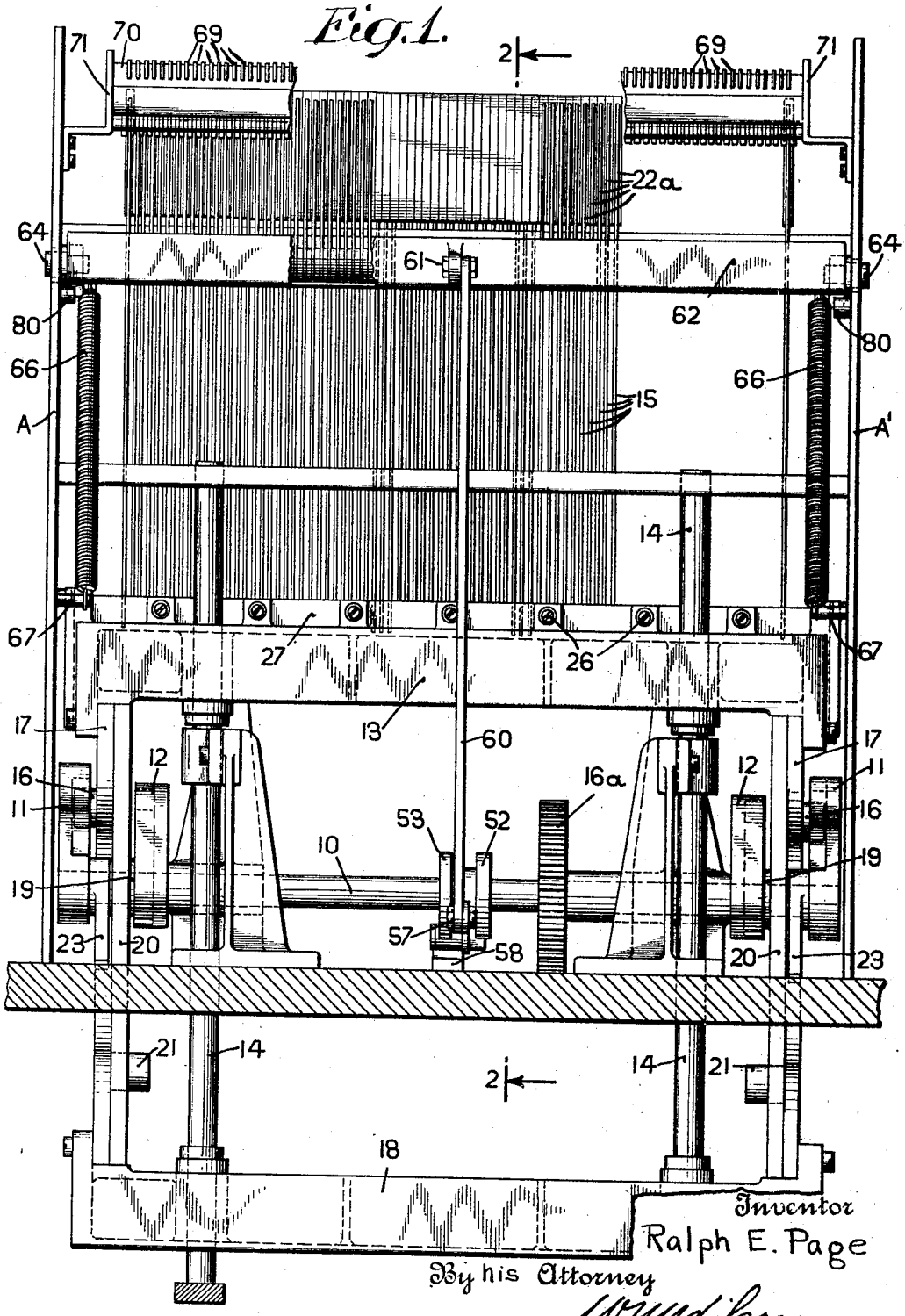
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PRINTING HEAD RECIPROCATOR

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Fig. 1.



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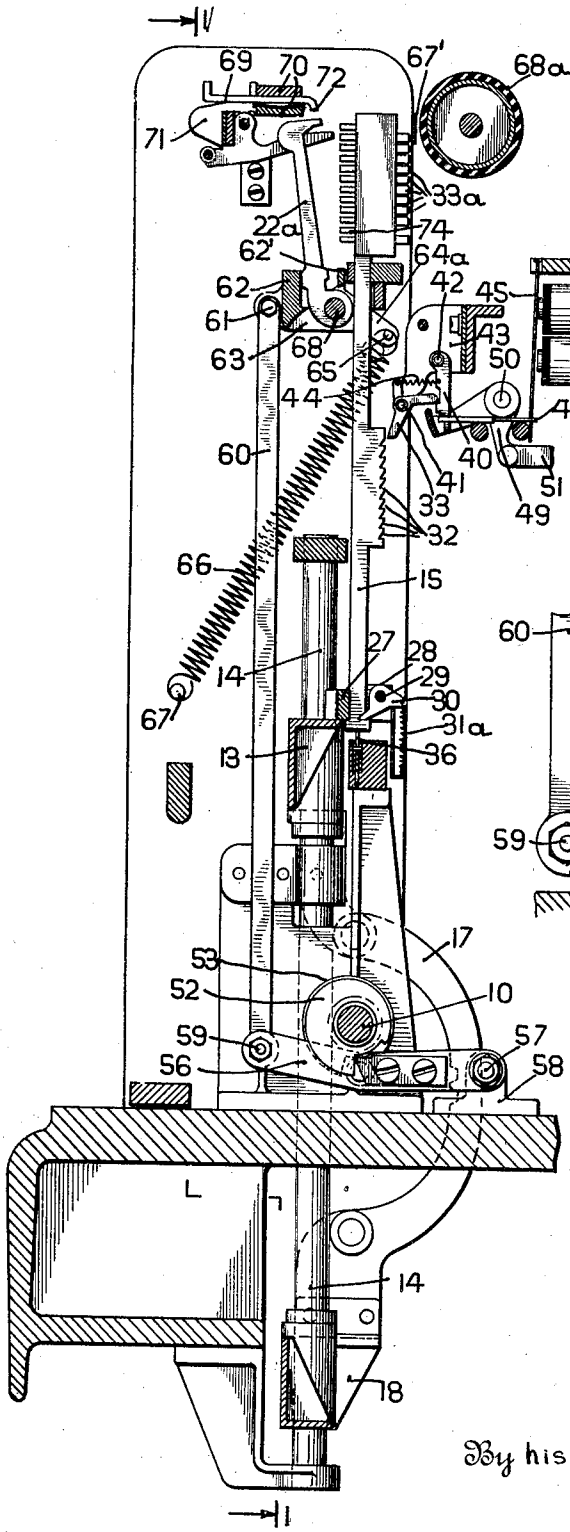


Fig. 2.

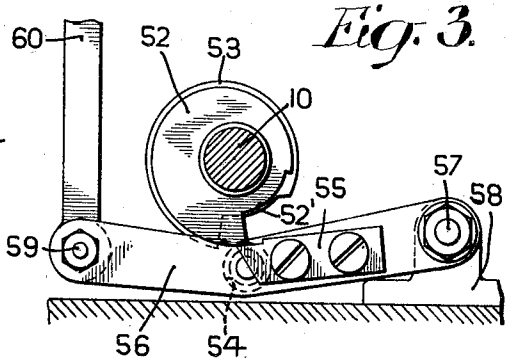


Fig. 3.

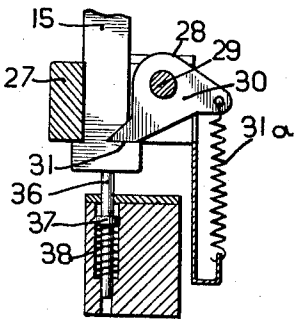


Fig. 4.

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PRINTING HEAD RECIPROCATOR

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Fig. 5.

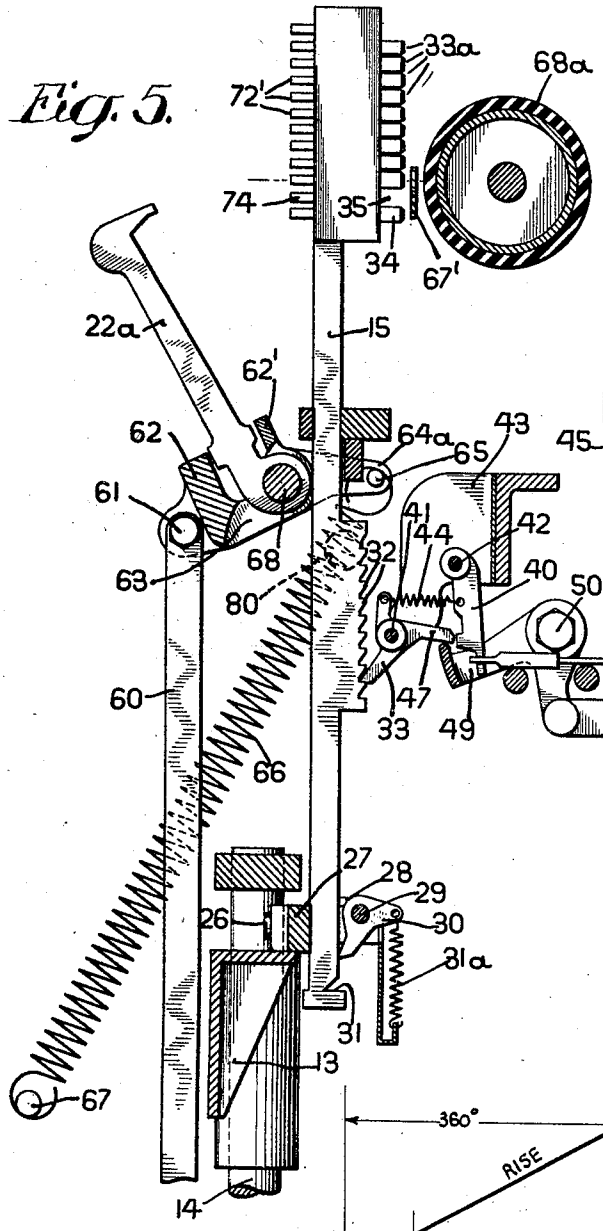
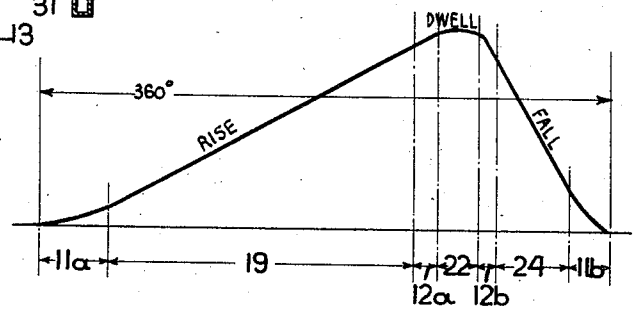


Fig. 6.



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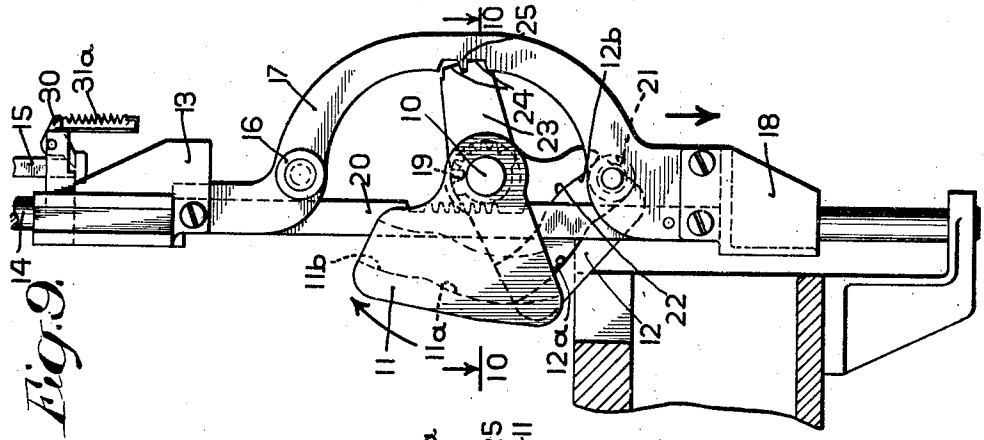


Fig. 9.

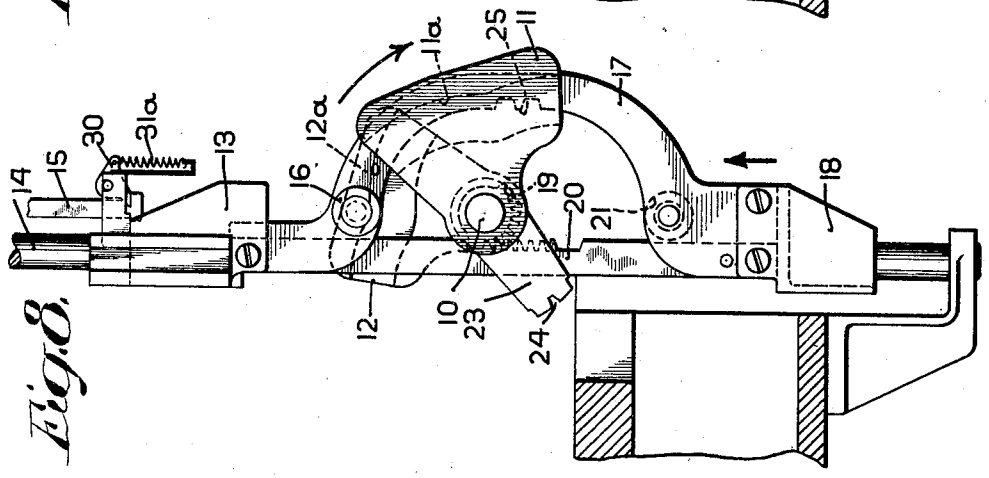


Fig. 8.

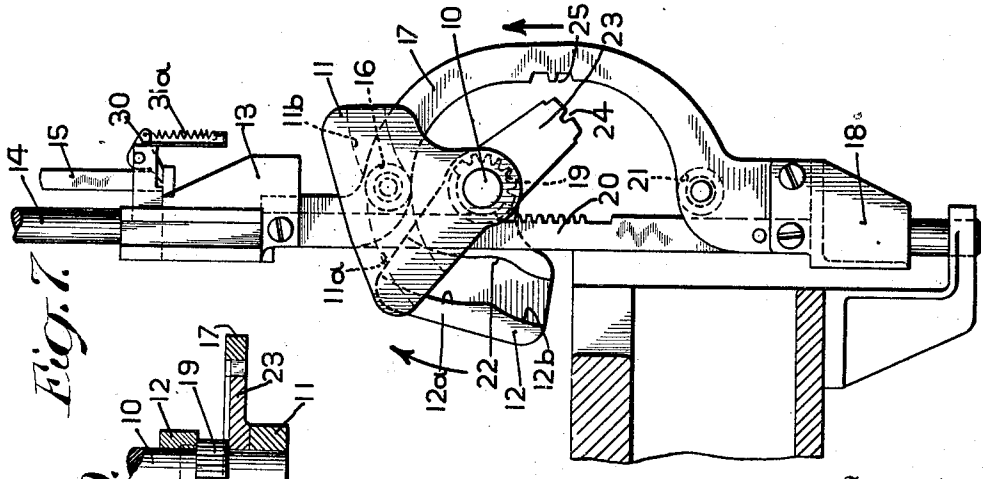


Fig. 7.

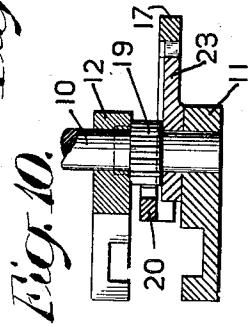


Fig. 10.

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Patented Nov. 10, 1931 1,830,765

UNITED STATES PATENT OFFICE

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PRINTING HEAD RECIPROCATOR

Application filed September 2, 1927. Serial No. 217,079.

This invention relates to reciprocatory printing machines and more particularly to a printing head reciprocator to be used in conjunction with accounting machines or the like.

Many tabulating machines in commercial use are equipped with a printing attachment which includes type bars, having type uniformly spaced thereon, and reciprocable to bring the different type into printing position. It is desirable that the type bars have a uniform motion throughout their type selecting stroke and this has been very difficult of attainment when straight type bars are used. The type bars are driven from a rotary shaft through the intermediary of either arms and links or cams. The difficulty of obtaining uniform rectilinear motion from the link construction without introducing unduly complicated operating connections is obvious. Theoretically the cam drives may provide the desired uniform motion but practically the accurate machining of the cams for this purpose presents a serious construction problem. Furthermore, when box cams are used there is always more or less tendency for the parts to bind, thus entailing further designing and machining problems to avoid excessive wear on the operating parts.

According to the present invention a simpler form of type bar drive is contemplated in which the motion of the type bars throughout the type selecting portion of their stroke is made absolutely uniform without the accurate machining of parts which has heretofore been necessary. This is accomplished by the use of a rack and pinion drive for the bars in which case the pinion may be operated from the rotating drive shaft. Owing to the reciprocatory movement of the type bars, however, provision should be made for removing the shocks due to the reversals of direction of movement of the bars from the rack and pinion as otherwise a rapid deterioration of the gear teeth would result. This is taken care of by providing the rack and pinion drive only for the intermediate portions of the stroke, when the type are actually passing printing position, and providing separate cam drives for the end or reversing portions of the stroke. As these end portions of the stroke do not require uniform motion the cams may be designed to reverse the motion with as little shock to the parts as may be.

The invention further contemplates the elimination of springs for operating the type bars either in their advancing or restoring movements. The restoring movement is likewise effected in the preferred embodiment by a rack and pinion drive which preferably is independent of the advancing rack and pinion and designed to provide for a quick return motion. It is obvious, however, that uniform motion during the restoring portion of the stroke is not essential and the bars could be driven during this portion of the stroke by cams, linkage or even springs and the principal advantages of the invention, in regard to uniform operating movement during the type selecting stroke, still realized.

The general scheme of operation of the preferred embodiment of the invention may be briefly summarized. The type bars are started in advance direction with gradually increasing speed by a cam drive. When normal speed for the advance stroke is attained the drive is assumed by a rack and pinion device which maintains the normal uniform speed until all types have passed printing position. After this the drive is assumed by a second cam drive which reduces the speed gradually to zero, reverses the direction of movement of the bars and gradually increases their speed in the reverse direction. When normal high restoring speed is reached the drive is assumed by a second rack and pinion drive which operates until towards the end of the reversing stroke when the drive is again taken up by the first cam drive to again reverse the motion.

The principal object of the invention is to provide a reciprocatory drive for a printing mechanism in which a uniform motion is obtained during the type selecting stroke and to provide improved and simplified construction and operation of parts for this result.

Another object of the invention is to provide for a rack and pinion drive for recipro-

catory type carrying mechanism and to provide for removing the shocks due to reversal of movement from the rack and pinion drive.

Still another object of the invention is to provide a combined cam and rack and pinion drive for a reciprocatory printing mechanism with a view to obtaining uniform motion during the type selecting portion of the stroke and to eliminate shocks to the drive mechanism during reversals of movement of the printing mechanisms.

Still another object of the invention is to provide for eliminating operating springs in a reciprocatory printing mechanism.

Further objects and advantages will be more fully set forth in the accompanying specification and claims and shown in the drawings, in which

Fig. 1 is a front elevational view of the printing head reciprocator.

Fig. 2 is a sectional side elevation of same.

Fig. 3 is a detail of the hammer actuating mechanism.

Fig. 4 is a detail showing a connection between the type carriers and the reciprocating cross head.

Fig. 5 is an enlarged detail of the mechanism shown in Fig. 2.

Fig. 6 is a diagram illustrating the operation of the printing head.

Figs. 7, 8 and 9 are similar detail views showing the operation of the parts in different positions, and

Fig. 10 is a section taken on line 10—10 of Fig. 9.

Referring to Fig. 1, the device comprises a main printing shaft 10 carrying pairs of cams 11 and 12 fixed thereto at each side of the machine, a cross head 13 mounted for vertical movement on rods 14, a plurality of type bars 15 and other suitable mechanism which will be presently described. A gear 16*a* rigidly mounted on the shaft 10 meshes with a gear (not shown) on a tabulating machine which rotates the shaft 10 one complete revolution for each printing cycle.

At the beginning of the cycle, as shown in Fig. 7, cam followers 16 mounted on the upper end of the arcuate arms 17 fixed at their lower ends to a cross piece 18 and at their opposite ends to the cross head 13 begin to coact with portions 11*a* of cams 11. As the cams 11 continue to rotate clockwise, cam portions 11*a* coacting with followers 16, cause the cross head 13 to be raised with gradually accelerated speed as indicated in Fig. 6. At a predetermined point in the cycle of the machine, the cam followers 16 will leave their coacting cams 11 at which time mutilated gears 19 also fixed on the shaft 10 will engage the teeth on the racks 20 which are connected at their upper ends to the cross head 13 and at their lower ends to the cross piece 18. At this point the racks 20 will have attained a linear speed which corresponds to the peripheral speed of the gears 19 above referred to. During the time that the gears 19 engage the teeth on the racks 20 the cross head 13 and the type bars 15 will be moved upwardly at a constant speed as indicated in Fig. 6, so that the type pass a given point synchronously with the passage of a corresponding index point on the tabulating card through the usual card reading or analyzing device. The means for arresting the movement of the type bars 15 at any desired denomination when a circuit is set up through a perforation in a card at an index point showing the denomination desired, will be presently described.

As the mutilated gears 19 become disengaged with the teeth on the racks 20 (Fig. 9) cam followers 21 mounted on the lower ends of the arcuate arms 17 will engage portions 12*a* of their coacting cams 12 fixed on the shaft 10. The engagement of these cam followers with cam portions 12*a* will decelerate the upward movement of the cross head 13 to zero velocity. As cam 12 continues to rotate, the cam follower 21 coacts with the portion 22 of the cam 12 designed to impart a dwell to the type bars, at which time printing hammers 22*a* (Figs. 2 and 5) will strike against the type standing in printing position to print the characters represented by the type. During this printing operation the shaft 10 will continue to rotate. After the cam followers 21 have passed the dwell portion 22 on the cams 12, these portions 12*b* of cams cause the cross head 13 to gradually descend beginning at a low speed and rapidly accelerating until the speed of the descending cross head 13 and the arcuate arms 17 is the same as the speed of the arms 23 rigidly fixed on the shaft 10 (Figs. 7, 8 and 9). The arms 23 are provided with gear teeth 24 at one end which engages a tooth 25 on the arcuate arms 17 on the downward stroke of the cross head. The engagement of the arms 23 with the arcuate arms 17 takes place just before the cams 12 release their cam followers 21 after which the arms 23 continue to move the cross head downwardly as indicated in Fig. 6. As teeth 24 and 25 disengage, cam followers 16 engage portions 11*b* of cam 11 designed to slowly decelerate the downward movement of the cross head, until the parts reach the positions shown in Fig. 7 where the cross head has reached its lowermost position at which time, the cycle is ready to be repeated upon continued turning of the shaft 10.

Thus in one cycle of the shaft 10 the cross head 13 is started from a position of rest, accelerated upwards to normal speed, which speed is maintained uniform during the time type is passing the printing platen. The cross head 13 then dwells for a moment holding the type in printing position while printing is effected and very quickly returns to

its initial position with substantially no shock or noise. Fig. 6 shows clearly the motion diagram of the cross head. From this diagram it will be noted in reading from the left that the heavy line indicates the movement of the cross head 13, the rise commencing on its zero position and increasing its speed through a gradual curve, then rises at a constant speed until near the upper limit of its movement when it decelerates and then dwells for a moment after which it commences to descend, rapidly accelerating its speed and then descends through the greater part of its downward movement at a constant speed, then decelerates near its lower extremity to a zero velocity.

Reference will now be had to Figs. 2, 4 and 5 wherein the operation of the type bars 15 and their associated parts will be described. Rigidly fixed to the cross head 13 by means of screws 26 is a bar 27 which carries a cross rod 28 upon which are pivotally mounted at 29 impositive locking pawls 30, it being understood that there is a pawl for each type bar 15. As will be noted in Fig. 4, the nose portion of each pawl 30 is urged by spring 31*a* to engage a notch 31 in the lower end of each type bar 15 so that when the cross head 13 rises in the manner previously described, the pawls 30 will cause the type bars 15 to rise in unison with the cross head 13. Each type bar 15 (Figs. 2 and 5) has a series of notches 32 thereon which coact with a pawl 33 normally locked out of engagement with the notches 32 by means which will be presently described, it being understood that there is a pawl 33 for each type bar. The notches 32 are so spaced that when a type bar 15 moves upwardly in the manner described, as each type 33*a* is reaching its printing position a corresponding notch 32 on the type bar will be passing the latching pawl 33. If the latching pawl 33 is tripped during the upward movement of the type bar it will engage one of the notches 32 and prevent further rise of the bar, the impositive locking pawl 30 slipping out of its notch 31 to prevent interference with further upward movement of the cross head 13. This stopping of the type bars holds one of its type 33*a* in printing position opposite the platen 68*a* and the particular type selected depends on the time of tripping latch 33. In the present instance I prefer to so arrange the type elements 33*a* that the zero type 34 is at the bottom of the type head of bar 15 and after skipping the position 35 the type elements 32 in the ascending order are from 1 to 9; the 9 being the uppermost type. In automatic accounting machines the zero type are usually called by a separate controlling system which depends for its operation on the printing of a significant figure to the right of it. The spacing shown is convenient for such a system but as it does not enter into the present invention it will not be further described. After printing is effected in a manner to be explained later, the locking pawl 33 is withdrawn from engagement with the notch 32 in a manner also to be presently described.

Upon the downward stroke of the cross head 13 the pawl 30 will slide downwardly along the type bar 15 until it engages the notch 31 (Figs. 2 and 4) at the bottom of the type bar whereupon it will carry the type bar downwardly with it and thus restore it to its initial position. Should the friction between the pawl 30 and the type bar 15 be sufficient to carry the type bar downwardly without the pawl 30 engaging in the notch 31, the type bar will descend until it strikes a shock absorbing stop pin 36 (Fig. 4) slidably mounted in the frame of the device. This pin has a collar 37 at its upper end against which a coil spring 38 rests; thus the collar is held against the frame of the device causing the pin 36 to be extended when in its normal position. Should the type bar 15 abut the surface of the pin 36, the spring 38 will be compressed slightly until its force of compression is sufficient to overcome the friction between the pawl 30 and the type bar 15 at which point it would hold the type bar stationary permitting the pawl 30 to be slidably restored downwardly to engage its respective notch 31.

The tripping of latch 33 to engage a notch 32 in the type bar 15 is effected by means of a magnet 35*a* which is energized by a circuit completed in any desired manner at a time depending on which type hammer is to be actuated for printing. Normally the pawl 33 is locked in the position shown in Fig. 2 by the latch 40. As will be noted the pawl 33 and the latch 40 are pivotally mounted at 41 and 42 to brackets 43 fixed to the device and are biased by a spring 44 which serves a double purpose; firstly, that it holds the latch 40 in engagement with the end of the pawl 33 as shown in Fig. 2 and secondly, that it urges the nose of the pawl 33 when unlatched against one of the notches 32 on the type bar 15. When the magnet 35*a* is energized, it attracts its armature 45 which is connected by a link 46 to the latch 40 and thus pulls the latch to the right as viewed in Fig. 5, out from under the tail piece 47 of the pawl 33 thereby releasing the pawl permitting it to engage with one of the notches 32 to which the type bar had been set in the manner previously described. As soon as printing has been effected, a bail 49 pivoted at 50 is actuated by a link 51 which rocks the bail about its axis in a clockwise direction lifting the tail piece 47 of the pawl 33 upwardly so that the latch 40 urged by the spring 44 may again latch the pawl 31 out of engagement with the notches 32. The link 51 referred to is actuated by mechanism in the tabulating machine which is not necessary to disclose in the present instance.

Reference will now be had to Figs. 1, 2 and 3 for a description of the manner in which printing is effected. Rigidly mounted on the shaft 10 are two cams 52 and 53. Riding on cam 53 is a cam roller 54 and wiping on cam 52 is a removable cam wiper 55. Both the cam roller 54 and cam wiper 55 are fixed to a link 56 pivoted at 57 to a bracket 58 in the machine. The opposite end of the link 56 is pivoted at 59 to another link 60 pivoted through pin 61 to a bail plate 62 extending in front of all the hammers as viewed in Fig. 1. Integral with the plate 62 at each end thereof are webs 63 pivoted to the frame members A and A′ on studs 64. In the rear of all the hammers as viewed in Fig. 1, extends a companion bail plate 62′ also integral with webs 63. The hammers are pivoted between plates 62 and 62′ on a pin 68 (Fig. 5) carried by webs 63, the width of the hammer being such as to permit it a slight play between the plates. Extensions 64*a* of the webs 63 carry studs 65 to which are anchored a pair of springs 66, the other ends of which are mounted on pins 67 of the frame members A and A′. As cams 52 and 53 rotate clockwise during the cycle, cam roller 54 coacts with cam 53 to slowly lower link 60 and thereby rock plates 62 and 62′ counterclockwise, permitting hammers 22*a* to move away from the type lugs and at the same time to tension springs 66. Near the end of the upward movement of cross head 13, cam 53 leaves roller 54 and cam 52 then engages the acute tip of cam wiper 55 and stays in contact therewith for a short interval until the dwell of the cross head occurs as indicated in Fig. 6. At this time the recess 52′ of cam 52 reaches the tip of cam wiper 55 and springs 66 being no longer restrained by the cam 52 oscillates bail plates 62 and 62′ rapidly in a clockwise direction, bail 62 carrying hammers 22*a* toward the type lugs. When the hammers are almost in contact with the type lugs, web extensions 64*a* strike studs 80 (Fig. 1) on the frame members A and A′, thus stopping bail plates 62 and 62′ but the hammers being permitted a slight play between said plates, continue to move due to their inertia and strike the type lugs 72′ (Fig. 5) which are at the printing position and effect printing against the usual platen roll. The forward movement of the hammers is limited by the bail plate 62′. It is desired to have the printing operation quick and accurately timed. The use of a single cam and coacting roller fails to meet the requirements because of the inaccuracy necessarily resulting from the construction of these parts. For this reason, the second cam 52 and its wiper 55 is provided. During the major portion of the cycle, the roller 54 and cam 52 coact and during this time prevent coaction of cam 52 and wiper 55. Just before the printing action is desired to take place, roller 54 is released by cam 53 allowing engagement for a short interval of cam 52 and wiper 55 after which the wiper is released to permit the printing operation as explained. The tip of wiper 55 does not strike the bottom of the recess 52′ in the cam 52 beceause roller 54 engages cam 53 to prevent this. Thus the possibility of wear on the tip of wiper 55 is held to a minimum and consequently the latter is always accurate in its action. All the type bars 15 that are not being used to record columns in the record card may be held down by manually pushing the locking latches 69 (Figs. 1 and 2) in the direction of the type bars. These latches are slidably mounted in a series of grooves between two plates 70 running the entire length of the printing head and attached to the side frames of the device by brackets 71, (Fig. 1). When one of the latches 69 is pushed toward one of the type bars the turned-down end 72 of the latch will engage over the top of the type bar thus preventing it from being raised in the manner previously described.

While I have shown and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions 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. I intend to be limited therefore only as indicated by the scope of the following claims:

1. In apparatus of the class described, a cyclically movable type bar, a releasable driving means therefor, and a plurality of actuating means to actuate said driving means uni-directionally effective at different times during each cycle.

2. In apparatus of the kind described, a type bar, a driving means therefor, an impositive coupling between the bar and its driving means, resilient means for effecting the coupling and means for releasing said coupling.

3. In apparatus as described, a type bar, a driving means therefor, an impositive coupling between the bar and the driving means, means for effecting release of said coupling during the forward stroke of the type bar and resilient means for effecting recoupling of said bar and driving means during the return stroke of the bar.

4. Means for cyclically driving a type bar, comprising a plurality of driving members active during each cycle, and a single actuating shaft for the plurality of driving members, some of said driving members being of a different character or type than the others.

5. Means for cyclically driving a type bar, comprising a main shaft and driving means for the bar carried by said shaft, said driving means including a gear and a cam each acting during a different portion of the cycle.

6. Means for cyclically driving a type bar,

comprising a main shaft, cams carried thereby for gradually moving the bar during predetermined portions of the cycle and gears for rapidly driving the bar during other portions of the cycle.

7. Means for cyclically driving a type bar, comprising a main shaft, means carried thereby for gradually moving the type bar at predetermined portions of the cycle, and other means carried thereby for rapidly moving the type bar during the remaining portions of the cycle.

8. In apparatus of the class described, a type bar, and means for reciprocating the bar comprising a plurality of independent actuating members, each separately active during a different portion of the reciprocating cycle to move the type bar in one direction.

9. In apparatus of the class described, a reciprocating type element, a main actuating shaft, and a plurality of separate actuating means driven by said shaft effective to reciprocate the type element during each reciprocating cycle.

10. Means for driving a type bar comprising an actuating member, and a spring-urged member carried thereby to releasably engage the type bar to drive said bar to a differently adjusted position.

11. Apparatus of the class described comprising a type bar, actuating means therefor, a pawl carried thereby and a cooperating notch in the bar engaged by the pawl to effect a driving engagement between the bar and the actuating means to drive said type bar to a differentially adjusted position.

12. In a device of the kind described, a type bar, a positive drive therefor, means for actuating said bar, and a spring pressed plunger for absorbing the shock of the bar at the end of restoring its movement.

13. In a device as described, a reciprocable type bar, carrying a series of individual type means for differentially adjusting said bar by cyclically moving the bar at a variable speed during certain portions of the cycle, and other means for moving the bar at constant speed during the remaining portions of the cycle.

14. In a device as described, a reciprocable type bar, carrying a series of individual type means for differentially adjusting said bar by moving the bar with a variable velocity, and other means for at times moving the bar with a constant velocity.

15. In a hammer actuating mechanism, a main actuator, a cam member driven by said main actuator and adapted to impart a gradual retracting movement to the hammer and another cam member driven by said main actuator and adapted to permit a sudden forward movement of the hammer.

16. In a hammer actuating mechanism, a cam actuator, a cam follower cooperating therewith to impart a gradual movement to the hammer, a second cam follower alternately cooperating with said actuator to permit a sudden movement of the hammer said first follower during its cooperation with said actuator holding the second follower from engagement with said actuator.

17. In a printing device, including type bars and a series of individual hammers for striking the same to effect printing, means for releasably driving said hammers, means for releasing the drive of said driving means from said hammers prior to the latter striking said type bars, and means comprising spaced members for thereafter permitting a limited movement of the hammers toward the type bars to strike the latter, said means having provision for limiting the latter movement of said hammers.

18. A printing mechanism including reciprocable type bars and driving mechanism therefor, said driving mechanism comprising a rack and pinion device for driving a bar at uniform speed during an intermediate portion of a stroke and a cam driving device for decelerating, reversing and thereafter accelerating the bar at the ends of its stroke.

19. A printing mechanism including reciprocable type bars and driving mechanism for moving them from a normal position through a plurality of printing positions, a releasable connection between said driving mechanism and said type bars and resilient means for causing a recoupling of said driving mechanism and type bars and for holding said bars in normal position.

20. In a printing mechanism comprising in combination with a cyclically reciprocable bar carrying a series of printing type, and separately acting means whereby said bar is gradually driven from its position of rest and thereafter at a constant and uniform speed past a predetermined printing line.

21. In a printing mechanism comprising in combination with a cyclically reciprocable bar carrying a series of printing type, and means whereby said bar is gradually driven from its position of rest and thereafter at a constant and uniform speed past a predetermined printing line, said means being effective to positively restore said bar to its normal starting position.

22. In a printing mechanism comprising in combination with a cyclically reciprocable bar carrying a series of printing type, cam means whereby said bar is gradually driven from its position of rest and thereafter by a rack and pinion device past a predetermined printing line.

In testimony whereof I hereto affix my signature.

RALPH E. PAGE.