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RECORD CONTROLLED MACHINE

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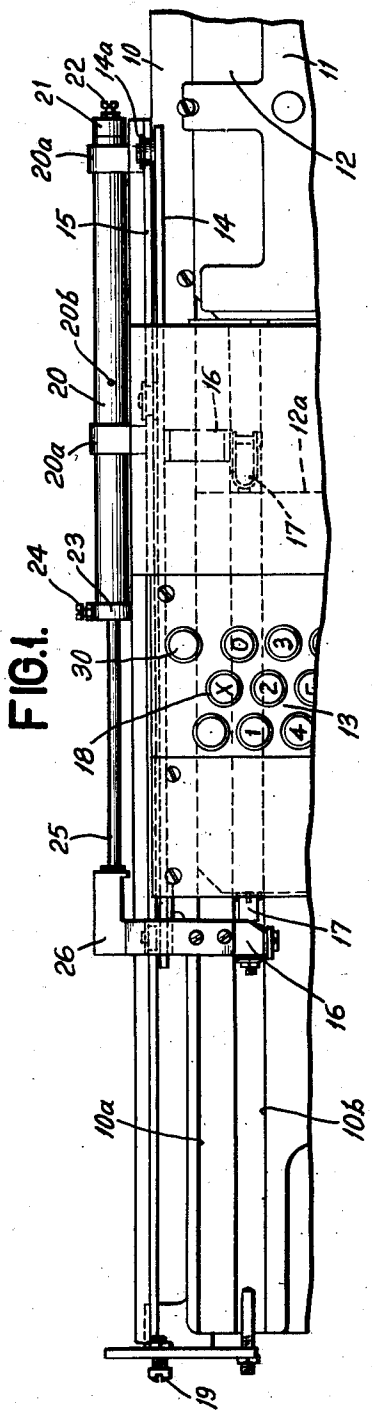


FIG. 1.

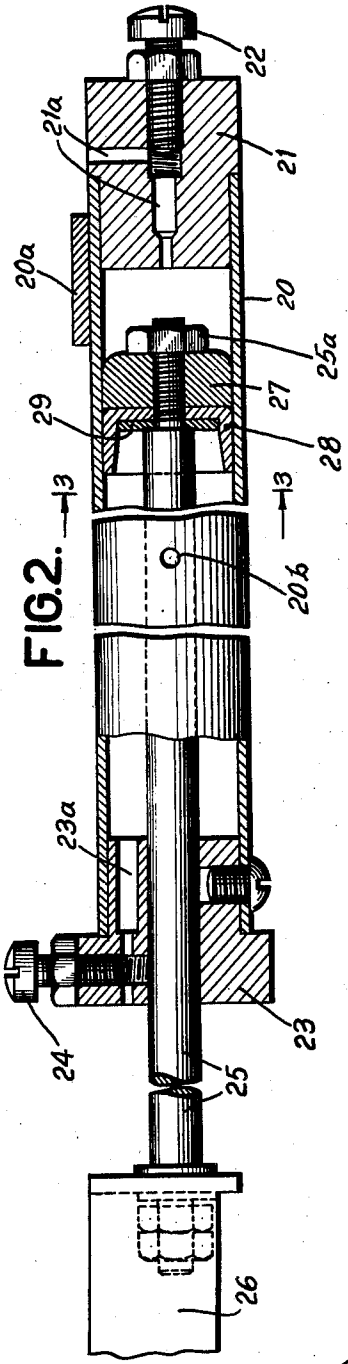


FIG. 2.

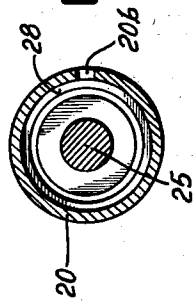


FIG. 3.

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RECORD CONTROLLED MACHINE

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5 Claims. (Cl. 164—112)

This invention relates to record perforating machines, particularly machines of the type used to perforate the well known Hollerith accounting and statistical record cards.

The broad object of the invention is to provide an improved carriage retarding device for record perforating and like machines employing a carriage as a means of feeding the record medium past perforating devices or other recording instrumentalities.

An object is to provide a carriage retarding device having a more uniform control over the travel of the carriage than can be obtained with the usual centrifugal carriage brake device or dash-pot retarding device of which many varieties have been used in machines of the type mentioned.

An object is to provide a carriage retarding device which has small bulk and few working parts.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawing, which discloses, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawing:

Fig. 1 is a plan view of a portion of a record perforating machine embodying the present invention.

Fig. 2 is a large scale view, partly in section, of the retarding device.

Fig. 3 is a vertical section on the line 3—3 in Fig. 2.

Fig. 1 shows the present invention applied to the well known "International" manual electric key punch which is commonly employed to perforate Hollerith accounting and statistical record cards to represent accounting and statistical data. Since this machine is well known only a very brief general description will be given of it. It will be understood that the disclosure of the present invention herein as applied to aforesaid machine is purely by way of illustration and that the invention may be applied to other perforating machines and to other machines employing carriages and operated under the same conditions.

The reference numeral 10 designates the base of the machine which is provided with a shallow groove 10*a* or guideway of the same width as the height of the well known Hollerith record card so as to guide the card longitudinally of the base 10 and along its top surface. On the right hand end of the base 10 is located a card magazine generally designated 11 having the blank cards 12 which are to be perforated. The bottom cards in the magazine 11 are located in the shallow groove 10*a* and suitable mechanism is provided to advance a card lengthwise from the magazine 11 along the groove 10*a* to the left as a preliminary to the commencement of card perforating operation. At the center of the machine there is provided a manual keyboard 13 which controls the punches for perforating the record card to represent data. The cards advance from the magazine 11 and are moved to first column punching position indicated by the card 12*a* shown in dotted lines in Fig. 1 and from this point the card to be punched is conveyed to the left in Fig. 1 by means of the card carriage.

This carriage consists of a bar 14 which is supported and guided for horizontal movement from right to left in Fig. 1 by a support bar 15 suitably mounted on the base 10, the bar 14, which comprises the backbone of the carriage, being provided with suitable rollers 14*a* which run on the top edge of the bar 15. This bar 14 is also provided with suitable teeth which cooperate with the usual escapement mechanism to space the card 12*a* one column at a time, each column of the record card being punched and advanced to the next column position in a well known way by aforesaid escapement mechanism.

Secured to the bar 14 are the arms 16 to which are pivotally connected card feeding fingers 17 which engage the ends of the card and cause it to be transported to the left in Fig. 1 when the carriage is moved in the same direction. The carriage comprising the bar 14, the arms 16, and the feeding fingers 17 is constantly urged to the left (Fig. 1) by means of a suitable spring motor not shown. The base 10 is provided with a deeper groove 10*b* to receive the ends of the fingers 17 to insure that the card 12*a* will be properly engaged by the fingers 17. In the use of this machine in punched accounting and statistical record cards it is often necessary to skip a major portion of a record card without perforating any data. For this purpose there is provided either an automatic skip bar controlling mechanism which need not be shown herein and a skip key 18 which enables skipping to be effected manually. During such skipping movements the carriage usually acquires considerable momentum since for such operations the usual escapement pawls or dogs are released from the carriage for free movement of the carriage by the spring motor. Since the carriage is purposely made relatively light in weight to insure a rapid feed of the carriage between punching operations the

carriage acquires considerable momentum which is suddenly checked when the escapement pawls are reengaged with the rack at the point where punching is to be resumed or the card removed by hand at its extreme left hand position (Fig. 1).

Such carriages are commonly provided with some form of retarding device which comes into play when the carriage reaches too great a speed to check the carriage and momentarily slow it down sufficiently to reduce shock when it is finally arrested. Such devices, however, do not fully satisfy the requirements since they are more commonly built on the principle of the centrifugal governor and the carriage must acquire considerable speed before the governor begins to function. On the shorter movements of the carriage the governor may not function at all. Furthermore such devices do not smoothly check the carriage and bring it to a stop but tend to allow the carriage to increase in velocity up to a point and then maintain the velocity uniform until the carriage is positively stopped. Thus, if punching is to be terminated at the middle of the card and the card fed to the extreme left hand position in Fig. 1 prior to its removal the carriage will be traveling with maximum velocity when it strikes the final stop 19 which determines the left hand limit of travel.

Dash-pots of the conventional sort do not prove entirely suitable because of the long travel of the carriage requiring the large compression ratio between the limits of carriage movement unless the dash-pot is made very large in diameter in relation to the travel of the piston. On account of their bulk such dash-pots are not feasible when built in the conventional way with a small orifice and large compression chamber. Such dash-pots tend to function only on very long movements of the carriage and have relatively little effect on short movements because of the inability to build up sufficient air or oil pressure to materially effect the speed of the carriage.

According to the principles of the present invention there is provided a retarding device in the form of a dash-pot having a double action to enable a cylinder having a high compression ratio to be used to avoid bulk and at the same time to obtain sufficient retarding action with a relatively long stroke of the piston of the retarding device.

The retarding device consists of a cylinder 20 composed of a long tube attached to the base 10 by means of suitable clamps 20*a* which may take the form of straps screwed to the base. The right hand end (Figs. 1 and 2) of the cylinder 20 is permanently closed by means of a cylinder head in the form of a plug 21 having a valve screw 22 for regulating the flow of air to the interior of the cylinder through two air passages 21*a* in the plug 21. The left hand end is provided with a plug 23 having an air passage 23*a* and a valve screw 24 and acting as a stuffing box for the piston rod 25. A screw 23*b* removably secures plug 23 to the cylinder 20.

Near the middle of the cylinder 20 there is provided an orifice or port 20*b* which is located a little to the left of the middle of the space inside cylinder 20 between the plugs 21 and 23. At its left hand end the piston rod 25 is connected to a bracket 26 attached to the left hand arm 16 of the card carriage. At its right hand end the piston rod 25 is provided with a piston 27 and a cup washer 28 of leather which is held between the piston 27 and a washer 29 abutting a shoulder in the piston rod, the right hand end of the piston rod being reduced to form said shoulder and threaded to receive a nut 25*a* which clamps the piston 27, the cup washer and the washer 29 to the end of the piston rod.

The orifice or port 20*b* is located so that when the card carriage is close to its mid-position the orifice will be closed by the cup washer 28 or by the piston 27. The adjustment of the piston rod 25 is not critical so long as the port 20*b* is closed when the carriage is in the mid-position. In order to illustrate the functioning of the retarding device it will be convenient to use an extreme condition which will seldom be met in practice. Let it be assumed that the carriage is in the column 1 or extreme right hand position, as in Fig. 1, and that it is desired to skip to the column 80 or extreme left hand position. Depression of the skip key 18 or the usual release key 30 causes the usual escapement pawls to be released and allows the carriage spring motor to draw the carriage to the left as far as it will go as determined by the usual final stop 19. During the first half of the stroke of the carriage the air trapped in the left hand end of the cylinder 20 is free to escape through the orifices 20*b* and 23*a* and offers little obstruction to the movement of the carriage. However, air will pass through the passages 21*a* only to the extent permitted by the valve screw 22 with the result that a progressively increasing vacuum will be created in the space to the right of the piston 27 which will have a retarding effect upon the carriage. Thus, as the momentum of the carriage tends to increase, the vacuum likewise will tend to increase, and a checking influence will be exercised on the carriage tending to prevent excessive speed of the carriage at the midpoint of the carriage travel.

At the mid-point of the carriage movement the orifice 20*b* will be closed by the cup washer 28 and prevent further escape of air from the left hand end of the cylinder 20 except to the limited extent controlled by the valve screw 24 with the result that the air in the left hand end of the cylinder will start to compress as the carriage passes its mid-position. Eventually a port 20*b* will again be opened and permit air to more rapidly enter the right hand end of the piston to break the vacuum therein. However, by this time the air in the left hand end of the cylinder will have become partly compressed so that the tendency of the carriage to accelerate due to the relieving of the vacuum will not be very great. With continued movement of the carriage to the left, the increasing compression in the left hand end of the cylinder, however, reduces the speed of the carriage and prevents it from moving at an excessive rate. During this period the right hand end of the cylinder has practically no effect in retarding the carriage. However, this is more than offset by the increased compression in the left hand end with the result that the carriage will be gently stopped in the last column position.

The condition just described represents the worst possible condition that could be encountered in which the carriage would ordinarily be permitted to build up maximum velocity and arrested in the last column position at the point in which the carriage ordinarily has its maximum velocity when permitted to run free from the extreme right hand position. In practice it will seldom be necessary for the carriage to travel continuously throughout its entire stroke,

but skipping will be for relatively shorter distances which may occur anywhere in the stroke of the carriage or several such movements may occur during the punching of a single card. If the skipping movements take place in punching the left hand half of the card, that is columns 1 to 40 of a conventional 80 column card, the left hand half of the retarding device will virtually have no effect, but the retarding of the carriage will be effected by the vacuum induced in the right hand half of the cylinder 20. On the other hand, skipping movements for the right hand half of the card will be controlled by the compression of air in the left hand half of the cylinder. During the punching of card columns when the carriage is moving intermittently and relatively more slowly the pressures in the two halves of the retarding device will tend to equalize with the result that the retarding effect will be relatively slight on short movements of the carriage but will increase in proportion to the number of columns skipped.

One advantage of the retarding device is that it is possible to make the cylinder very long and narrow and to connect the piston rod directly to the carriage. This greatly reduces the bulk of the retarding device and reduces the number of working parts since otherwise it would be necessary to use a large cylinder with either a mechanical leverage reducing linkage or some form of reducing gear to get the same effect with an ordinary dash-pot.

By making the retarding device double acting, that is operating upon the combined effect of compression and vacuum, the retarding action is distributed more evenly over the stroke of the piston without the necessity for using a dash-pot having a large piston diameter in relation to the stroke to avoid too great an extent of compression, that is a high compression ratio. For example, if it were attempted to get the same effect with an ordinary single acting dash-pot consisting of a cylinder of the same dimensions in relation to the stroke as shown in Fig. 1, the compression ratio would be so great that upon a long continuous travel of the carriage the pressure would build up to such a high value that the carriage would move very sluggishly or not at all at the end of the skipping movement. This would greatly slow down the machine and offset the benefit derived from skipping.

On the other hand, in order to keep the size of the dash-pot within reasonable limits to avoid too high a compression ratio, it will be necessary to use some form of reducing motion to enable the short stroke dash-pot of small size to be operated by the relatively long stroke carriage. This, of course, will mean a multiplicity of links and levers or gearing which will add considerably to the cost of manufacture of the punch and introduces additional parts which must be lubricated and which are liable to be sluggish in action due to inertia, dirt, gummy oil, and improper lubrication. Furthermore more complicated mechanical linkages or gearing will wear with time and require frequent adjustment of the dash-pot to offset the wear which always tends to make moving parts operate more freely.

In the past it has been customary to use rack and pinion operated centrifugal braking devices, such as the well known shot governor and similar forms of governors, but the long racks which must be used for this type of governor are expensive to make and tend to bind or become sluggish in action due to dirt accumulating on the rack and gumming of the oil which must of necessity be used to lubricate the rack and pinion. Also, governors of the centrifugal friction brake type tend to wear at the friction producing surfaces and lose their braking effect, requiring frequent adjustment or replacement.

In the present case the effects of wear can be easily compensated by adjusting the valve screws 22 and 24 since the effect of wear is to make the piston operate more freely permitting leakage past the piston which can be offset by reducing the passage of air through the orifices 21c and 23c. Since the vacuum and compression in the cylinder 20 both tend to expand the cup washer 29, a considerable amount of wear can occur in the cylinder 20, the piston 27, and the cup washer 28 before replacement of any of these parts is necessary to restore the effectiveness of the retarding device.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions 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. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In combination with the carriage and frame of a record perforating or other office machine having a carriage, a retarding device comprising a cylinder and piston, one of which is connected to the carriage and the other to said frame, and a piston attached to said piston rod and closely fitting said cylinder, said cylinder having vents at both ends and a vent at its middle whereby the space interior of said cylinder on one side of said piston acts as a vacuum chamber to check the speed of the carriage by vacuum during one portion of the travel of the carriage and the space on the other side of said piston acts as a compression chamber to check the carriage by compression during the remainder of the travel of the carriage, said middle vent permitting free flow of air into or out of the respective chambers to render one chamber less effective while the other is operative.

2. In combination with the carriage of an office machine, a carriage retarding device including a cylinder and a piston traveling in said cylinder, one of which elements is connected to the carriage and the other relatively fixed, said cylinder veing vented at its ends to permit the intake and discharge of air from the ends of the cylinder, said cylinder also being vented at its middle to permit a freer flow of air from one chamber during the first half of the stroke of the piston and to permit a free flow of air in the other half of the cylinder after the carriage has passed its midpoint of travel, one of said chambers being operative to check the carriage of the vacuum induced therein and the other to check the carriage by compression induced therein, said compression chamber being freely vented while the vacuum chamber is operative and the vacuum chamber being freely vented while the compression chamber is operative.

3. In combination with the carriage of an office machine, a carriage retarding device including a cylinder and a piston, one of which is directly connected to the carriage and the other fixed,

said cylinder having a relatively high compression ratio and being vented at both ends and at the middle to reduce the compression at one side of the piston to enable one half of the cylinder to function to retard the carriage by vacuum alone while the carriage is moving half of its stroke and to permit the remaining portion of the cylinder to function by compression alone during the remainder of the stroke of the carriage.

4. In combination with the carriage of an office machine, a fluid pressure retarding device for said carriage including a cylinder and piston, one of which is actuated by said carriage while the other remains fixed, said cylinder having two fluid pressure chambers the total length of which at least equals the travel of the carriage with direct actuation of said device by the carriage without intervening motion reducing means, said cylinder being considerably smaller in diameter than the total travel of the piston so as to have a high compression ratio and vented intermediate its ends to reduce the compression ratio on either side of the piston to enable the carriage to move more freely than would be permitted by a cylinder which is not vented intermediate its ends.

5. In combination with the carriage of an office machine, a retarding device of the fluid pressure type including a cylinder and piston, said cylinder being closed at both ends and vented to permit escape of fluid from one chamber while permitting entrance of fluid at the other chamber and also being vented intermediate its ends to increase the flow of fluid into or out of one chamber at a rapid rate while the remaining chamber functions to retard the carriage by compression or vacuum according to the extent of travel of the piston.

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