May 5, 1964 M. J. WHITE 3,131,570

TWO SPEED INCREMENTAL DRIVE

Filed Jan. 9, 1961 3 Sheets-Sheet 1

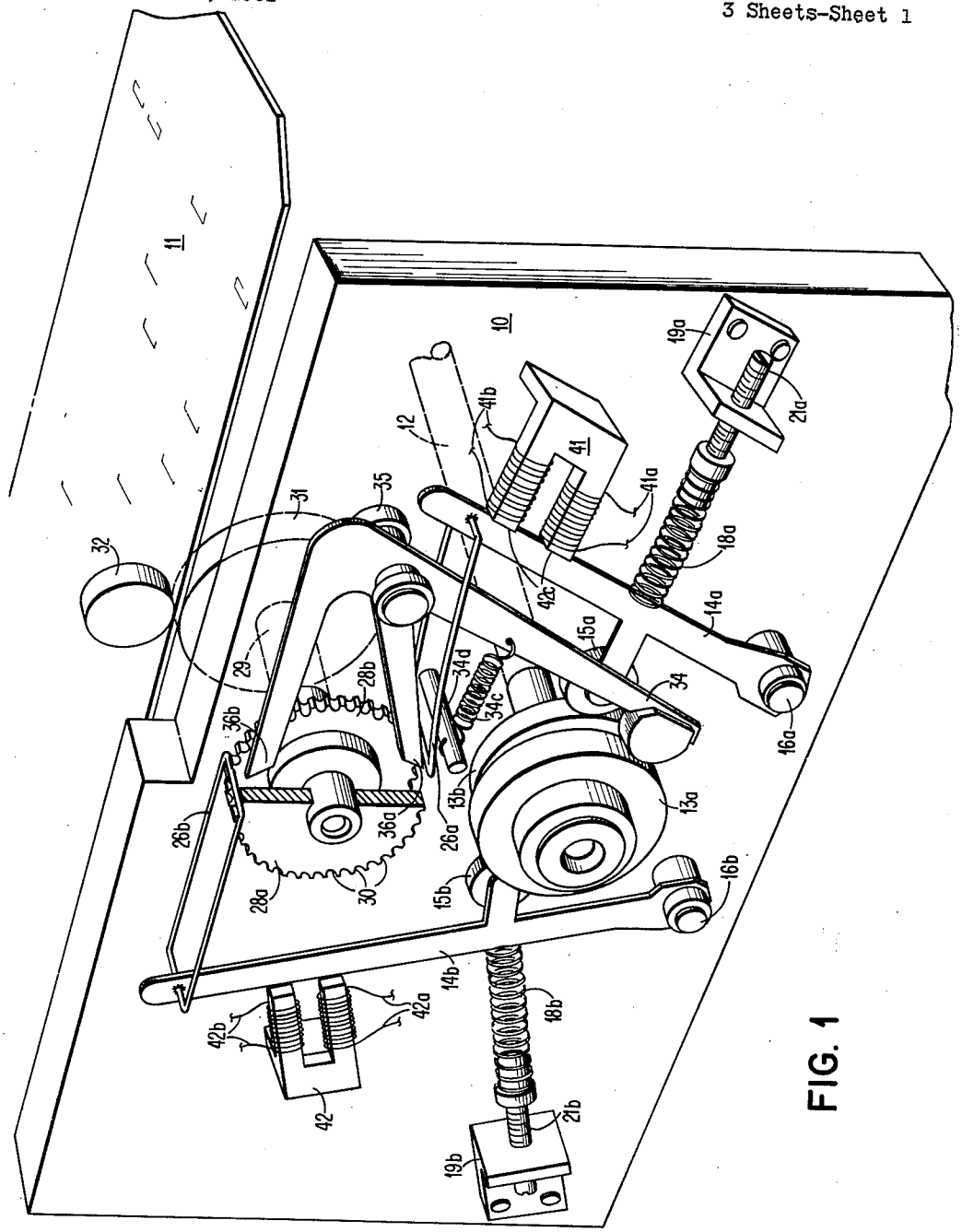


FIG. 1

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3 Sheets-Sheet 2

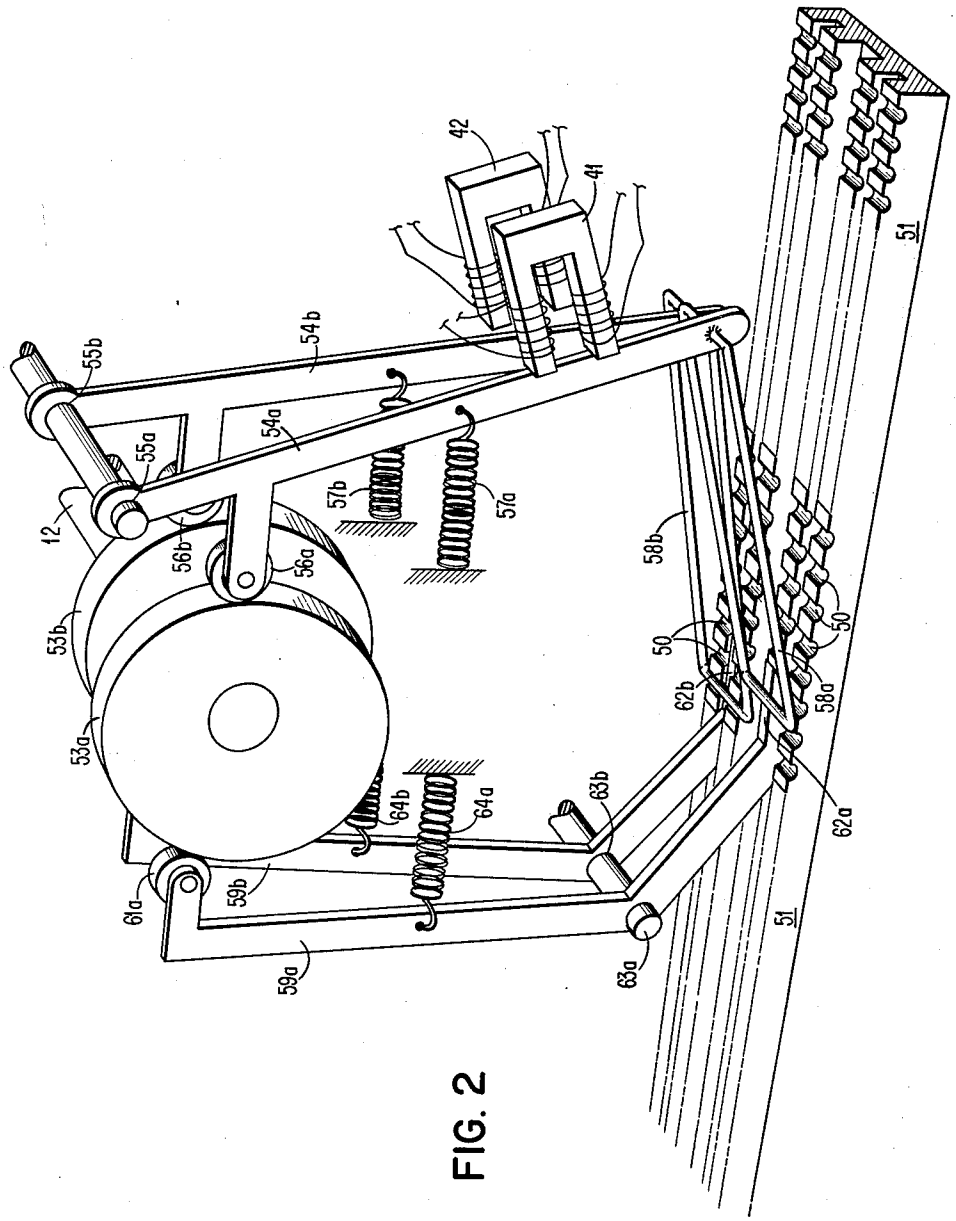


FIG. 2

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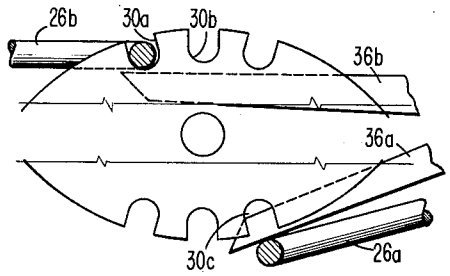


FIG. Ia

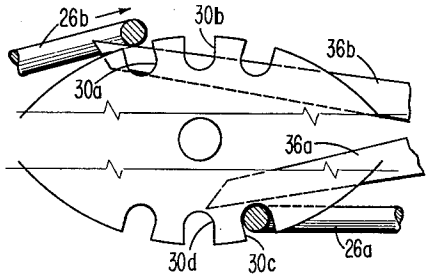


FIG. Ib

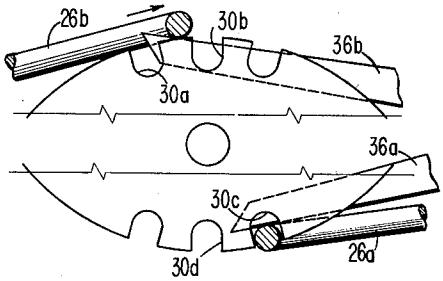


FIG. Ic

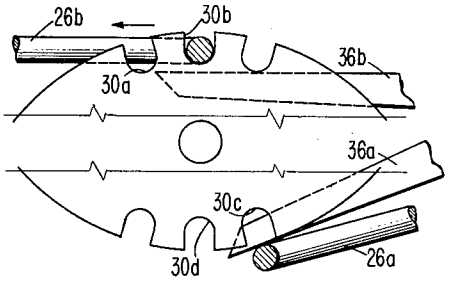


FIG. Id

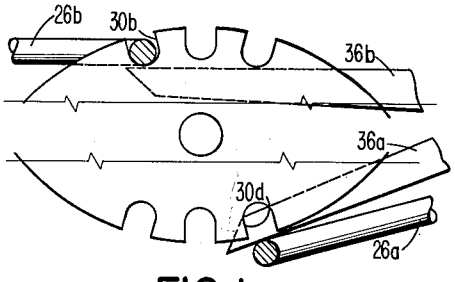


FIG. Ie

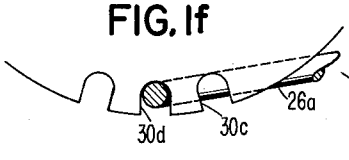


FIG. If

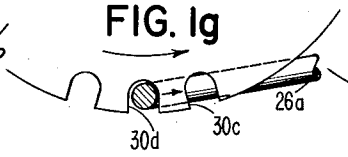


FIG. Ig

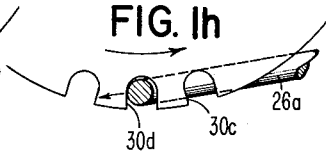


FIG. Ih

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3,131,570

TWO SPEED INCREMENTAL DRIVE

Malcolm J. White, Los Gatos, Calif., assignor to International Business Machines Corporation, New York, N.Y., a corporation of New York

Filed Jan. 9, 1961, Ser. No. 81,481
3 Claims. (Cl. 74—125)

This invention relates in general to incremental drive mechanisms and relates more particularly to such mechanisms which are capable of being driven at one or the other of two speeds.

There are numerous applications where a variable speed incremental drive mechanism is required, such as in punched card feeding mechanisms and in drives for printer carriages in which the carriage must be accurately positioned and stopped at each printing station and must be rapidly moved between adjacent printing stations. In copending application, Serial No. 862,922, now Patent Number 3,078,732, Gunter H. Schacht and Lawrence A. Wilson, assigned to the same assignee as the present application, there is disclosed an incremental drive mechanism which provides incremental movement in either of two directions. The incremental movement available with the above mentioned invention includes incremental motion in either of two directions and an oscillatory motion comprising alternate increments of movement in opposite directions. Basically, the above incremental drive mechanism includes a rotating shaft which drives a pair of cams, with one of these cams driving two spring loaded pawl actuating arms back and forth in opposite phase. Each of these pawl actuating arms is pivoted at one end and is connected at the other end to a pawl member so that the pawl members move back and forth in response to movement of the pawl actuating arms by the cam. The other end of each pawl engages notches in a ratchet which is connected to the load to be driven, so that movement of the pawl while it is engaged with a notch imparts driving movement to the load. The other cam on the rotating shaft drives a pair of spring loaded pawl lifters which guide the ends of the respective pawls in and out of engagement with the notches at the proper times in the drive cycle.

The above structure also includes control means for selectively disengaging one or the other pawl actuating arms to selectively latch an arm out of driving operation. With one pawl actuating arm latched out of engagement, the other or driving pawl actuating arm is moved into and out of driving engagement with the notches in the ratchet to produce incremental movement of the notches and attached load in one direction, the direction of movement being determined by which of the two pawl actuating arms is latched.

One of the significant features of the above described incremental drive mechanism is the use of notches in the ratchet which have substantially parallel sides for a substantial portion of the notch depth before becoming rounded at the bottom of the notch. This use of parallel sides in each notch results in the retention of the pawl member in the notch for a considerably longer portion of the drive cycle than would result were conventional notches having more rounded sides utilized. By so maintaining the pawls in the notches for a maximum portion of the drive cycle, there results a maximum return of kinetic energy from the decelerating load and other parts of the drive through the pawls to the spring loaded pawl actuating arm. This retention of the pawl members in the notches insures that the kinetic energy involved in decelerating the load is returned through the ratchet and pawl to the spring which is urging the pawl actuating arm in one direction. Thus, the energy from the deceleration of the load in one portion of the cycle is returned to the pawl actuating arm spring where it is stored and then utilized in the next portion of the cycle to urge the pawl actuating arm and pawl forward to perform the subsequent acceleration stroke.

Broadly, the present invention contemplates apparatus utilizing some of the features of the above described structure to produce controllable two-speed incremental drive in one direction. In accordance with the present invention, a drive shaft drives a pair of cams, one of which drives a pair of pawl actuating arms in opposite phase with respect to each other. Each pawl actuating arm is pivoted at one end and is connected at the other end to a pawl member which is engageable with notches in a ratchet connected to the load to be driven. The two pawl members are disposed with respect to the ratchet so that they drive the ratchet during opposite halves of the drive cycle. Where the ratchet is in the form of a wheel having notches around the periphery thereof, the pawls are located at points 180° apart on the circumference of the ratchet wheel and are so disposed and driven that when one pawl is commencing its portion of the drive cycle the other pawl has just completed its portion of the drive cycle and is returning to the position at which it will resume driving. Where the ratchet is in the form of an elongated member having notches spaced along the length thereof, the pawls are disposed to engage adjacent portions of the notches, with one pawl just completing its portion of the drive cycle when the other pawl is just commencing its portion of the drive cycle.

Control means are provided for selectively latching one or both of the pawl actuating arms out of driving engagement with the ratchet. With one arm latched out of driving engagement with the ratchet, the non-latched arm will drive the ratchet in its usual fashion, but the ratchet will be driven only during the half cycle corresponding to the unlatched arm, and the pawl which is connected to the latched arm will merely rock in and out of engagement with a ratchet notch without imparting any driving movement thereto. Under these conditions, with one pawl actuating arm latched, the non-latched arm drives the ratchet and connected load at a given speed. With both pawl actuating arms unlatched, the ratchet is driven alternately during half cycles of the drive cycle by each pawl, so that the average speed is twice the average speed at which the ratchet is driven with one arm latched. Thus the device provides a controllable two-speed incremental drive mechanism, which provides a first speed of operation in which one half of the drive cycle is utilized for driving and the other half is available for other types of operations on the stationary load, and provides a second speed of operation which is double the first speed without requiring any higher speed operation of any of the elements of the driving system.

Objects and advantages of the present invention will be apparent from the following description when read in connection with the accompanying drawings in which:

FIG. 1 is a perspective view illustrating one embodiment of the present invention in connection with incremental drive for a card feeding mechanism;

FIG. 2 is a perspective view illustrating an alternative embodiment of the invention for driving a ratchet member in the form of an elongated strip having a plurality of notches therein;

FIGS. 1*a* to 1*h* are fragmentary views of portions of the ratchet and pawls illustrating representative positions of these elements in different portions of the drive cycle.

Referring to FIG. 1 by character of reference, there is shown one embodiment of the present invention for imparting incremental motion at either of two speeds to a card member **11** such as a punched card. It is assumed

that it is desired to drive card 11 in a given direction at either of two speeds in incremental steps corresponding to the width of a column on the card. In the assumed application of the invention to a card punching device, the first speed may be utilized to drive the card to position successive punch positions at the punch station, while the second speed may be utilized to drive the card when the punching is completed ("card eject") or when large fields of the card are not to be punched ("skip punch"). Also, in a combined card punch-card reader device, the second speed may be utilized to drive the card through the reading station where a higher card velocity is permissible. The energy for driving card 11 may be supplied from a suitable motive power source such as a continuously running motor (not shown) which drives a drive shaft 12 extending through a base block 10. A pair of cams 13*a* and 13*b* are connected to one end of drive shaft 12. The inner cam 13*b* moves a pair of pawl actuating arms 14*a* and 14*b* by means of rollers 15*a* and 15*b*, respectively, which are coupled to these actuating arms and which ride on the surface of cam 13*b*. Actuating arms 14*a* and 14*b* are pivoted in journal members 16*a* and 16*b* respectively, and each of these arms is urged toward cam 13*b* by associated spring members 18*a* and 18*b*. Springs 18*a* and 18*b* are adjustably connected to mounting blocks 19*a*, 19*b* by set screws 21*a* and 21*b*.

The upper ends of pawl actuating arms 14*a*, 14*b* opposite to their pivoted ends are connected to spring pawl members 26*a*, 26*b* respectively. Pawl members 26*a*, 26*b* may be of any suitable type, but preferably each is in the form of an elongated spring which is bent into a general U shape and which is securely connected at one end to its associated pawl actuating arm. The other end of each of spring members 26*a*, 26*b* is adapted to engage the notches in a notched ratchet which is shown in the embodiment of FIG. 1 as a pair of wheels 28*a*, 28*b* having a plurality of notches 30. Wheels 28*a*, 28*b* have their corresponding notches aligned but are spaced from each other to permit pawl lifters to move therebetween to disengage the pawls from the notches, as will be discussed more in detail below. Wheels 28 drive a shaft 29 which is journaled in block 10 and connected to a card feedroll 31. Card 11 is driven by the pressure of a spring loaded idler wheel 32 which works against the intermittently rotating feedroll 31.

Outer cam 13*a* moves a pawl lifting member 34 which is adapted to alternately lift the spring pawls out of a notch 30 in notched wheels 28. Pawl lifter 34 is pivoted at a journal 35 and is provided with projecting fingers 36*a*, 36*b*, which extend between wheels 28*a*, 28*b* to engage the ends of the associated pawls 26*a*, 26*b*. The cammed end of pawl lifter 34 is maintained in contact with the surface of cam 13*a* by a spring 34*c* which is connected to a stud 34*d* secured to base 10.

A pair of control magnets 41, 42 are provided on base 10 for controllably latching the pawl actuating arms 14*a*, 14*b*. Control magnets 41, 42 may be of any suitable type, but preferably they are the type having magnetic pole faces which touch or are closely adjacent to the associated pawl actuating arm when that arm is in the position represented by arm 14*a* in FIG. 1. Control magnets 41 and 42 may be of any suitable type magnetically, but preferably each is of the type having a pair of coils 41*a*, 41*b*, 42*a*, 42*b*. Coils 41*a*, 42*a*, which may be termed the "hold" coils, are continuously energized and operate to pass a flux through a magnetic circuit including the associated pole pieces and the pawl actuating arm. With only the hold coil of a given magnet energized, when the associated pawl actuating arm comes into contact with the magnet pole face, it will be retained against the pole face, so as to prevent this actuating arm from imparting any driving motion to wheel 28. However, when the associated "buck" coil 41*b*, 42*b* is pulsed while the arms 14*a* or 14*b* are at the pole faces,

the magnetomotive force therefrom opposes or bucks the magnetomotive force produced by the associated hold coil to reduce or cancel the effective flux in the magnetic circuit, thus releasing the pawl actuating arm from the pole face. Under these conditions, with both the hold and the buck coils energized, the pawl actuating arm follows a regular path and is not influenced by the control magnet.

The use of the hold and buck coils discussed above for the control magnet has the advantage of permitting very high speed operation of the control without requiring any substantial amounts of energy through the control magnet windings. It will be noted that the control magnets do not perform any work in the sense of attracting or moving the pawl actuating arms. This mechanical work of moving the pawl actuating arms toward the control magnet is performed by cam 13*b* through rollers 15*a*, 15*b* while the work of urging the actuating arms away from the magnet is performed by springs 18*a*, 18*b*. Thus, the coils of the control magnets are not required to perform any work in the sense of attracting or moving the pawl actuating arms and hence the magnetic fields utilized in the magnet to hold the pawl actuating arms may be much smaller than would be required if the magnets had to move the arms.

As an alterative to the use of the "hold" and "buck" coils in the manner described above, the following may be utilized. When it is desired to latch one of the pawl actuating arms out of engagement, the hold coil is energized as before to retain the pawl actuating arm against the magnet pole face. When an arm is not to be latched out of engagement, the hold coil is de-energized as the arm nears or touches the pole face and the buck coil is then energized. This use of the buck coil aids in overcoming the remanent magnetization resulting from the hold coil to insure that the arm is not retained against the magnet pole face.

The operation of the present invention can perhaps best be understood by referring to the diagrams 1*a* through 1*e* which illustrate the operation when only one pawl is driving ratchet 28 and the load is consequently being driven at a first speed which is one half the average speed obtainable when both pawls are driving. Under these conditions, pawl 26*b* will be doing the driving and hence pawl 26*a* will not be effective in the driving cycle. Thus pawl actuating arm 14*a* associated with pawl 26*a* will be held in the latched position by the associated control magnet 41. In FIG. 1*a*, the driving pawl 26*b* is in slot 30*a* but is about to be lifted therefrom by the associated pawl lifter 36*b*, while the inactive pawl 26*a* is about to enter slot 30*c*. In FIG. 1*b*, pawl 26*b* has left notch 30*a* under the action of pawl lifter 36*b* and is about to be driven to the right toward slot 30*b*. At this time, the non-driving pawl 26*a* is in slot 30*c* to detent the wheel 28 during movement of a driving pawl 26*b* between adjacent notches. In FIG. 1*c*, driving pawl 26*b* is approaching notch 30*b*, while non-driving pawl 26*a* is being moved out of notch 30*c* by pawl lifter 36*a*.

In FIG. 1*d*, driving pawl 26*b* has entered notch 30*b*, while pawl 26*a* has been lifted clear of notch 30*c* by pawl lifter 36*a*. In FIG. 1*e*, pawl 26*b* is driving wheel 28 in a clockwise direction to move notch 30*b* one increment in a clockwise direction so that the load connected to wheel 28 moves an amount equal to one increment of motion of wheel 28. During this driving of wheel 28 by driving pawl 26*b*, pawl 26*a*, of course, is clear of the notches and rides on the surface of the wheel between adjacent notches. At the end of the one increment of motion, pawl 26*b* starts to leave notch 30*b*, which notch now occupies the position which was occupied by notch 30*a* in FIGS. 1*a*, 1*b* and 1*c*. At the same time, the non-driving pawl 26*a* enters notch 30*d* to detent the wheel 28. The next step in the drive cycle would then be substantially identical to that shown in FIG. 3*a*, except that wheel 28 will have been rotated in a counterclockwise direction one incre-

ment of movement so that each of the notches will be displaced one increment of motion in a counterclockwise direction.

From the above description, it will be understood that when operating at a first speed, the unlatched pawl drives the ratchet during one half of the drive cycle (a drive cycle being considered as one complete revolution of cams 13*a*, 13*b*), and the ratchet is stationary during the other half cycle while the pawl whose actuating arm is latched rocks in and out of one of the notches 30. In the assumed application of the invention to a card punch, the card is advanced one increment of movement as the ratchet rotates during the first half of the drive cycle, and the card is stationary for punching during the other half cycle when the ratchet is not moving.

It will also be apparent from the above description that to provide motion at a second speed which is double that of the first speed, both pawl actuating arms are unlatched so that each pawl drives the ratchet during alternate halves of the drive cycle. Thus, pawl 26*a*, instead of rocking in and out of a slot as in FIG. 1, will operate in a manner similar to pawl 26*b* to drive ratchet 28 during one half of the cycle while pawl 26*b* drives the ratchet during the other half cycle to produce an average speed which is double the speed with only one pawl driving.

It has been mentioned heretofore that the design of the slots in the driving wheel 28 plays a significant part in enabling the device of the present invention to operate at relatively high speeds without excessive heat generation in the moving parts. The diagrams of FIGS. 1*f–h* illustrate the action of these slots in retaining the spring pawl members therein for a maximum length of time, to result in a maximum absorption of kinetic energy in the system. In the diagrams of FIGS. 1*f–h*, wheel 28 is to be moved one increment of movement to the left, similar to the operation shown diagrammatically in FIGS. 1*a* through 1*e*. In FIG. 1*f*, the wheel 28 is shown at rest with pawl member 26*b* resting in notch 30*b*. As pawl 26*b* is driven to the left by arm 14*b* and cam 13*b* to accelerate the wheel in a clockwise direction, the pawl exerts a pulling force against the left hand edge of slot 30*b*, as indicated by the arrow. This action accelerates the ratchet wheel in a clockwise direction. Under these conditions of acceleration, the cam 13*b* is driving the pawl and the associated load, while spring 18*b* is under very light compression and hence does not exert any appreciable effect on the system.

In FIG. 1*h*, the system is decelerating, under which conditions the pawl 26*b* rides against the right hand edge of slot 30*b* and thus exerts a force toward the right, as indicated by the arrow. At this time, spring 18*b* is under increased compression. Under these conditions, spring 18*b* is absorbing the kinetic energy of the decelerating mass in the system and keeps arm 14*b* against the cam to provide controlled deceleration of the load without excessive heat generation in the system. The substantially parallel sides of the notch serve to retain the pawl therein, during this deceleration, so that a maximum amount of kinetic energy is transferred to the spring. This energy which is stored in spring 18*b* during the deceleration cycle will, of course, be returned to the system to accelerate the pawl actuating arm 14*b* and pawl 26*b* during the next cycle of movement.

FIG. 2 illustrates an alternative embodiment of the present invention in which the ratchet member is in the form of an elongated strip 51 having a plurality of spaced notches 50 therein. Ratchet 51 is connected to a suitable load which is to be driven in incremental steps at either of two speeds. For example, rack 51 may drive a printer carriage which is to be moved in increments representing the distance between adjacent printing positions and which is to be stopped for printing for a short interval at each printing station. Under these circumstances, the device of the present invention will drive the carriage between printing stations at a first speed during one half of the drive cycle, with only one pawl in driving engagement with the ratchet and will maintain the carriage stationary at the printing station during the other one half of the driving cycle. The printing carriage may also be driven at a second speed when both pawls are in driving engagement, this second speed being double that of the first speed. This second speed is useful, for example, when the printing for a given line is completed or when it is indicated that a large field on the printing medium is to be skipped.

In the embodiment of FIG. 2, drive shaft 29 drives a pair of cams 53*a*, 53*b* which in turn drive a pair of pawl actuating arms 54*a*, 54*b*. Pawl actuating arms 54*a*, 54*b* are journaled at 55*a*, 55*b*, respectively, and have the motion of their corresponding cams communicated thereto by rollers 56*a*, 56*b* which ride on the surfaces of the cams. Pawl actuating arms 54*a*, 54*b* are urged against cams 53*a*, 53*b* by springs 57*a*, 57*b* respectively. Cams 53*a*, 53*b* are substantially identical in contour, but are mounted on shaft 29 180° out of phase with each other, so that the motions they impart to the following pawl actuating arms 54*a*, 54*b* are similarly 180° out of phase with each other. Pawl actuating arms 54*a*, 54*b* are provided with spring pawl members 58*a*, 58*b* which engage notches 50 in rack 51.

Cams 53*a*, 53*b* also drive a pair of pawl lifter members 59*a*, 59*b* which are disposed 180° around the cams from their associated pawl actuating arms. Pawl lifters 59*a*, 59*b* are pivoted at points 63*a*, 63*b* respectively, and are urged against the surfaces of their associated cams by spring members 64*a*, 64*b*. Pawl lifters 59*a*, 59*b* have roller members 61*a*, 61*b*, respectively, which ride against cams 53*a*, 53*b* to communicate the motion of these cams to the pawl lifters. The other ends of the pawl lifters are provided with pointed lifting members 62*a*, 62*b* which are disposed in the grooves between the parallel rows of notches in rack 51 so as to lift pawl members 58*a*, 58*b*. From a study of FIG. 2 and from the preceding description of the embodiment of FIG. 1, it will be readily appreciated that projecting fingers 62*a*, 62*b* of the pawl lifters operate in a manner similar to fingers 36*a*, 36*b* of the embodiment of FIG. 1 to lift the pawls 58*a*, 58*b* from notches 50.

The apparatus of FIG. 2 is also provided with control magnets 41, 42 which function in a manner similar to that described in connection with the embodiment of FIG. 1 to selectively latch pawl actuating arm 54*a*, 54*b* out of driving engagement with the notches in ratchet 51.

The operation of the embodiment of FIG. 2 to provide incremental motion of ratchet 51 at either of two speeds in a given direction will be apparent from the drawing and from the preceding description of the operation of the embodiment of FIG. 1. To drive ratchet 51 at a first speed, one or the other of magnets 41, 42 is energized to selectively latch its associated pawl actuating arm 54*a*, 54*b* out of driving engagement. Assuming that magnet 41 is energized to latch pawl actuating arm 54*a*, pawl actuating arm 54*b* is driving the ratchet 51 while pawl 58*a* associated with latched pawl actuating arm 54*a* merely rocks in and out of the notches 50 under the action of pawl lifter 59*a* without imparting any driving movement to ratchet 51. This operation will be substantially identical to that described above for the embodiment of FIG. 1 and shown diagrammatically in FIG. 3, with pawl actuating arm 54*b* and pawl 58*b* driving the ratchet 51 for one half of the drive cycle, and with the ratchet being stationary during the other half of the drive cycle while driving pawl 58*b* is returning to its position to start another driving stroke.

To provide movement of ratchet 51 at a second speed which is double that of the first speed, neither of control magnets 41, 42 is energized, so that both pawl actuating arms 54*a*, 54*b* and their associated pawls 58*a*, 58*b* are in driving engagement with ratchet 51. Under these circumstances, each of pawls 58*a*, 58*b* drives ratchet 51 in the same direction during its half of the drive cycle to pro-

duce a resultant average velocity of ratchet 51 which is double the velocity imparted thereto with only one pawl driving.

Thus, it will be apparent that I have provided an incremental drive mechanism which is operable at a first speed to provide increments of motion at a first speed, with a period between incremental motions in which the load device is stationary, and is operable to drive the load at a second speed which is double that of the first speed. It will also be apparent that this two-speed operation is obtained without requiring that any of the mechanical parts of the driving system (other than the ratchet itself) be driven at any higher speed for the second speed than for the first speed. In other words, it will be appreciated from the description of the embodiments of FIGS. 1 and 2 that all of the elements of the driving system, including the cams, pawl actuating arms, pawl lifters and pawls, operate at the same velocity during both the first speed operation and the second speed operation, and it is only the ratchet 51 and the attached load whose average speed is varied. This type of operation, in which the velocity of the driving components is not changed for variations in load speed, is a distinct advantage since it eliminates many problems which arise from making changes in the velocity, acceleration or deceleration characteristics of a drive mechanism to provide variable speed drive.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in the form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus for producing incremental motion from a rotating shaft comprising a substantially circular ratchet having a plurality of notches therein, a first pawl and a second pawl adapted to engage said notches, a first pawl actuating arm and a second pawl actuating arm connected respectively to said first and second pawls, means including a cam driven by said shaft for driving said first and said second pawl actuating arms in opposite phase in a cyclic manner to move said pawls into and out of engagement with said notches to rotate said ratchet in incremental steps in one direction at a first speed, means cyclicly driven by said cam for controlling the movement of each of said pawls into engagement with one of said notches for a portion of a cycle and for moving each of said pawls out of engagement with said notches during a portion of said cycle, each of said notches having substantially parallel sides for a substantial portion of the depth thereof so as to retain said pawls therein for a substantial portion of said cycle, and electromagnetic means for selectively latching one of said pawl actuating arms away from said cam following position to prevent the pawl associated with the latched one of said arms from moving said ratchet during the cycle so that said ratchet is driven at a second speed when said one actuating arm is latched which is one-half said first speed at which said ratchet is driven when said one actuating arm is not latched.

2. Apparatus for producing incremental motion from a rotating shaft comprising an elongated ratchet having a plurality of notches therein, a first pawl and a second pawl adapted to engage said notches, a first pawl actuating arm and a second pawl actuating arm connected respectively to said first and second pawls, means including a cam driven by said shaft for driving said first and said second pawl actuating arms in opposite phase in a cyclic manner to move said pawls into and out of engagement with said notches to move said ratchet in incremental movement in one direction at a first speed, means cyclicly driven by said cam for controlling the movement of each of said pawls into engagement with one of said notches for a portion of a cycle and for moving each of said pawls out of engagement with said notches during a portion of said cycle, each of said notches having substantially parallel sides for a substantial portion of the depth thereof so as to retain said pawls therein for a substantial portion of said cycle, and electromagnetic means for selectively latching one of said pawl actuating arms to prevent the pawl associated with the latched one of said arms away from said cam following position from moving said ratchet during the cycle so that said ratchet is driven at a second speed when said one actuating arm is latched which is one-half said first speed at which said ratchet is driven when said one actuating arm is not latched.

3. Apparatus for producing incremental motion from a rotating shaft comprising a ratchet having a plurality of notches therein, a first pawl and a second pawl adapted to engage said notches, a first pawl actuating arm and a second pawl actuating arm connected respectively to said first and second pawls, means including a cam driven by said shaft for driving said first and said second pawl actuating arms in opposite phase in a cyclic manner to move said pawls into and out of engagement with said notches in opposite phase to move said ratchet in incremental movement in one direction at a first speed, means cyclicly driven by said cam for controlling the movement of each of said pawls into engagement with one of said notches for a portion of a cycle and for moving each of said pawls out of engagement with said notches during a portion of said cycle, each of said notches having substantially parallel sides for a substantial portion of the depth thereof so as to retain said pawls therein for a substantial portion of said cycle, and electromagnetic means for selectively latching one of said pawl actuating arms away from said cam following position to prevent the pawl associated with the latched one of said arms from moving said ratchet during the cycle so that said ratchet is driven at a second speed when said one actuating arm is latched which is one-half said first speed at which said ratchet is driven when said one actuating arm is not latched.

References Cited in the file of this patent

UNITED STATES PATENTS

102,056	Sibley et al.	Apr. 19, 1870
305,752	Kellogg	Sept. 30, 1884
2,343,549	Groghan	Mar. 7, 1944
2,942,486	Beguin	June 28, 1960

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,131,570 May 5, 1964

Malcolm J. White

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 21, strike out "away from said cam following position", and insert the same after "arms" in line 19, same column 8.

Signed and sealed this 5th day of January 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents