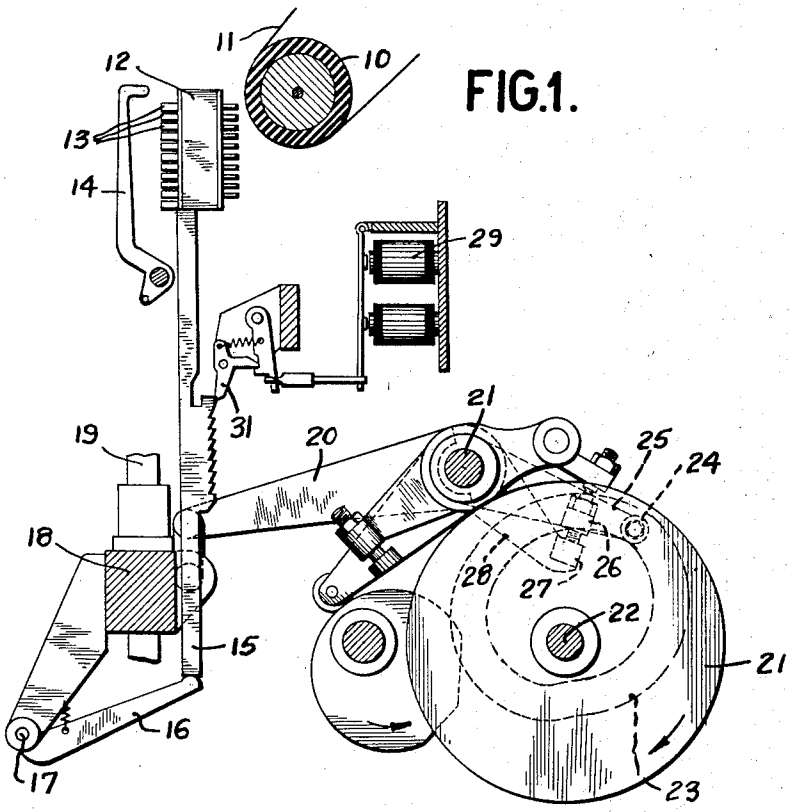


FIG.1.

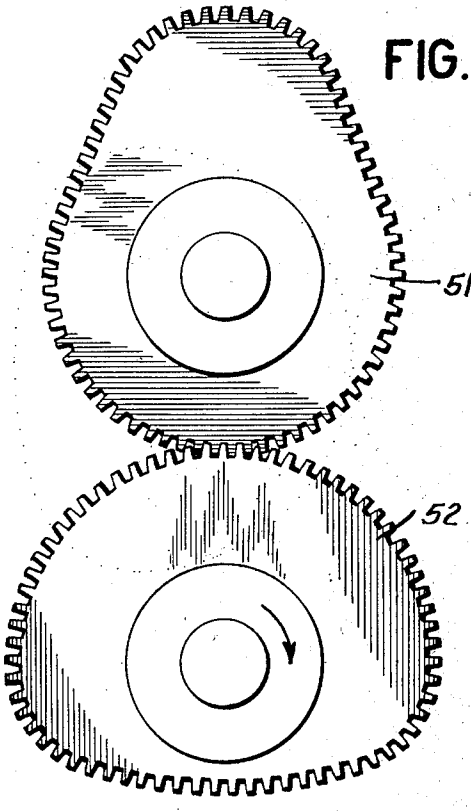


FIG.2.

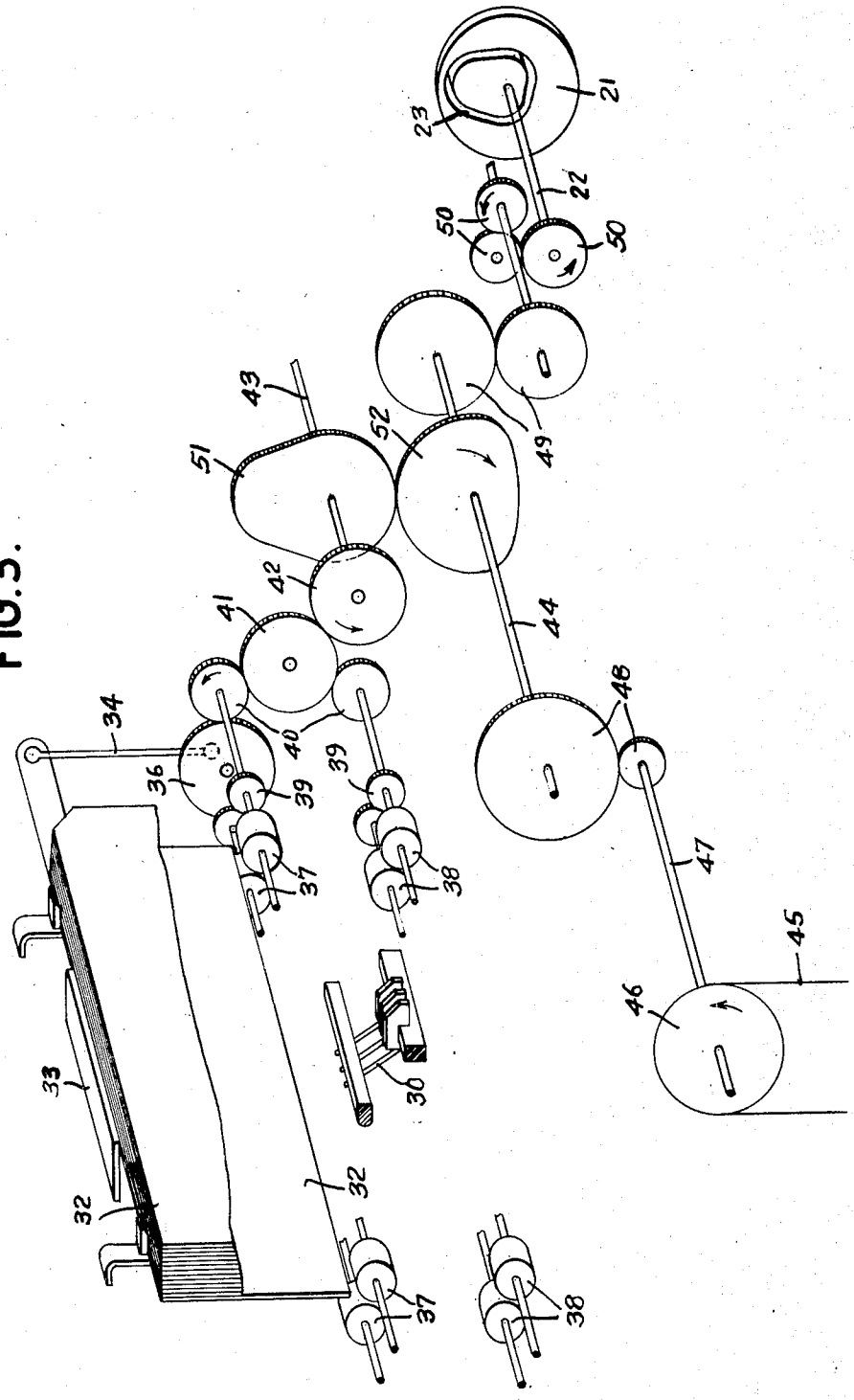
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FIG. 3.



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1,933,331

RECORD-CONTROLLED MACHINE

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Application December 24, 1931
Serial No. 582,961

5 Claims. (Cl. 101—93)

This invention relates to accounting and statistical machines, particularly those operating according to the well-known Hollerith system wherein perforated record cards control the various machine functions.

The primary object of the present invention is to improve machines of the above type so as to enable them to be operated at a greater speed.

Another object is to provide means for reducing the wear and tear on the machine.

A further object is to provide mechanism permitting the smoother operation of the machine when listing items under control of the perforated records.

A specific object is to provide mechanism which permits the machine to be operated at a higher speed without requiring that the machine as heretofore known be entirely redesigned and reconstructed.

Various other objects, advantages or features of the present invention will be pointed out in the following description and claims or will be apparent after a study thereof and of the accompanying drawings.

In said drawings,

Fig. 1 is a vertical section through a portion of the machine, and illustrates diagrammatically the construction and operation of the printing mechanism.

Fig. 2 is an elevation of the means for coordinating the feeding of the record cards with the printing mechanism.

Fig. 3 is a perspective view showing diagrammatically the card feeding mechanism, various drive shafts and gearing, and the cam for operating the printing mechanism.

The present invention is an improvement in the machine illustrated and described in Letters Patent No. 1,379,268 granted to Clair D. Lake, an improved form of which is illustrated in Letters Patent No. 1,757,123, granted to Lake and Page. It will be understood, however, that the invention is not limited to application in the particular machine selected for purposes of illustration as it may be applied to others equally as well.

It has been found from practical experience that there is a limit to the speed at which listing or recording operations can be performed in machines of the type illustrated in the above patents, owing to the nature of the construction of the printing mechanism which usually includes a large number of reciprocating or oscillating parts such as type bars, for example. Up to a certain practical limit of speed the machine operates satisfactorily but, when the practical limit of speed is exceeded, the inertia of the reciprocating parts causes the machine to operate incorrectly besides resulting in excessive wear on the machine due to pounding of the parts when they are suddenly arrested at the end of their stroke.

The Hollerith machine cycle has for convenience been divided into a number of periods of time all of equal length called "points" ten of which points are required to permit the entry of an item by printing upon a record sheet and also in the accumulating mechanism. Additional points are required to permit time for certain machine functions to be performed and various parts of the machine to be restored preparatory to begining the next cycle.

Machines as heretofore constructed embodying the Hollerith system and according to the patents mentioned above have commonly operated according to what is known in the art as a 14-point cycle. This cycle has ten points during which an item is entered in the accumulating mechanism and printed which leaves only four points in which the accumulator carrying mechanism performs its operations, the type bars are restored, and various other parts restored to normal position which necessarily cannot be restored before the accumulating mechanism and printing mechanism have performed their useful work. Naturally there is a very small margin of time permitted for the conditioning of the machine for the next cycle.

The margin of time allowed for the restoration of the parts is so small compared to the time allotted to the performance of useful work that the parts of the machine devoted to the printing function necessarily must be restored more than twice as fast as they perform their useful work so that the harmful effects of inertia become very pronounced above the practical speed limit of the machine.

The accumulating mechanism, the card feeding mechanism, and mechanism associated with them have unidirectional rotary motion principally. As a sequence, the machine can be operated at a much faster speed when tabulating alone than when listing items as the printing mechanism is composed principally of oscillating or reciprocating parts and acts as a drag on the machine. When the practical speed is exceeded the inertia of the parts is so great that the type bars either fail to fully return to normal position before the next cycle commences

or are returned with a heavy jar which is very destructive as it causes excessive wear on the machine besides causing the machine to operate noisily.

It would be possible, of course, to secure a smoother operation of the printing mechanism by lengthening the cycle of operations to permit a more gradual restoration of the printing mechanism. Such an expedient would not be commercially practical as it would require increased spacing of successively fed record cards to allow more time for the restoration of the printing mechanism thereby reducing the capacity of the machine and requiring that the speed of the machine as a whole be increased to compensate for the increased spacing of the cards and nothing would be gained.

The present invention aims to provide mechanism which permits the machine to be operated at a greater speed during listing operations and contemplates changes in the printing mechanism and card feeding mechanism which permit the type bars to be restored more gradually without, however, lengthening the operating cycle. Owing to the fact that the printing mechanism of this invention operates much smoother and with less jar than the printing mechanism of previously known machines, it is possible to operate the machine at a greater speed during listing operations, thereby increasing its capacity. The manner in which the foregoing results are secured will now be described in detail.

In Fig. 1 there is illustrated diagrammatically the well known recording mechanism of an accounting and statistical machine of the Hollerith type as illustrated and described in the patents above mentioned. The numeral 10 represents the usual resilient platen adapted to support the record sheet 11 upon the surface of which items may be printed from the usual type bars 12. The latter are mounted to reciprocate vertically and carry a series of movable type elements 13 which may be forced against the record sheet 11 at the appropriate time by means of pivoted printing hammers 14 which operate in the well-known manner. The lower ends 15 of the type bars 12 rest upon spring-urged arms 16 pivotally mounted at 17 to a crosshead 18.

The crosshead 18 is adapted to reciprocate upon vertical guide rods 19 supported by the machine frame and is moved vertically by arms such as 20 fixed to a cross shaft 21 carried by the machine frame. Normally the parts occupy the position shown in Fig. 1 in which position none of the type elements 13 are at the printing line. Once each card cycle the arms 20 are raised by a cam 21 mounted upon a shaft 22 which is driven at the rate of one revolution per card cycle by suitable means such as an electric motor. The cam 21 has a cam groove 23 cooperating with a roller 24 carried by a cam follower arm 25 loosely mounted on the shaft 21. The arm 25 has an offset lug 26 carrying an adjusting screw abutting a similar lug 27 carried by an arm 28 fixed to the shaft 21. It will be obvious that, when the cam 21 makes one revolution in the direction of the arrow thereon (Fig. 1), the arm 25 will be drawn downwardly thereby rocking the arm 28 and shaft 21 in a clockwise direction to raise the arms 20 and move the crosshead 18 vertically, this movement being at a uniform rate and synchronous with the reading of the perforations in the record cards.

If there should happen to be a hole in any card column of the record card, the magnet 29 will be energized by current passing through the card reading brush 30 (Fig. 3) in the usual manner which will cause a latch 31 associated with the magnet 29 to be released in the well known manner, thereby arresting the type bar 12 with the type element 13 corresponding to the index point position in which the hole is present so that eventually, when the crosshead 18 reaches its upper limit of travel, the printing hammers 14 will be released in the usual manner and cause an impression to be taken upon the record sheet 11. During the remainder of the cycle the crosshead 18 is gradually lowered thereby carrying downwardly all the type bars which were operated.

In machines as heretofore constructed the cam groove 23 in the cam 21 was so designed that it took ten-fourteenths of a revolution of said cam to move the type bars 12 vertically the full distance necessary to print the value of any of the ten index point positions of the record card devoted to receiving perforations representing amounts to be printed. This allowed only four-fourteenths of a revolution in which to restore the parts to the position shown in Fig. 1.

It was found, as heretofore stated, that there was a limit to the practical speed at which the machine could be operated owing to the limited time permitted in which to restore the type bars to the position in Fig. 1 and if an attempt was made to operate the machine faster than the practical speed, the type bars 12 would be either sluggish in returning to their normal positions owing to the inertia effect or they would be drawn down with a jar which proved to be very destructive and caused much noise as well as excessive wear on the machine.

Obviously it is possible to eliminate the effects of jarring by making the cam groove 23 of such a shape that the restoration of the type bars is made more gradual but this could only be done heretofore by lengthening the machine cycle since at least ten points of the cycle are required for adding and printing operations and would require changing the card feeding mechanism to increase the gap between successive cards. It will be seen that the necessity of providing more time for the restoration of the type bars by adding to the length of the machine cycle is wasteful for the reason that it diminishes the speed of the machine.

In order to speed up the machine without lengthening the machine cycle, the cam 21 has been made a 20-point cam instead of a 14-point cam; that is to say, it has been arbitrarily divided into twenty equal parts so that ten points may be devoted to restoring the type bars thus providing a more gradual restoration of the type bars and a smoother operation of the machine permitting the machine to be operated at a higher speed. The cam groove 23 is so arranged that the type bars 12 start to rise at substantially the beginning of the cycle and move upwardly at a uniform rate of speed until cam 21 has moved a half revolution or ten points at which point the type bars 12 reach their upper limit of travel and the printing hammers 14 become released.

During the remaining half revolution of the cam 21, the type bars 12 will be gradually restored so that at the beginning of the succeeding revolution of cam 21 they will start to rise again.

Naturally enough, since the movement of the

type bars 12 must be synchronized with the reading of the perforations in the card under the brushes 30, it is necessary to coordinate the feeding of the cards with the movement of the type bars. By changing the cam groove 23 so that only half a revolution of the cam is required to cover the ten index positions of the card, the time permitted for the brushes 30 to read the ten index point positions in the card has been materially shortened; consequently, it is necessary to change the operating relation between the card feeding mechanism and the printing mechanism since the cards are fed and analyzed according to a 14-point cycle whereas the recording mechanism is to be operated according to a 20-point cycle.

In order to accomplish this coordination, mechanism is provided for causing the record cards to be fed at a faster rate during the time when the brushes are reading the holes in the card than the rate at which the cards are fed when the remainder of the card and the gap between cards is passing the brushes. The manner in which the rate of feed of card feeding mechanism is increased for a portion of the cycle is illustrated in Figs. 2 and 3.

Referring to Fig. 3, the numeral 32 represents a batch of cards in the card supply hopper which cards are removed one at a time by a suitable picker 33 actuated by a connecting rod 34 pivoted to the side of a gear 36, each card being carried down by the picker 33 into position to be gripped by upper feed rollers 37 which in turn, feed the card down past the usual analyzing brushes 30, other feed rollers 38 cooperating with rollers 37 to move said card past the brushes. The feed rollers 37, 38 are driven by suitable gearing 39, 40, 41, the gear 41 being driven by another gear 42 carried by a shaft 43. The latter shaft is driven in a manner presently to be explained, by a shaft 44 which in turn is driven by a suitable source of power, such as a motor, through a belt 45, pulley 46, shaft 47, and gearing 48, connecting the shafts 44, 47. The cam 21 is driven by the shaft 44, through gearing 49 and 50 so that the cam 21 makes one complete revolution during the time which it takes for corresponding index point positions in two successive cards to pass the brushes 30. In machines as previously constructed, the driving ratio between the shafts 43, 44 is such that the cards 32 move at a uniform rate past the brushes and according to a 14-point cycle.

It will be seen that if the cards 32 were to move at a uniform rate past the brushes 30, as was formerly the case, the cam 21 in the course of a half revolution would raise the type bars through their full movement and would complete such movement quite some time before the brushes had read all of the ten index point positions which control the type bars in printing operations; thus, the printing mechanism and the card reading brushes 30 would not operate synchronously.

It is necessary, in order to coordinate the feeding of the cards 32 and the reading of the perforations in said cards 32 by brushes 30, to cause the cards 32 to move faster during the first half revolution of cam 32, the feed then being slowed down or decelerated and subsequently accelerated during the remaining half revolution of cam 21. This is accomplished by means of cam gears 51, 52, as they may be aptly called, the cam gear 51 being mounted on the shaft 53 and meshing with the cam gear 52 which is mounted on the shaft 44.

It will be noted by reference to Fig. 2 which shows the parts in the position which they occupy during the middle of the accumulating and printing portion of the cycle that cam gears 51 and 52 are so designed that the shaft 43 will move faster during the accumulating and printing part of the cycle than at other times, this movement being uniform but gradually decelerating and accelerating during the time which the upper edge of the card and the gap between the cards is passing the brushes; thus, the card will move at a uniform rate during the first half revolution of the cam 21, then the card will be gradually slowed down to allow time for certain of the mechanisms of the machine to be restored to normal position and then the card feed is increased again in readiness for beginning the next card cycle.

It will be seen from the foregoing description that the printing mechanism will operate more smoothly since the restoration of the parts is effected more gradually; consequently, the type bars will come to rest at the end of their downward stroke without jar thereby permitting the machine to be run faster without causing errors in recording items or excessive wear on the machine.

Naturally, since the accumulating mechanism must operate synchronously with the reading of the holes in the card and the printing of the items accordingly, said accumulating mechanism must be driven at a higher speed than the accumulating mechanism of the patents referred to hereinbefore. This may be readily accomplished by changing the gear ratio of the driving gears connecting the main driving shaft of the machine to the driving shaft for the differentially controlled clutches so that said clutches are driven synchronously with the reading of the holes in the card and the printing mechanism.

The invention has been described as embodied in a specific form in a well-known type of record controlled accounting and statistical machine solely for the purpose of illustrating the invention and it will be understood that the invention is not limited either to the specific form shown and described or to application in the particular type of machine disclosed. Various modifications may be made in the invention as desired or it may be embodied in other types of machines without in anywise altering the invention in substance.

I claim:

1. In a record controlled machine, a device for analyzing records while in motion, printing mechanism controlled by the analyzing device in accordance with data designations in said records, said printing mechanism including type bars, means controlled by the analyzing means for arresting the type bars in printing position, and means for operating the type bars to move the latter to printing position, said last named device including an element adapted to first move the type bars to printing position and thereafter to gradually restore said type bars to normal position; and means for feeding said records at one speed while the type bars are being moved to printing position and at another speed while the type bars are being restored.

2. In a record controlled machine, a recording element settable in accordance with data designations in control records, means adapted to be effective during a portion of each record cycle

to sense said designations and control the setting of the recording element in accordance with said designations, means for feeding the records to the sensing means, means cooperating with the recording element for physically setting said element to recording position while the latter is being controlled by the sensing means, and means for continuously operating the feeding means and effective to operate the latter at a higher rate of speed during the portion of a record cycle in which sensing of the designations in the card and setting of the recording element takes place than at other times in the cycle.

3. In a record controlled machine, record feeding means, printing mechanism controlled by data designations in records fed by the feeding means including type bars movable to and from printing position, means effective in a single record cycle for first moving the type bars to printing position and then restoring them, and means operated by the moving means for continuously operating the feeding means and adapted to feed said records at a faster rate of speed during the portions of said cycle when the type bars are being moved to printing position than when the type bars are being restored.

4. In a record controlled machine, a record feeding means, printing mechanism adapted to be controlled by data designations in records fed by the feeding means including type members movable to and from printing position, means effective in a single record cycle for first moving the type members to printing position and then restoring them, and means operated by the last named means for continuously operating the feeding means to feed said records at a faster rate of speed during the portions of said cycle when the type members are being moved to printing position than when the type members are being restored, said operating means comprising intermeshing cam gears connecting said moving means to the feeding means.

5. In a record controlled machine, a card feeding device, analyzing means for sensing control designations in each card as it is fed by the feeding means, recording means controlled by said designations, a continuously operating driver for the recording means, and cam gears connecting said driver to the feeding device, said cam gears being adapted to continuously operate the feeding device at given speed while the recording means is under control of the designations in the cards and at a different speed at other times.

CLAIR D. LAKE.