March 4, 1952 C. G. DUDIS 2,587,824

RUBBER DRIVE FOR PRINTING HAMMERS

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FIG. 5

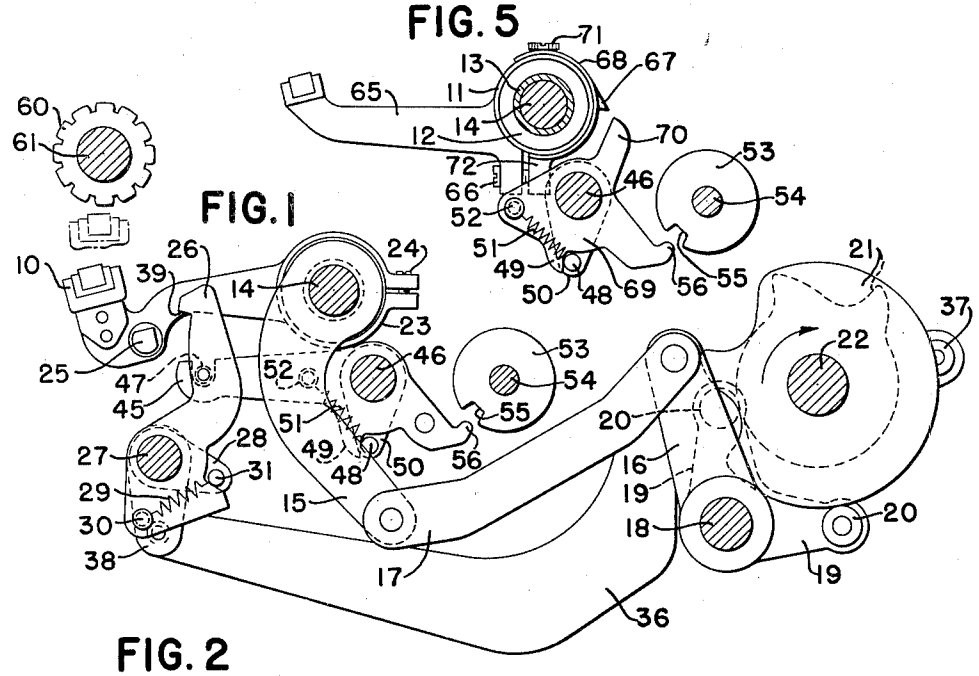


FIG. 1

FIG. 2

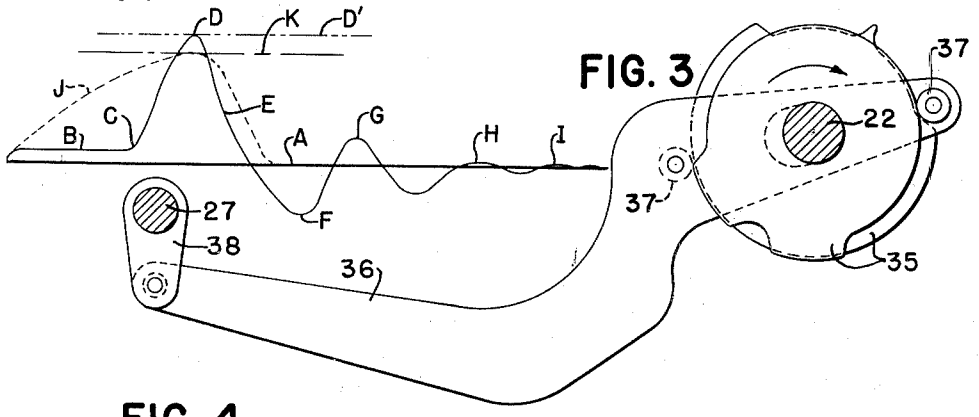
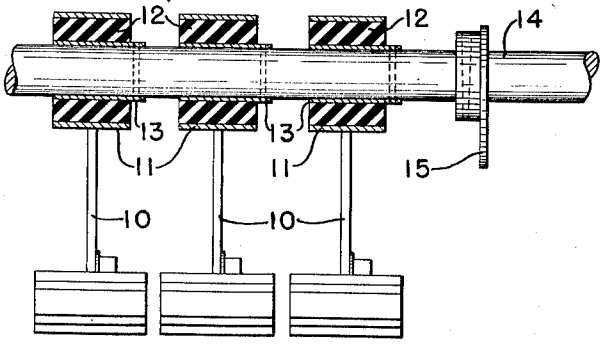


FIG. 3

FIG. 4



INVENTOR
CHARLES G. DUDIS

BY Earl Benet
Henry Silbereis

HIS ATTORNEYS

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RUBBER DRIVE FOR PRINTING HAMMERS

Charles G. Dudis, Dayton, Ohio, assignor to The National Cash Register Company, Dayton, Ohio, a corporation of Maryland

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10 Claims. (Cl. 101—93)

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This invention relates to improvements in operating means for printing hammers for accounting machines.

The object of the invention is to provide a rubber spring drive for a printing hammer.

A specific object of the invention is to provide a rubber connection between the drive means and the printing hammer for actuating the printing hammer in its printing operation.

Another object of the invention is to provide a single drive member having a plurality of rubber bushings secured thereto, and a printing hammer secured to each rubber bushing, whereby the printing hammers can all be cocked from a single power source, together with means to select one or more of the hammers to be cocked by said drive member.

With these and incidental objects in view, the invention includes certain novel features of construction and combinations of parts, a preferred form or embodiment of which is hereinafter described with reference to the drawing which accompanies and forms a part of this specification.

In said drawing,

Fig. 1 is a side elevation of the hammer selecting and operating mechanism;

Fig. 2 is a graph charting the movements of a printing hammer when released for a printing operation;

Fig. 3 is a detail view of the printing hammer cocking mechanism;

Fig. 4 is a sectional detail view showing how the hammers are mounted on the drive member and illustrates the rubber spring bushing connections for three of a plurality of hammers; and

Fig. 5 shows a modified means for selecting printing hammers for operation.

General description

The invention, described in general terms, comprises rubber spring bushings mounted between the printing hammers and a single shaft, together with means for selecting hammers to be operated for printing. The rubber springs comprise bushings of rubber, which are used in place of well-known steel springs for forcing the printing hammer against type characters to provide the proper printing pressure.

One of the problems in the use of steel springs for forcing a hammer against the type characters for printing operations is to prevent rebound of the hammers after the impression is made, which rebound often causes "shadow" printing. Tests have demonstrated that no such rebound occurs with the use of the novel rubber spring disclosed herein. The use of rubber springs results in a better printing pressure, so that superior printing impressions are obtained, and also makes the printing of carbon copies feasible, a result heretofore not found satisfactory when steel springs were used. Such superior printing results from a quick, sharp blow, thus delivering the maximum amount of energy in the shortest time.

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The novel construction also provides an improved printing operation in that the alinement of the face of the printing hammer is better maintained, due to the fact that the driving force for the hammer is located around the axis of movement of the hammer. In prior mechanisms, the driving force is applied at a point remote from the axis of the hammer and offset from the center of the hammer platen face. For example, in the machine disclosed in the patent to Shipley No. 1,817,883, the hammers **703**, **704**, and **705** have their platens offset from the supporting arms, and, in use, there is a tendency for the hammer platen to strike the type carriers at an angle, which results in one end of the platen striking first and then rocking across the face of the type carriers, with the result that the printing is not uniform across the complete line of printing, and, in addition, the ribbon wears faster at the point of first impact. This excessive wear of the ribbon not only shortens its life but also has a tendency to deplete the ink supply at this point. All these factors result in defective printing. Applicant's novel construction causes the face of the hammer to strike an even blow distributed over the entire face of the type carrier line.

Detailed description

A plurality of printing hammers **10** (Figs. 1 and 4) are provided, the number of hammers varying according to the number of columns of data to be printed. The hub of each hammer **10** comprises a sleeve **11**, in which a rubber bushing **12** is inserted, and an inner sleeve **13** is inserted into the inner opening of the rubber bushing **12**. The hub may be assembled by any method, such as by a chemical bond, by a mechanical bond, or specifically by a friction bond, such as those illustrated in the United States Patent No. 1,732,657, issued to Picaquerez, and Nos. 1,739,270 and 1,782,770, issued to Thiry. The illustrated methods provide a secure bond between the elements of the hub.

The inner sleeves **13** are secured to a common drive shaft **14**. Also secured to the drive shaft **14** is an arm **15**, connected to an arm **16** by a link **17**. The arm **16** is pivoted on a shaft **18**

and can be connected to a pair of cam follower arms 19, either by a hub or through the shaft 18. The cam follower arms 19 are provided with rollers 20, coacting with a pair of cam plates 21 in the usual manner, and the cam plates are secured to a main shaft 22.

The hammers 10 may be provided with a split hub 23 (Fig. 1) to provide for radial adjustment of the hammer 10 on the sleeve 11, instead of forming the sleeve 11 directly on the hammer, as shown in Fig. 4. A screw 24 provides a means for clamping the split hub 23 on the sleeve 11. This radial adjustment is provided to vary the energy stored in the rubber bushing, so that the impact of the printing blow can be varied according to the printing to be effected, such as the number of carbon copies desired.

Each hammer 10 is provided with a stud 25, which is engageable with a latch pawl 26 when the latter is selectively released in a manner presently described. The latches 26 are pivoted on a shaft 27, and each latch 26 is flexibly connected to an arm 28, secured on the shaft 27. A spring 29 is stretched between a stud 30 on each latch pawl 26 and a stud 31 on each arm 28. A separate latch pawl 26, arm 28, and spring 29 is provided for each hammer 10, so that the hammers can be selectively operated.

The shaft 27 (Fig. 3) is operated during machine operations by a pair of cams 35 secured to the main shaft 22. One end of a pitman 36 is slidably mounted on the shaft 22, between the cam plates 35, and the pitman 36 has thereon two oppositely facing rollers 37 coacting with the cam plates 35. The left-hand end (Fig. 3) of the pitman 36 is pivoted to an arm 38 on the shaft 27. The pitman is moved, first to the right (Fig. 3) and then back to the position shown, for each printing operation. As illustrated herein, the cam plates 35 are constructed to oscillate the pitman twice during each machine operation. Movement of the pitman to the right rocks the shaft 27 counter-clockwise (Figs. 1 and 3), which, through the arm 28 and the spring 29, tends to rock the latch pawl 26 counter-clockwise to position a shoulder 39 thereon into the path of the stud 25. This movement of the latch pawl 26 is normally prevented by a latch 45 pivoted on a shaft 46. The latch 45 is notched to engage a stud 47 on the latch pawl 26. The notch in the pawl 45 is held in engagement with the stud 47 by a stud 48, which is engaged by a finger 49 on the latch 45. The stud 48 is carried by an arm 50 secured to the shaft 46. A spring 51 is connected to the stud 48 and a stud 52 on the latch 45 for a flexible connection whereby the latch 45 is selectively withdrawn from engagement with the stud 47.

The pawl 45 is selectively withdrawn from engagement with the stud 47 under control of a notched disk 53 secured to a shaft 54. During a machine operation, the shaft 46 is rocked counter-clockwise (Fig. 1) and carries the stud 48 therewith and, through the spring 51, tends to rock the pawl 45 likewise. If a notch 55 is in the path of movement of a finger 56 on the pawl 45, the pawl 45 moves to withdraw the notch therein from engagement with the stud 47, thus freeing the latch pawl 26 to position the shoulder 39 thereon into the path of movement of the stud 25. If no notch 55 lies in the path of the finger 56, the notch in the pawl 45 is not withdrawn from the stud 47, and therefore the latch pawl 26 is held in the position illustrated in Fig. 1.

No means is disclosed herein for setting the disks 53 or for rocking the shaft 46, since this mechanism is well known in machines of the type to which the present invention is shown applied. For a detailed description of these mechanisms, reference may be had to United States Patent No. 2,373,510, issued to Spurlino et al. on April 10, 1945.

The disks 53, one for each hammer 10, are selectively positioned by a differential mechanism controlled by manipulative devices, in the manner disclosed in said patent, for selectively determining which hammer 10 is to operate in a given machine operation for the purposes described in said patent. It is sufficient to say that, when a notch 55 is positioned in the path of the finger 56, the hammer will operate to effect a printing record, and, when no notch 55 is in the path of the finger 56, no printing will be performed.

Operation

Assuming that a printed impression is to be made during an ensuing machine operation, during the initial part of the machine operation the selecting disk 53 is selectively adjusted to position a notch 55 into the path of the finger 56, and thereafter the shaft 46 is rocked counter-clockwise (Fig. 1). Since a notch 55 is in the path of the finger 56, the arm 50 on the shaft 46, through the spring 51, rocks the pawl 45 to disengage it from the stud 47 on the latch pawl 26. Immediately thereafter, the cams 35, acting through the pitman 36 and the arm 38, rock the shaft 27 to move the stud 31 on the arm 28 upwardly, thus permitting the spring 29 to rock the latch pawl 26 into the path of movement of the stud 25 on the hammer 10. After the latch pawl has assumed such moved position, the cam plates 21, through the link 17 and the arm 15, rock the shaft 14 clockwise (Fig. 1) to rotate the sleeve 13, the rubber bushing 12, and the hammer 10 likewise, until the hammer 10 is arrested when the stud 25 thereon contacts the shoulder 39 on the latch pawl 26, whereupon the hammer is stopped, but the shaft 14 continues to rotate. This continued rotation of the shaft 14 produces a torsional shear of the rubber bushing 12 and produces potential energy therein. After the proper torque has been produced in the rubber bushing 12, the latch pawl 26 is withdrawn by the cam plates 35 to release the hammer 10 to strike a printing blow on the type carriers 60, carried on a stationary rod 61. At the same time, the shaft 14 begins to reverse its movement, thus starting to return the hammer toward its normal position. The effect of this action is described below.

The characteristics of the rubber used for a given printing mechanism will vary with its design, its weight, and the force required to obtain a clear printed impression, and the proper size and characteristics of the rubber bushing must be determined by experiment.

A plurality of printing impressions can be made during each machine operation, the number being controlled by the shapes of the cams 21 and 25. As illustrated herein, these cams are shaped to cause two impressions to be taken by each cocked and released printing hammer during every machine operation.

In the application illustrated, rubber of 60 durometer was found satisfactory, and, to determine the movements of a hammer operated by a rubber bushing having this characteristic, a drum recorder was used to obtain curves indicating

movements of the hammer when printing. The paper speed on the drum was set to a speed of $\frac{1}{10}$ inch per milli-second. The curves obtained are illustrated in Fig. 2. In Fig. 2, line A indicates the normal position of the hammer. Line B indicates the rise of the hammer when the stud **25** contacts the shoulder **39** of the latch pawl **26**, and the length of line B represents the time during which the hammer is held by the latch pawl **26** and the rubber bushing **12** is being twisted by the shaft **14**, to store energy therein. At the point C, the latch pawl **26** is pulled off the stud **25**, and the hammer **10** is snapped upwardly to strike the type character wheel **60** at point D, and the high point is illustrated by chain line D'. At this time, the shaft **14** starts to return and tends to pull the hammer down. This movement causes a drop E in the curve, which indicates a rapid fall of the hammer to the point F. A series of rebounds occur, which are indicated at G, H, and I, which rebounds are very small and do not reach the height D', which is necessary to make a second printed impression. This is due in part to the return movement of the shaft **14** and the tendency to restore the hammer to normal position immediately the latch pawl **26** is withdrawn, and in part to the return of the rubber bushing to its state of rest. This results in a novel method of preventing a second impression due to rebound, and therefore a rubber-spring-operated hammer does not require additional rebound-preventing mechanisms, while at the same time the energy stored in the rubber spring **12** by the twisting action is sufficient to obtain a clear print on a plurality of carbon copies, when such copies are desired. This superior printing result is obtained due to the rapid action of the rubber spring when released, which gives a strong impression blow.

The operation of the hammer **10** when it is not arrested by the latch pawl **26** is indicated on the graph (Fig. 2) by the dotted line J. This condition prevails when no notch **53** is opposite the finger **56**, and the latch **45** holds the latch pawl **26** in normal position. When the shaft **14** is rocked, the hammer **10** rises to the level of the chain line K, which is below the printing point D, and therefore no impression is made. The highest position assumed by the hammer in this operation is shown by chain line in Fig. 1.

Fig. 2 illustrates the vibrations of the hammer when operated by the mechanism as illustrated; that is, when the cam plates **21** are designed to restore the shaft **14** immediately the printing impact takes place. If in some installations it is necessary to delay the return of the hammer until the latter stage of the machine operation, the vibrations of the hammer have been shown by experiment to be substantially like those illustrated by points H and I along the line K. In no case does the hammer rise sufficiently to cause shadow printing by a second impact on the type carrier by rising to the height of point D.

In addition to the improved printing results described, the present invention also adapts itself to a simpler hammer-selecting means for columnar printing. Any number of hammers **10** can be arranged on the common shaft **14**, and only one operating mechanism need be furnished for actuating all the hammers selectively, either singly, or in any combination, or all at one time. The selection of hammers is determined by the differential positioning of the selecting disks **53**, one being provided for each latch **45**, and one latch **45** is provided for each latch pawl **26**.

By referring to Fig. 4, it will be apparent that all the rubber bushings **12** will be actuated through the one arm **15**. Whether or not the bushing will be twisted depends on the position of the corresponding latch pawl **26**. In this way, any one or more hammers can be actuated to print in its corresponding column on the record material.

Modified form

Fig. 5 discloses a modified form of hammer-selecting means. In this form, a hammer **65** is bonded on the sleeve **11** in the same manner described above. In this form, a shoulder **67** formed on a plate **68** is provided, which plate is adjustably mounted on the hub of the hammer by a slot into which a screw passes and is secured in a tapped hole in the hub of the hammer. A lug **72** is secured to the plate **68**, and the lug is tapped to receive an adjusting screw **66**. By means of the screws **71** and **66**, the shoulder **67** can be adjusted on the periphery of the hammer hub to vary the torque when the machine is operated. A selecting pawl **69** is rotatably mounted on the shaft **46**, which is provided with a finger **49** in the same manner as the latch pawl **45**. The finger **49** is held in engagement with the stud **48** on the arm **50** by the spring **51**, one end being attached to a stud **52** on the selecting pawl **69** and the other end being attached to the aforesaid stud **48**. The pawl **69** is provided with an upright finger **70** movable into, or out of, the path of the shoulder **67**. The position assumed by the finger **70** is controlled by the notched disk **53** in the same manner as in the first form described above. To this end, the notched disk is provided with one or more notches **55**, and the selecting pawl **69** is provided with a finger **56**.

In its operation, when the finger **56** on the selecting pawl **69** enters a notch **55**, the finger **70** moves into the path of the shoulder **67**, and thereafter, when the shaft **14** is rocked, the shoulder **67** engages the end of the finger **70**, whereupon the hammer is arrested and the rubber bushing **12** is twisted, in the manner described above, to store energy therein to print when the hammer is released. In this form of embodiment of the invention, the hammer **65** is released for its printing stroke when the shaft **46** is rocked to withdraw the finger **56** from the notch **55**, whereupon the upright finger will also be withdrawn from engagement with the shoulder **67**. The amount of energy stored is determined, in part, by the distance the stop **67** is adjusted from the top of finger **70**. The mechanism for rocking the shaft **46** is shown and described in the above-mentioned Spurlino et al. patent.

While the forms of the invention shown and described herein are admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the forms or embodiments disclosed herein, for it is susceptible of embodiment in various other forms.

What is claimed is:

1. In a printing mechanism of the class described, the combination of a printing hammer having a hub; a drive shaft; a rubber spring to actuate the hammer, said rubber spring comprising a bushing bonded to the inner wall of the hub of the printing hammer and to the outer wall of the drive shaft; a latch pawl movable to engage the printing hammer to hold the printing hammer as the drive shaft is operated to torsionally shear the rubber bushing to create torsional energy in the rubber bushing; means to thereafter withdraw the latch pawl from engagement

with the hammer to release the said torsional energy and thereby operate the hammer for making a printing stroke; and means to operate the drive shaft.

2. In a printing mechanism of the class described, the combination of a printing hammer having a hub; a drive shaft; a rubber spring to actuate the hammer, said rubber spring comprising a bushing bonded to the inner wall of the hub of the printing hammer and to the outer wall of the drive shaft whereby the printing hammer can be operated by the drive shaft; a latch pawl movable to engage the printing hammer to hold the printing hammer against movement when the drive shaft is operated; a latch normally engaging and holding the latch pawl in a position where the latch pawl cannot engage the printing hammer; means to selectively control the release of the pawl from the latch pawl to cause the latch pawl to move into engagement with the printing hammer whereby the hammer is selectively held as the drive shaft is operated to torsionally shear the rubber bushing to create potential energy in the rubber bushing; means to withdraw the latch pawl from engagement with the printing hammer after the torsional energy has been created to thereby cause the rubber bushing to operate the hammer for making a printing stroke; and means to operate the drive shaft.

3. In a printing mechanism of the class described, the combination of a printing hammer having a hub; a drive shaft; a rubber spring to actuate the hammer, said rubber spring comprising a bushing bonded to the inner wall of the hub of the printing hammer and to the outer wall of the drive shaft; a latch pawl movable to engage the printing hammer to hold the printing hammer as the drive shaft is operated to torsionally shear the rubber bushing to create potential energy in the rubber bushing; means to thereafter withdraw the latch pawl from engagement with the hammer to release the said energy and thereby operate the hammer for making a printing stroke; and means to operate the drive shaft to first torsionally shear the rubber bushing and to return the drive shaft and the bushing immediately the hammer makes its printing stroke to prevent the hammer from rebounding sufficiently to cause a second printing stroke.

4. In a printing mechanism of the class described, the combination of a printing hammer having a hub; a drive shaft; a rubber spring to actuate the hammer, said rubber spring comprising a bushing bonded to the inner wall of the hub of the printing hammer and to the outer wall of the drive shaft whereby the printing hammer can be operated by the drive shaft; a latch pawl movable to engage the printing hammer to hold the printing hammer against movement when the drive shaft is operated; a latch normally engaging and holding the latch pawl in a position where the latch pawl cannot engage the printing hammer; means to selectively control the release of the pawl from the latch pawl to cause the latch pawl to move into engagement with the printing hammer whereby the hammer is selectively held as the drive shaft is operated to torsionally shear the rubber bushing to create potential energy in the rubber bushing; means to withdraw the latch pawl from engagement with the printing hammer after said energy has been created to thereby cause the rubber bushing to operate the hammer for making a printing stroke; and means to operate the drive shaft to first torsionally shear the rubber bushing and to return the drive shaft and the bushing immediately the hammer makes its printing stroke to prevent the hammer from rebounding sufficiently to cause a second printing stroke.

5. In a printing mechanism of the class described, the combination of a printing hammer having a hub; a drive shaft; a rubber spring to actuate the hammer, said rubber spring comprising a bushing bonded to the inner wall of the hub of the printing hammer and to the outer wall of the drive shaft whereby the printing hammer can be operated by the drive shaft; a latch pawl movable to engage the printing hammer to hold the printing hammer against movement when the drive shaft is operated; a latch normally engaging and holding the latch pawl in a position where the latch pawl cannot engage the printing hammer; means comprising a differentially settable notched control disk coacting with the pawl to selectively control the release of the pawl from the latch pawl to cause the latch pawl to move into engagement with the printing hammer whereby the hammer is selectively held as the drive shaft is operated to torsionally shear the rubber bushing to create potential energy in the rubber bushing; means to withdraw the latch pawl from engagement with the printing hammer after the said energy has been created to thereby cause the rubber bushing to operate the hammer for making a printing stroke; and means to operate the drive shaft.

6. In a printing mechanism of the class described, the combination of a printing hammer having a hub; a drive shaft; a rubber spring to actuate the hammer, said rubber spring comprising a bushing bonded to the inner wall of the hub of the printing hammer and to the outer wall of the drive shaft whereby the printing hammer can be operated by the drive shaft; a spring-urged latch pawl movable to engage and hold the printing hammer against movement when the drive shaft is operated; a spring-urged latch normally engaging and holding the latch pawl in a position where the latch pawl cannot engage the printing hammer; a differentially settable notched control plate; means on the latch engageable with the notched control plate to selectively control the movements of the latch whereby the latch may be disengaged from the latch pawl to release the latch pawl for movement into engagement with the hammer, whereby the hammer is held when the drive shaft is operated to twist the rubber bushing and thereby create potential energy in the rubber bushing; means operable to engage the latch pawl with the hammer before the said energy is created and to withdraw the latch pawl from engagement with the hammer after said energy has been created to thereby cause the hammer to make a printing stroke; and means to operate the drive shaft.

7. In a printing mechanism of the class described, the combination of a printing hammer, operating means for the printing hammer consisting of a rubber bushing connected to the printing hammer and to a drive shaft therefor, a means to selectively arrest movement of the hammer, means to rock the drive shaft to create potential energy in the rubber bushing when the hammer is held, and means to withdraw the arresting means after said energy has been created to cause the force to operate the printing hammer.

8. In a printing mechanism of the class described, the combination of a pivoted printing

hammer, operating means for the printing hammer comprising a rubber bushing connected to the hammer around the axis of its pivotal movement, a drive means also connected to the rubber bushing, means to selectively arrest the printing movement of the hammer, actuating means to actuate the drive means while the hammer is arrested to store energy in the bushing, and means to withdraw the arresting means after said energy has been stored in the bushing to cause the hammer to make a printing stroke.

9. In a printing mechanism of the class described, the combination of a printing hammer, operating means for the printing hammer consisting of a rubber bushing connected to the printing hammer and to a drive shaft therefor, a means to selectively arrest movement of the hammer, means to rock the drive shaft in one direction to create potential energy in the rubber bushing when the hammer is held, and means to withdraw the arresting means after the said energy has been created to cause the energy to operate the printing hammer, said means to rock

the drive shaft movable in a reverse direction immediately the hammer is operated.

10. In a printing mechanism of the class described, the combination of a pivoted printing hammer, operating means for the printing hammer comprising a rubber bushing connected to the hammer around the axis of its pivotal movement, a drive means also connected to the rubber bushing, means to selectively arrest the printing movement of the hammer, actuating means to actuate the drive means in one direction while the hammer is arrested to store energy in the bushing, and means to withdraw the arresting means after said energy has been stored in the bushing to cause the hammer to make a printing stroke, said means to actuate the drive means movable in a reverse direction immediately the hammer starts its printing stroke.

CHARLES G. DUDIS.

No references cited.