Aug. 17, 1954 K. WESTINGER ET AL 2,686,584

APPARATUS FOR RECIPROCATING PAPER CARRIAGE OF ADDING MACHINES

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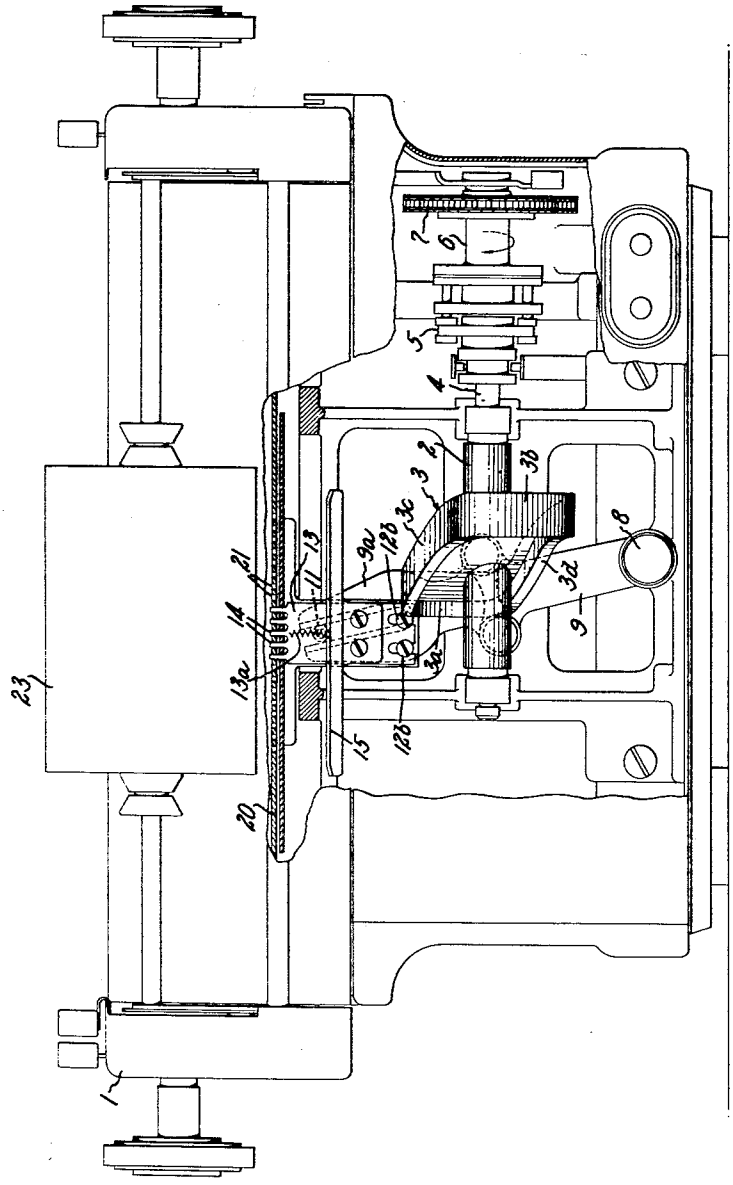


Fig. 1.

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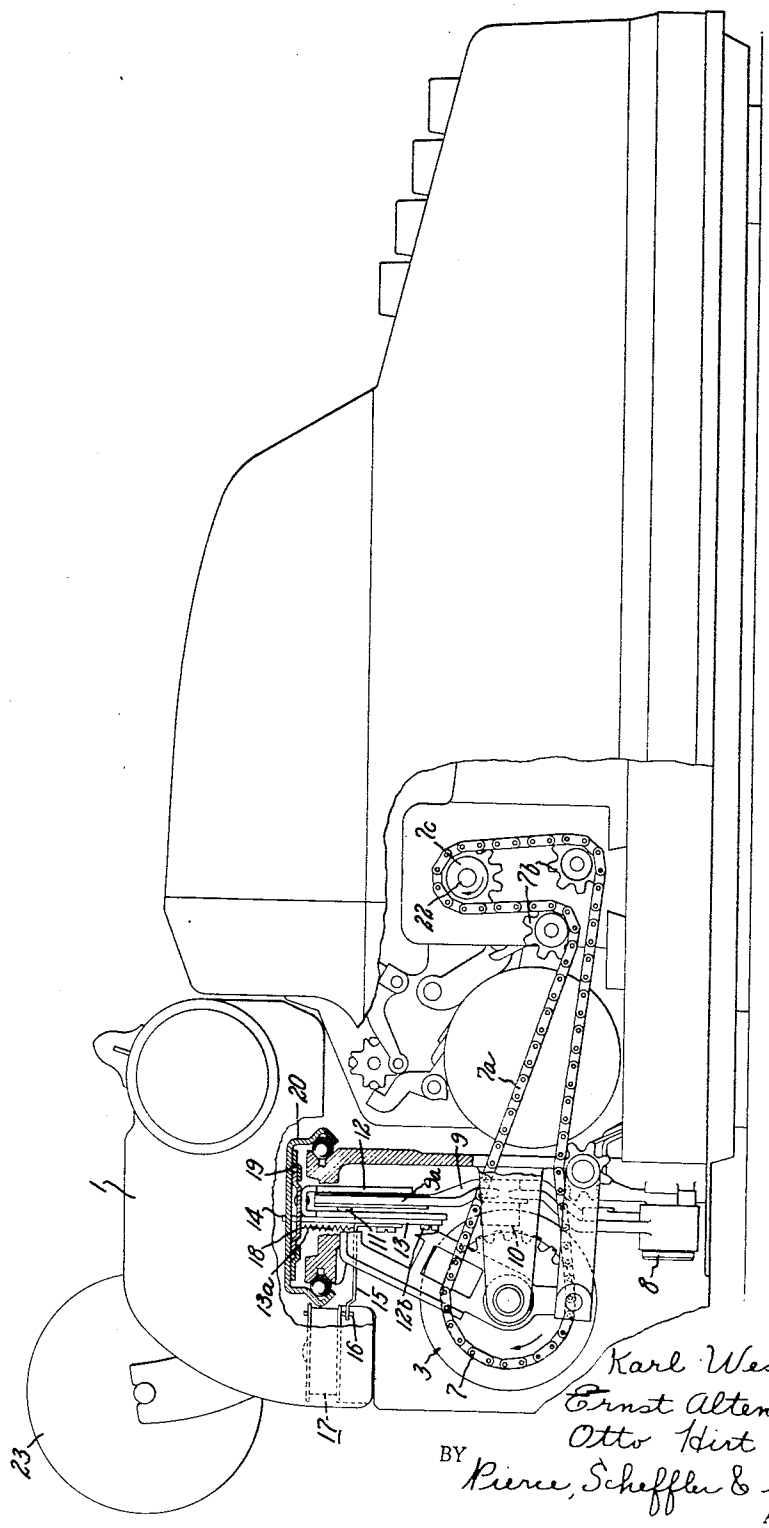


Fig. 2.

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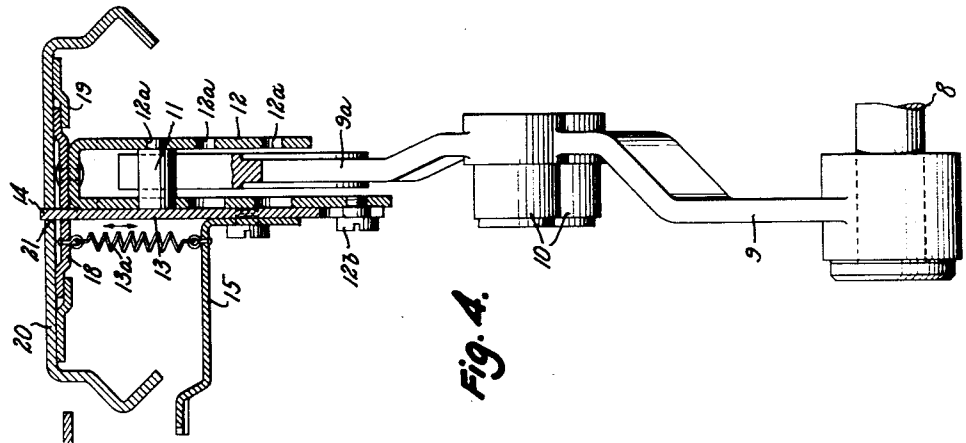


Fig. 4.

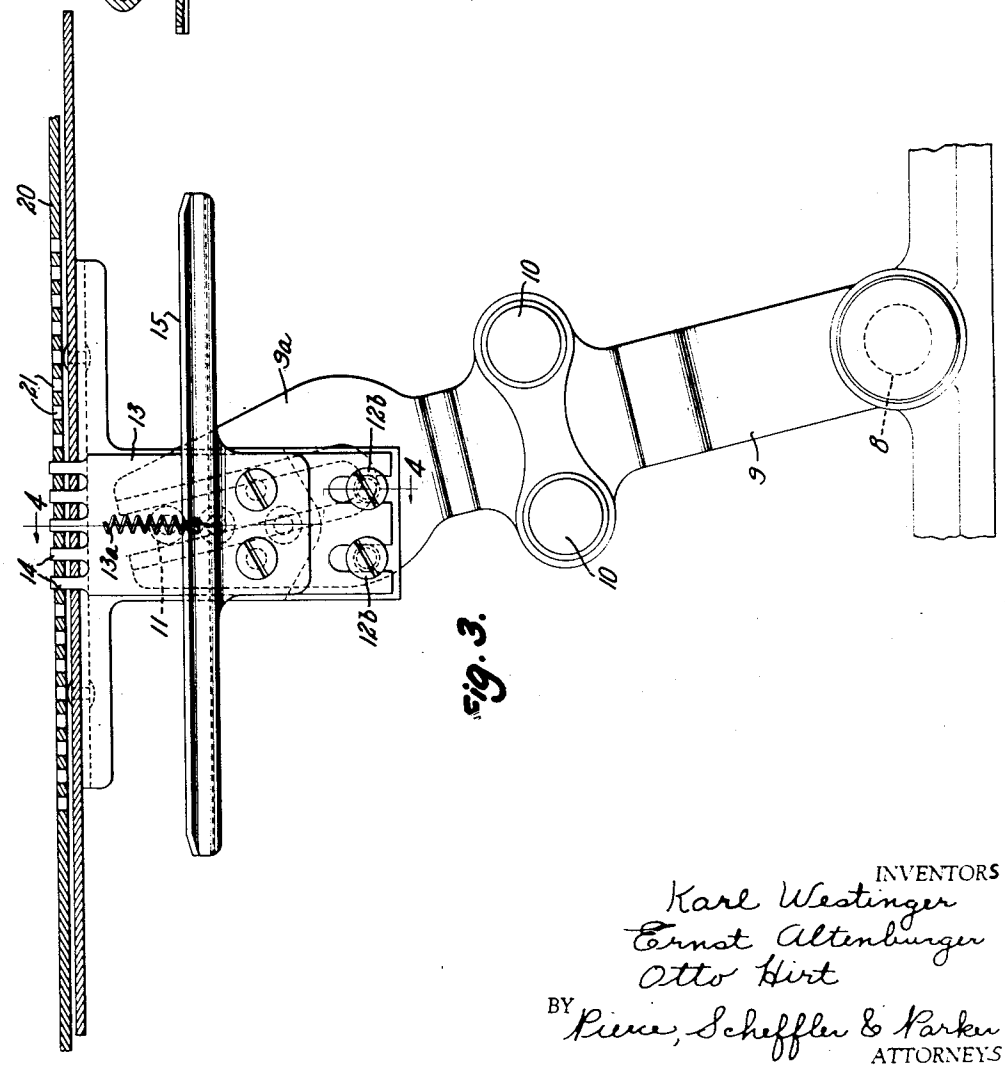


Fig. 3.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR RECIPROCATING PAPER CARRIAGE OF ADDING MACHINES

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4 Claims. (Cl. 197—176)

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The present invention relates to calculating machines and has particular reference to adding machines of the so-called "ten-key" type equipped with a carriage having a paper tape in roll form thereon and wherein the carriage and roll are caused to reciprocate between two positions with respect to the printing mechanism thereby to automatically present the columns of a pair alternately to the printing position so that successive settings of numbers on the keyboard will be printed alternately in the two columns.

The above type of reciprocatory carriage motion is useful for many purposes such as in the tabulation of debits and credits, gross and net weights, price and discount, etc. and it is the object of the present invention to provide an improved arrangement for effecting such motion which is most quiet but fast in operation, practically free from vibration and jolts, and which is simply and reliably constructed.

The improved drive for reciprocating the carriage is comprised principally of a rotary cam located beneath the paper carriage at the rear of the machine and which is coupled continuously to the main drive shaft of the machine. The main drive shaft always runs in the same direction in a step-by-step manner, one step at a time for each number set up on the keyboard, and printed on the tape, and hence the cam always runs in the same direction in a step-by-step manner and turns through 180° at each step. The cam is operatively connected by a cam follower to an oscillatory lever which is pivotally mounted at its lower end to the lower part of the frame of the machine and has its upper end coupled to the paper carriage. Consequently each time the cam turns through 180°, the oscillatory lever and hence the paper carriage is shifted from one of its two positions to the other.

The cam can be disconnected from the main drive shaft of the machine if it is desired to put the reciprocating drive out of action in order to print a single column of numbers and this is accomplished by interposing a clutch type coupling in the drive connections between the main drive shaft and cam and which is arranged to be operated by a special key or lever.

In accordance with another feature of the invention, the connection between the oscillatory lever and the paper carriage can be made at selected positions longitudinally along the carriage so that selected portions of the carriage can be caused to reciprocate with respect to the printing mechanism.

Still another feature of the invention is the

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provision of an indexing device which cooperates with conventional tabulator stops arranged at the rear of the carriage so as to enable the carriage to be shifted in a very fast manner to a selected position for reciprocation by the improved cam and lever drive.

The foregoing advantages and objects will become more apparent from the following detailed description of an adding machine incorporating one practical embodiment of the invention and the accompanying drawings in which:

Fig. 1 is a rear elevation of the machine with the rear wall broken away to show the improved paper carriage reciprocating mechanism in longitudinal elevation;

Fig. 2 is a side elevation of the machine with the side wall broken away to show the mechanism in side elevation;

Fig. 3 is a rear elevation drawn to an enlarged scale of the oscillatable lever mechanism by which the carriage is reciprocated; and

Fig. 4 is a vertical section taken on line 4—4 of Fig. 3.

With reference now to the drawings, the adding machine is seen to be provided with the usual paper carriage 1 arranged to slide transversely of the frame on rails provided for that purpose, keyboard and printing mechanism and other conventional components. The details of construction of these components of the machine have no relation to the present invention and hence have been omitted in the interest of simplifying this disclosure.

As seen in Fig. 1, mounted horizontally in spaced journals located in upstanding supports at the rear, middle part of the machine beneath the carriage 1 is a shaft 2 on which is mounted a cam 3. This cam includes two half cylindrical portions 3*a*, 3*b* each concentric with the axis of shaft 2 but which are opposite from each other, i. e. displaced 180° apart. Cylindrical portions 3*a*, 3*b* are also offset from each other along the axis of shaft 2, and are interconnected by two other straight portions 3*c*, 3*d*, which therefore extend obliquely to that axis. A stub portion 4 of the shaft 2 extends beyond the end journal and mounts a clutch coupling 5 of conventional construction which serves to normally couple shaft 2 with a shaft 6 which mounts a sprocket wheel 7. The coupling 5 is provided only for the purpose of facilitating the disconnection of the carriage reciprocating mechanism and is arranged to be actuated in or out by means of a special key or by a hand lever, neither of which has been shown.

As seen clearly from Fig. 2, the sprocket wheel 7 is connected by means of a sprocket chain 7*a* and idler sprockets 7*b* to another sprocket wheel 7*c* mounted upon and driven by the main drive shaft 22 of the machine. Drive shaft 22 always rotates in the same direction as indicated by the directional arrow and hence sprocket wheel 7, shafts 6, 2 and cam 3 will always rotate in the same direction. The electric controls for the motor which drives shaft 22 are such that after each number to be tabulated is set upon the keyboard and printed on tape 23, shaft 22 will be rotated through a number of degrees, 360° in the present embodiment, sufficient to cause shafts 6, 2 and hence cam 3 to rotate through 180°. The mechanism then stops until the next number to be tabulated is set up on the keyboard and printed. All of this control mechanism is conventional and hence has not been included in the present application. The motion of the reciprocating carriage is therefore not derived from the to-and-fro motion of a shaft in the machine (not shown) as in conventional constructions which require alternate coupling and uncoupling of the carriage reciprocating mechanism from that shaft but rather occurs uniformly during the entire running period of the electric drive motor.

A pivot bearing 8 is provided beneath cam 3 and shaft 2 and connected thereto is the lower end of a lever 9 which is arranged to oscillate in a plane parallel with but located to the inside of shaft 2. Lever 9 is provided intermediate its ends with a pair of rollers 10 and these are spaced apart by a distance equal to the width of cam plate 3 at its cylindrical portions 3*a*, 3*b* so as to always engage and roll in contact with opposite sides of the cam around its entire cam track which consists of the opposite faces of cam portions 3*a*, 3*b*, 3*c* and 3*d*.

The upper end of lever 9 terminates in a forked portion 9*a* in which is arranged to slide a pin 11. The latter is secured to an inverted U-shaped member 12 which embraces the forked portion 9*a*. It will be seen from Fig. 12 that the U-shaped member 12 is provided with a plurality of vertically spaced holes 12*a* in any one of which the pin 11 can be entered as is desired. The rear side of member 12 is provided with spaced guide pins 12*b* by which to mount a slider 13 for sliding movement in a vertical plane as indicated by the double headed arrow in Fig. 12. Slider 13 has approximately the same width as the member 12 and is provided with five teeth 14 at its upper end.

At a right angle to slider 13, and rigidly fastened to the same is a horizontal elongated bar 15 which has a notch or recess at the middle of its outer elongated edge. The bar 15 operates in known manner in cooperation with the stops 16 of a tabulator set mechanism 17 which is fastened to the rear side of carriage 1. These stops fit selectively into the central recess in bar 15 and hence enable the carriage to be shifted very rapidly from one position to another when the reciprocating drive is disconnected therefrom.

Also carried atop the upper part of the inverted U-number 12 is a rail 18 which has five holes through which the teeth 14 pass. The rail 18, for its part, is held in lateral guides 19 of base plate 20 integral with carriage 1 and which extends for the entire length of carriage 1. Plate 20 is provided throughout its length with a row of spaced holes 21 to receive the teeth 14 of slider 13 thus completing the coupling between lever 9 and carriage 1.

Slider 13 is slidably connected with the inverted U-shaped part 12 in such manner that it is normally drawn upward by a spring 13*a* so that teeth 14 therein guided by the holes in rail 18 engage the holes 21 in base plate 20. By means of a key disposed at the side of the carriage which is coupled to slider 13, it is possible to pull down the slider 13 against the action of its loading spring 13*a* thus releasing teeth 14 from holes 21 in plate 20 so that the paper carriage 1 can be shifted to another position relative to this carriage reciprocating mechanism. When the carriage reaches its new position, slider 13 is permitted to move upward and reengage teeth 14 in holes 21 of plate 20.

The mode of operation is as follows:

Assuming that shafts 6, 4 and 2 are connected by coupling 5, a number to be tabulated is set up on the keyboard of the machine to be printed on the tape 23. The electric motor mechanism of the machine then functions to rotate shaft 22 and sprocket wheel 7*c* through 360° and effects a 180° rotation of shaft 2 and cam 3. At the beginning of this rotary movement of cam 3 rollers 10 lie on opposite sides of the cam at the cylindrical portion 3*a*, as shown in Fig. 1, and slide along this portion first. During the initial angular displacement of cam plate 3 there will of course be no movement of cam follower rollers 10 and hence no pivotal displacement of lever 9 since this portion 3*a* of the cam track remains stationary relative to and does not progress longitudinally of the axis of shaft 2. During the time that rollers 10 are sliding along the cylindrical portion 3*a*, the amount set up on the keyboard is printed on tape 23. When the type hammers return from tape 23 into the rest position, cam 3 has turned so far that the rollers 10 now move onto the oblique portion 3*c*.

When however rollers 10 leave portion 3*a* and ride on the curved portion leading into the oblique portion 3*c*, lever 9 will begin to move pivotally from the rest position shown in Fig. 1 towards the right reaching a maximum velocity at about the middle of cam portion 3*c*. As rollers 10 reach the curved portion on the cam track where portion 3*c* begins to merge into the opposite cylindrical portion 3*b*, the velocity of lever 9 will begin to decrease in the same manner as it increased at the beginning of its stroke and the lever will come to rest at the other end of its stroke when rollers 10 reach cylindrical portion 3*b*. This also completes the 180° travel of the cam plate 3.

During pivotal movement of lever 9, it will be evident that pin 11 operating in slot 9*a* and hence slider 13 and paper carriage 1 are also caused to shift transversely of the machine and printing mechanism so as to bring the paper tape 23 to a new columnar position with respect to the printer.

The next number to be tabulated in the new position of the paper carriage 1 is then set up on the keyboard to be printed. When this has been done, shaft 22 is then driven in the same direction as before for another complete revolution causing cam 3 to be rotated, also in the same direction as before, for another 180°. Cam follower rollers 10 follow the cylindrical and oblique cam portions 3*b*, 3*d* in succession. As the rollers 10 ride on cylindrical cam portion 3*b*, the said next number is printed on the tape 23. As rollers 10 transfer to the oblique cam portion 3*d* they cause lever 9 to thus start in the reverse direction and carry paper carriage 1 back to its start-

ing position, thus completing one cycle of movement for the carriage. The cycle then repeats itself with the result that carriage 1 reciprocates between two positions with respect to the printing mechanism thereby to automatically present each of a pair of columns alternately to the printing position so that successive settings of numbers on the keyboard will be printed alternately in the two columns. The printing of an amount or number is thus always effected at the time when rollers 10 slide on the cylindrical parts 3*a* and 3*b* of cam 3 respectively, while transport of the carriage and return of the computing gear is effected at the time when rollers 10 slide on the oblique parts 3*c*, 3*d* respectively of cam 3.

The extent of the reciprocating stroke of lever 9 and paper carriage 1 depends upon two factors, one being the axial distance between the two semi-cylindrical end portions of cam 3 which determines the length of the oscillating stroke of lever 9, the other factor is the distance between the pivotal axis at bearing 8 for lever 9 and the center of pin 11. For any given case, the stroke of lever 9 cannot therefore be changed but as previously explained it is possible to shift pin 11 from one to another of the apertures 12*a* and to that extent change the distance from pin 11 to the pivot axis of lever 9 and hence effect a corresponding change in the length of reciprocation stroke of paper carriage 1.

If it is desired to change over from dual to single column tabulation, it is only necessary to declutch at coupling 5 thus disconnecting shaft 2 and cam 3 from the drive elements 22, 7*c*, 7*b*, 7*a*, 7 and 6. As previously explained, this is done by means of a special key or through a hand lever. Single column tabulation is required in simple problems of addition and might also be necessary in situations where intermediate values are to be found which are then registered in one column space only below each other. It is thus to be noted that the paper carriage reciprocating mechanism need only be disconnected for special situations and that normally it operates automatically without the necessity for key or other types of manipulation.

In the event that it becomes necessary to change the position of paper carriage 1 in order to execute certain tabulations or allow for differences in existing forms, slider 13 is then pulled down by means of a special key thus retracting teeth 14 from the slots 21 in plate member 20 of the paper carriage 1. The carriage can then be shifted as desired and for example can be brought quickly into a previously selected new position determined by the tabulator set mechanism 17.

In conclusion it will be seen that the entire arrangement for reciprocating the paper carriage in accordance with the present invention is not only extremely simple without interposed and more or less unreliable spring-loaded gear components but also brings about a surprisingly quiet

operation of the machine with a minimum of vibration thus eliminating the need for any special devices to hold the machine in place while in operation.

We claim:

1. In an adding machine including a laterally movable paper carriage, means for reciprocating said carriage between two positions relative to the printer mechanism whereby parallel columns of figures may be printed on the paper, said reciprocating mechanism comprising a cam arranged for rotation at the rear of the machine below said carriage on an axle parallel to said carriage, drive means for said cam connected to the drive mechanism of the machine and which serves to rotate said cam intermittently and always in the same direction between successive printing operations, a generally upright lever, means pivotally mounting the lower end of said lever on the machine, means connecting the upper end of said lever with said paper carriage including a pin slidable in a forked portion at the upper end of the lever, an inverted U-shaped member secured to said pin, a toothed member slidable on said U-shaped member and a base plate on said carriage having a row of spaced holes extending longitudinally of the carriage adapted to receive the teeth on said toothed member, and cam follower means carried by an intermediate portion of said lever and which bears upon and is actuated by said cam to impart an oscillatory motion to said lever and a reciprocatory motion to said carriage.

2. A reciprocating mechanism for an adding machine as defined in claim 1 wherein said inverted U-shaped member is provided with a plurality of sets of vertically spaced means for securing said pin to said member.

3. A reciprocating mechanism for an adding machine as defined in claim 1 wherein said inverted U-shaped member has attached thereto a rear projection elongated in the direction of and arranged parallel to said carriage, said projection having a slot adapted to engage a selected one of the plurality of tabulator stops carried by said carriage.

4. A mechanism for reciprocating the paper carriage of an adding machine as defined in claim 1 wherein said cam rotates in steps of 180° and includes a pair of oppositely disposed axially spaced semi-cylindrical portions connected by portions generally oblique to the cam axis.

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