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Natori

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[54] **MOTION TRANSFORMING MECHANISM**

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Related U.S. Patent Documents

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Filed: **July 11, 1973**

[52] **U.S. Cl.** ..... **74/112;** 74/30; 197/114 R; 197/133 R

[51] **Int. Cl.²** **F16H 27/00**

[58] **Field of Search** 74/112, 30, 31; 197/114, 133, 139

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[57] **ABSTRACT**

A motion-transformer suitable for use with a small printing machine utilizes a trigger mechanism in combination with a rotating drum and slidable members to convert the rotation of the drum into linear motion. The linear motion provides for intermittent advancement of paper on which printing is to be carried out.

7 Claims, 4 Drawing Figures

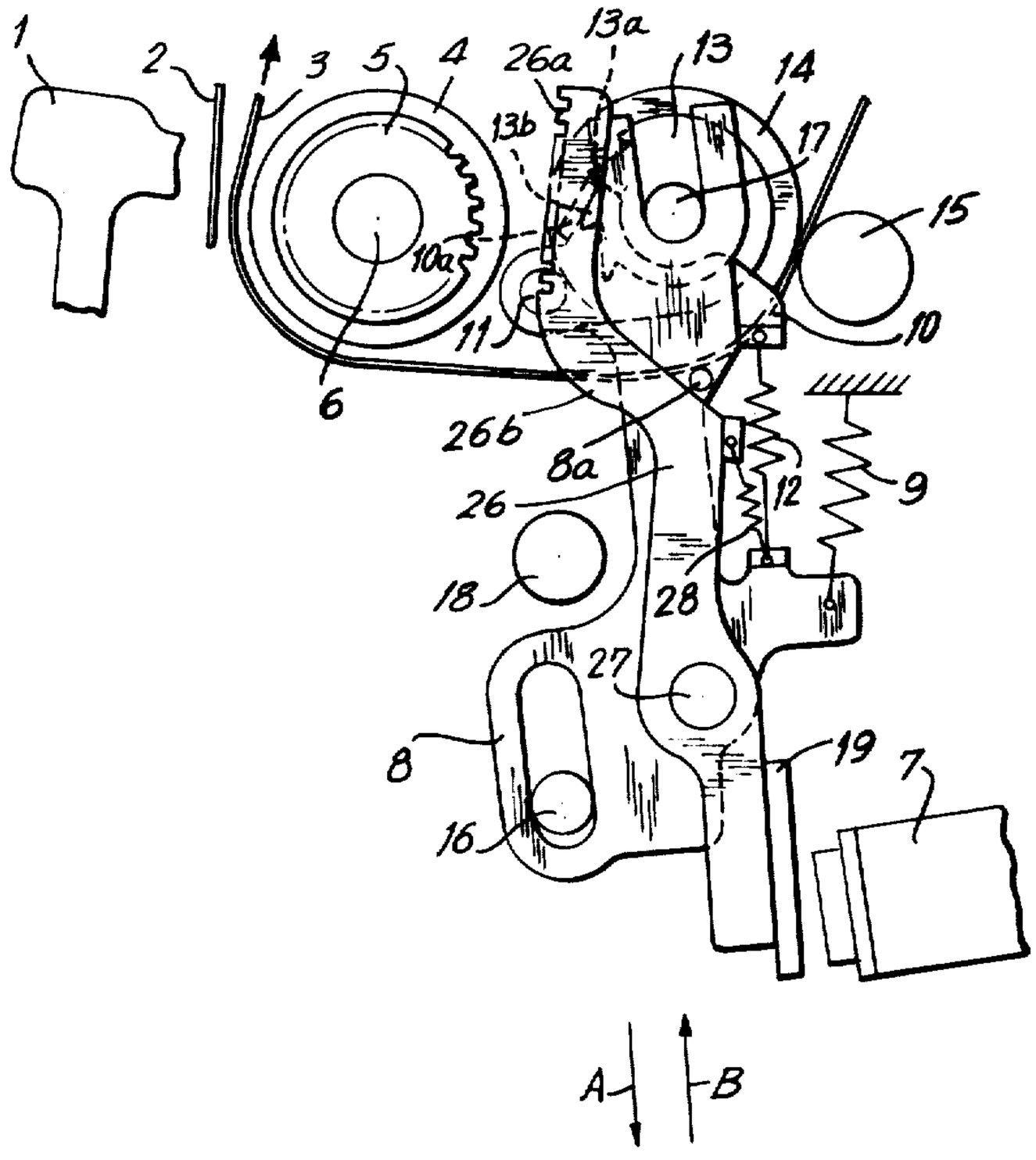


FIG. 1
PRIOR ART

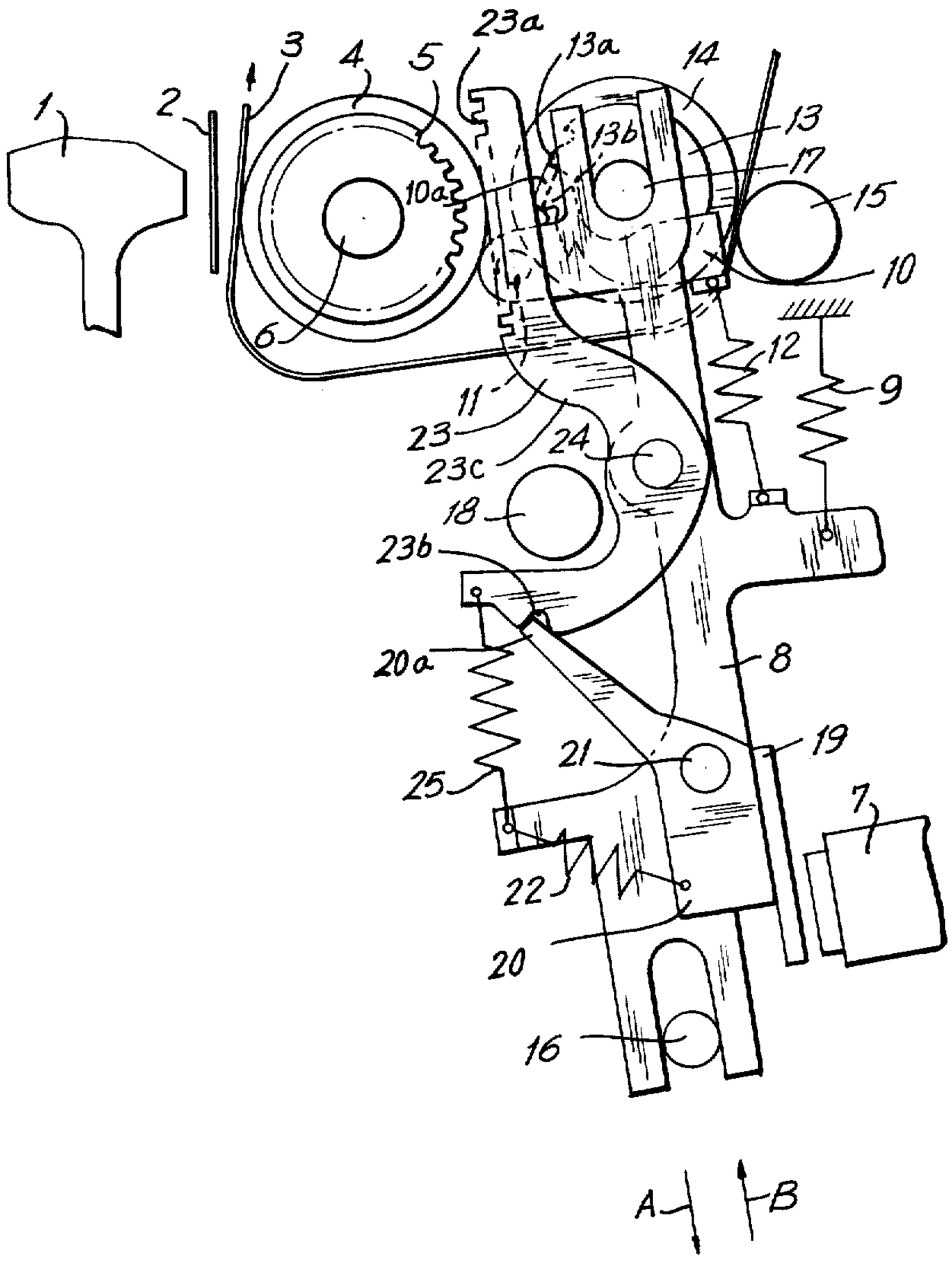


FIG.2

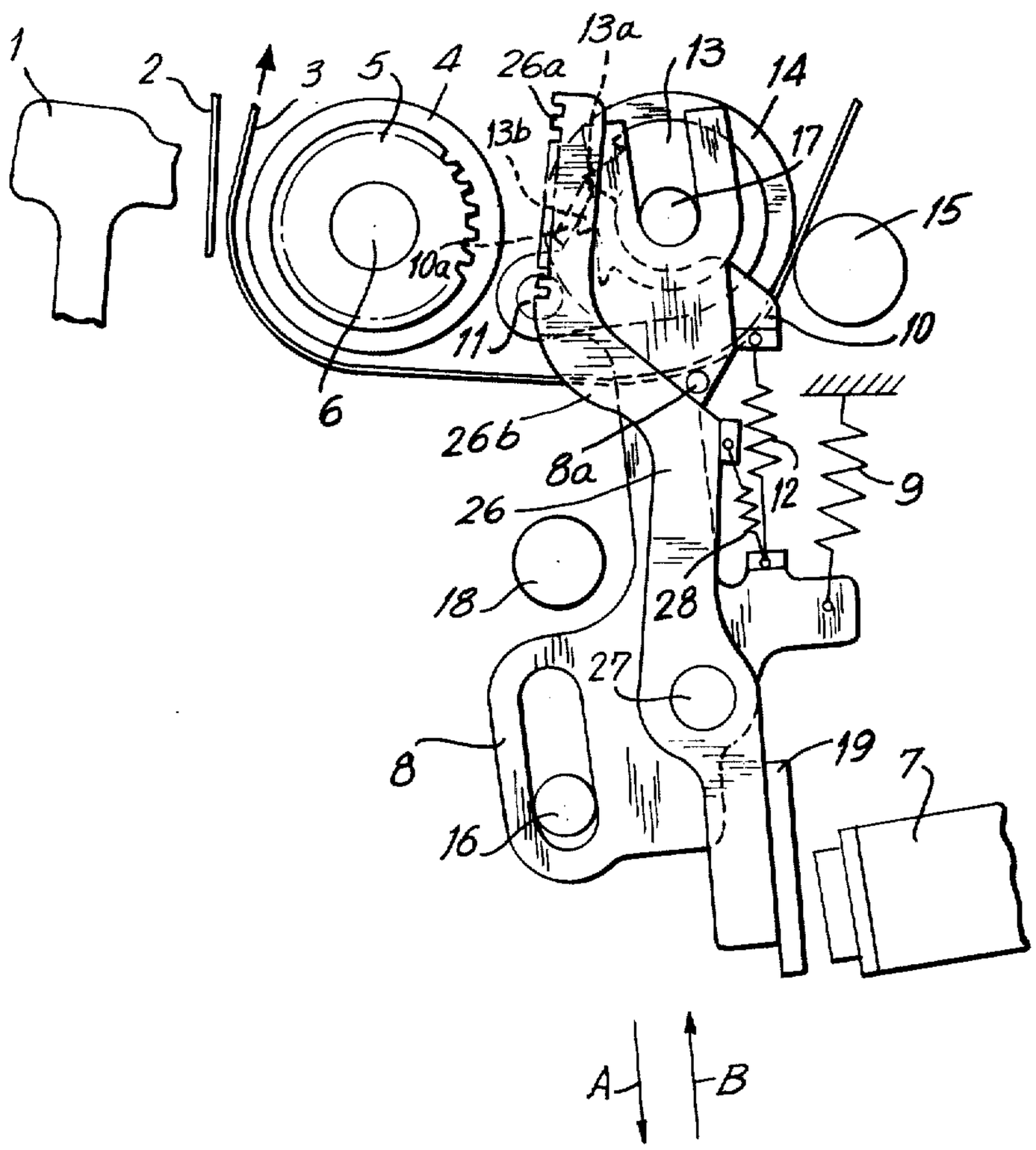

1
2
3
5
4
26a
13a
13
14
13b
17
15
10a
11
10
6
26b
8a
12
9
26
18
28
27
8
19
7
16
A
B

FIG. 3

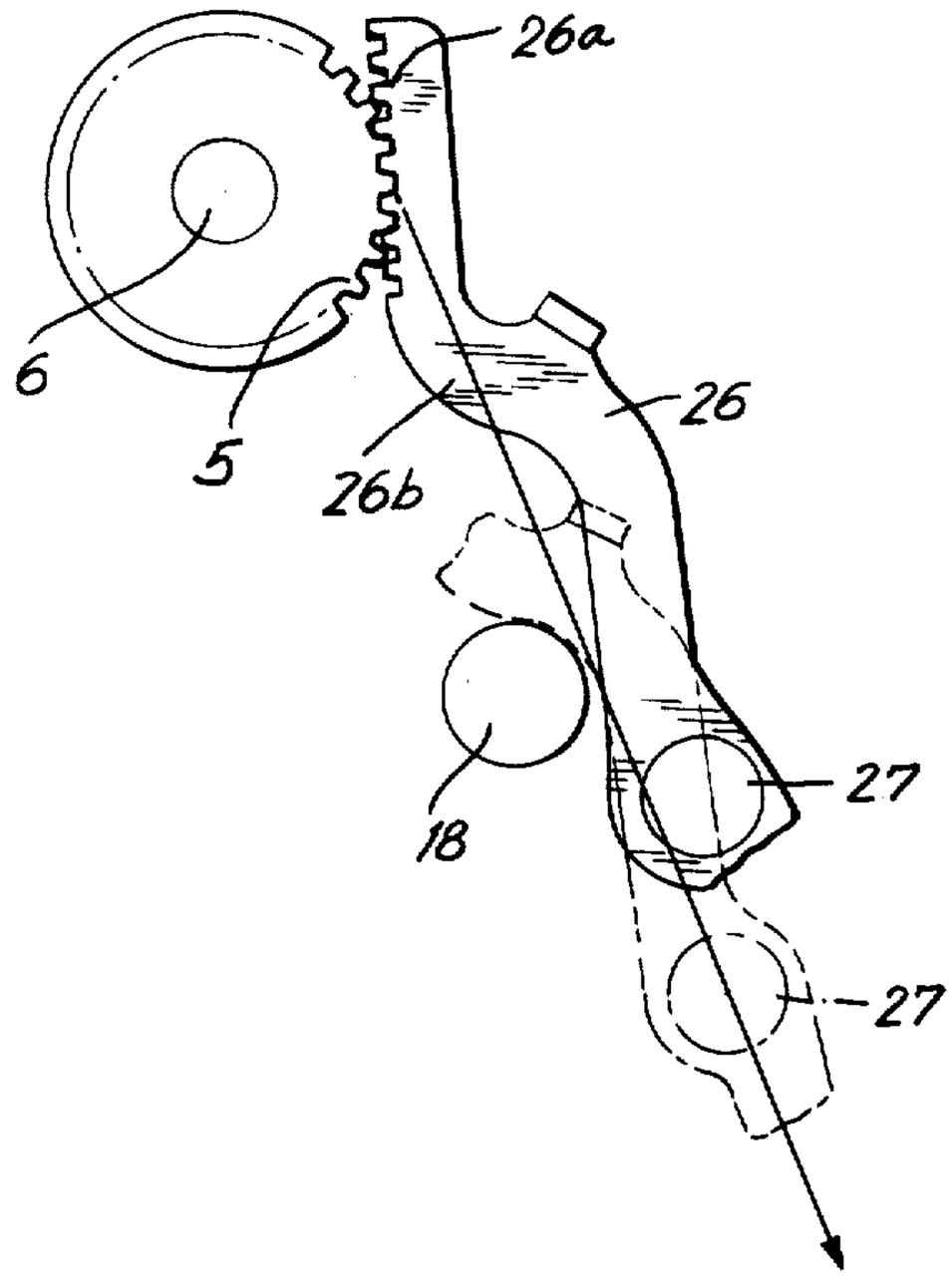
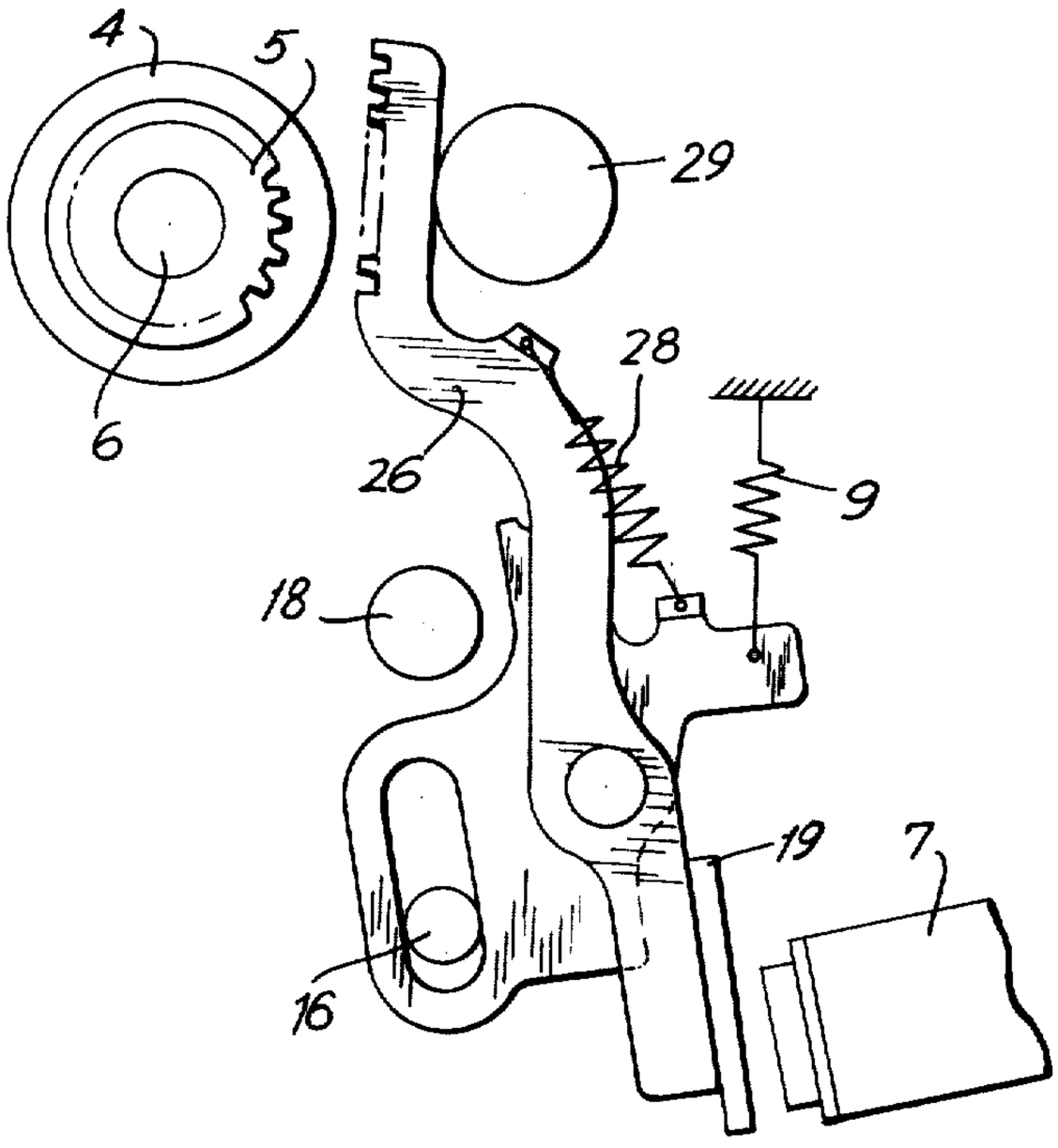


FIG. 4



MOTION TRANSFORMING MECHANISM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

In a conventional motion transforming mechanism for converting rotating into reciprocating motion, an objective which is encountered in small printing machines, the sliding portion of the mechanism which is responsible for advancement of the paper on which text is to be printed consists of a paper-feeding lever, a rack lever which makes contact with a rotating pinion gear and a trigger portion which is moved by an electromagnet. In addition, this portion of the mechanism requires three springs which are used to return the sliding portion of the mechanism to a normal position in which the rack is disengaged from the pinion.

The trigger portion of the mechanism must engage a notch in the rack lever as the sliding mechanism is pulled back into normal position, else the system will fail to function when the electromagnet is pulsed.

The conventional mechanism is unnecessarily complex because of the fact that the sliding portion of the mechanism involves at least three portions in addition to the springs. Further, the engagement of the trigger portion with the notch in the rack lever is uncertain so that it may happen that the rack lever engages the gear at inappropriate moments during operation of the system. Also, the system is not suitable for miniaturization because of the number of members involved in carrying out the necessary operations. Finally, start-up may be difficult because the trigger portion is disengaged from the electromagnet abruptly and the rack lever may become engaged with the gear which holds a print drum.

SUMMARY OF THE INVENTION

The motion-transformer of the present invention includes a reciprocating portion which consists only of a reciprocating member and a member for engaging a rotor, usually in the form of a gear. Only two springs are necessary for returning the reciprocating portion to its normal position, and the trigger mechanism may be either an electromagnet or other timing device for pivoting the engaging member into contact with the rotor. The reciprocating member is guided by two stops which limit the excursion thereof in both directions. The engaging member is disengaged from the rotor by means of contact with a camming portion of the engaging member.

Accordingly, an objective of the present invention is to provide an improved motion-transformer.

Another object of the present invention is to provide an improved motion-transformer for converting rotation into reciprocation using a mechanism suitable for employment in a small printing machine.

A further object of the present invention is to provide an improved motion-transformer suitable for advancing paper intermittently in a small printing machine.

An important object of the present invention is to provide an improved motion-transformer of simpler construction and having fewer parts than conventional motion-transformers.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWING

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. **1** is a conventional motion-transformer suitable for use in a small printing machine;

FIG. **2** is a motion-transformer in accordance with the present invention shown in position for use in a small printing machine;

FIG. **3** is a partial view of the same motion-transformer in engaged position; and

FIG. **4** is a partial view of the same motion-transformer in disengaged position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A motion-transformer for converting rotation into reciprocation in a small printing machine in which the motion-transformer shown is of conventional construction is shown in FIG. **1.** After the machine has printed one line of text, printed paper **3** is moved through a predetermined distance and the next line of text is printed by striking the printed paper **3** through an ink ribbon **2** against a print drum **4.**

To advance the paper, a plate **19** of a material having a high magnetic susceptibility such as iron is attracted by an electromagnet **7** which is pulsed for this purpose. Rotation of electromagnet lever **20** in a clockwise direction against the pull of spring **22** disengages end **20a** of electromagnet lever **20** from notch portion **23b** of rack lever **23.** Rack lever **23** is pivotably supported on paper feeding lever **8** by trunion **24.**

When electromagnet lever end **20a** is disengaged from notch **23b** rack lever **23** rotates counterclockwise around trunion **24** and engages gear **5** mounted for rotation with print drum **4** on shaft **6.** Gear **5** rotates continuously.

Engagement of rack **23a** with gear **5** rotating in clockwise direction applies a thrust through trunion **24** to paper-feeding lever **8** in the direction indicated by the arrow identified by A. The movement of paper-feeding lever **8** is guided by shaft **17** and stop **16.** Shaft **17** on which rotates paper feeding roller **14** also serves as a stop for paper-feeding lever **8** when moving in the direction indicated by the arrow labelled B.

As paper-feeding lever **8** moves in direction A, paper-feeding finger **10** which is supported on paper-feeding lever **8** by axis **11** is forced against the periphery of ratchet wheel **13** by spring **12.** Pawl **10a** which at the beginning of the downward stroke of paper-feeding lever **8** is resting against ratchet tooth **13a** rides over the exterior of the next tooth by virtue of the fact that paper finger **10** can pivot about axis **11** until the end of pawl **10a** engages ratchet tooth **13b.**

Rack lever **23** has a camming portion **23c** so located and so shaped that when paper-feeding lever **8** has moved in direction A far enough so that pawl **10a** has advanced by one tooth on ratchet wheel **13,** camming portion **23** comes in contact with stop **18** which causes

rack lever **23** to rotate clockwise against the pull of spring **25**, thereby disengaging rack **23a** from gear **5**.

In order to engage rack end **23a** of paper-feeding lever **8** with gear **5**, electromagnet **7** need be activated only long enough to take electromagnet lever **8** out of notch **23b**. After that, spring **25** holds rack lever **23a** in engagement with gear **5**. Consequently, when rack lever end **23a** is disengaged from gear **5** as the result of contact between camming portion **23c** and stop **18**, electromagnet lever end **20a** can slip into notch **23b** under the influence of the pull of spring **22**. As aforenoted, this action is somewhat uncertain as the result of which rack lever end **23a** may engage gear **5** at stages of the operation where this is not desirable. Rack lever end **23a** is disengaged.

In view of the fact that electromagnet **7** is unactivated when the movement of paper-feeding lever **8** in the direction A is terminated, spring **9** is now unopposed and takes over, moving paper-feeding lever **8** in the direction indicated by the arrow labelled B, moving lever **8** until it bottoms against shaft **17**. Simultaneously pawl **10a** acts on ratchet tooth **13b** rotating ratchet wheel **13** through an angle corresponding to the distance between ratchet teeth **13a** and **13b**. The direction of rotation of ratchet wheel **13** is, of course, clockwise. Rotation of ratchet wheel **13** causes corresponding rotation of roller shaft **17** and paper-feeding roller **14** which affixed to shaft **17** for rotation therewith. Roller **15** is mounted for free rotation and is pressed toward roller **14** by means which are not shown. The paper on which printing is to be carried out passes between rollers **14** and **15** and stepwise rotation of roller **14** as a result of the reciprocation of paper-feeding lever **8** causes stepwise advancement of paper **3** through the printing machine and across print drum **4** for printing thereon.

It will be noted that the reciprocating portion of the motion-transforming mechanism has three essential elements, namely the paper-feeding lever **8**, the rack lever **23** and the electromagnet lever **20**. Further, for operation as a motion-transformer three springs are necessary, namely springs **9**, **22** and **25**. The paper-feeding finger **10** and its associated spring **12** adapt the motion-transformer for use as a paper-feeding mechanism.

As aforenoted, the embodiment of the present invention reduces the number of reciprocating elements from **3** to **2** when the device is used simply as a motion-transformer, and the number of springs from **3** to **2**. The preferred embodiment is shown in FIG. **2**. Operation of the system is started by applying a pulse to electromagnet **7** which draws a plate **19** toward it. Preferably, the shape of cam **26** should be such that when engaging portion **26a** makes contact with rotor **35**, there is clearance between plate **19** and electromagnet **7**. Such clearance facilitates reciprocation of member **38**.

In FIG. **2**, rotor **35** is shown as a gear and engaging portion **26a** is shown as a rack. However, rotor **35** and engaging portion **26a** could also be the portions of a friction drive, where both rotor **35** and engaging portion **26a** lack teeth. Similarly, member **7** and plate **19** could be replaced by a mechanism designed to rotate cam **26** in counterclockwise direction of a limited period of time in each cycle. The design of such a mechanism is well within the capacity of one skilled in the art.

Cam **26** is mounted on member **38** by means of trunion **27** around which it rotates freely. When electromagnet **7** is activated, cam **26** is rotated counterclockwise against the pull of spring **28** until engaging end **26a** of cam **26** makes contact with rotor **35**. For this rotation to take place, the moment of force supplied by electromagnet **7** and plate **19** around trunion **27** must exceed the moment of force exerted by spring **28**.

Engagement of engaging portion **26a** with rotor **35** drives cam **26a** and consequently member **38** in the direction indicated by the arrow labelled A. Member **38** is guided by stop **16** and stop-shaft **17** where members **16** and **17** not only function as guides but as stops limiting the excursion of member **38** in each direction. The movement of cam **26** and member **38** in direction A continues until camming portion **26b** of cam **26** engages stop **18**. As a result of contact with stop **18**, cam **26** is rotated in clockwise direction disengaging end **26a** from rotor **35**. This terminates the force exerted by rotor **35** on member **38** driving same in direction A and allows spring **9** to take over, drawing the reciprocatable member **38** in the direction indicated by the arrow labelled B. Further, spring **28** in the absence of a force exerted by electromagnet **7** holds cam **26** in disengagement from rotor **35**.

The action of paper-feeding finger **10**, pawl **10a**, ratchet wheel **13**, paper-feeding roller **14**, and roller **15** is exactly the same as in the conventional mechanism shown in FIG. **1**.

The way in which stop **18** acts to disengage end **26a** from rotor **35** is shown in FIGS. **3** and **4**. In FIG. **3** cam **26** is engaged with rotor **35** and the relationship of camming portion **26b** to stop **18** as the two members make contact is shown in phantom in FIG. **3**.

The clockwise rotation of cam **26** may be limited by use of stop **8a** mounted on reciprocatable member **38**. Alternatively, an energy-absorbing damper **29** may be positioned anywhere along cam **26** to stop cam **26** in its clockwise rotation while preventing oscillation.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A motion-transforming mechanism comprising a rotor, a reciprocatable member proximate said rotor and movable in first and second directions opposite to each other, first and second stops positioned for guiding and limiting the excursion of said reciprocatable member, a trunion mounted on said reciprocatable member, a cam member mounted pivotably on said trunion, said cam member having a contacting portion engageable with said rotor and having a camming portion, first spring means normally holding said contacting portion disengaged from said rotor, second spring means normally holding said reciprocatable member against said first stop, trigger means for rotating said contacting portion of said cam member into engagement with said rotor by exerting a [pulsed] force moment greater than the force moment exerted by said

first spring means, said rotor rotating in such a direction that engagement of said contacting portion with said rotor moves said cam member and thereby said trunion and said reciprocatable member toward said second stop, and a guide proximate said cam member, said guide being so positioned that as said reciprocatable member carrying said cam member moves toward said second stop, said camming portion engages said guide, the shape of said camming portion being such that on engaging said guide, said cam member is rotated away from said rotor by movement of said reciprocating member toward said second stop, thereby disengaging said contacting portion [form] *from* said rotor [, said trigger means being adapted to terminate exertion of said pulse moment at or shortly after the disengagement of said contacting portion from said rotor thereby] *and* allowing said second spring means to draw said reciprocating member to said first stop, and said first spring means to hold said contacting portion disengaged from said rotor.

2. A motion-transforming mechanism as defined in claim **1** wherein said rotor is a pinion gear and said contacting portion is a rack.

3. A motion-transforming mechanism as defined in claim **1** wherein said trigger means is a pulsable electromagnet and said cam member comprises a plate affixed to same and so positioned and of said composition as to be movable by the magnetic flux from said electromagnet against the force exerted by said first spring means.

4. A motion-transforming mechanism as defined in claim **1** further comprising a pawl attached to said

reciprocatable member and a rotatable ratchet wheel, said pawl, said reciprocatable member and said ratchet wheel being so related that a single excursion of said reciprocatable member toward and away from said second stop rotates said ratchet wheel by an amount corresponding to the distance between successive teeth on said wheel.

5. A motion-transforming mechanism as defined in claim **4** wherein said mechanism is a portion of a small printing machine and said mechanism further comprises a first drum attached to said ratchet wheel for rotation therewith, a second drum mounted for rotation as the result of pressure urging said drums together, said first and second drums serving to receive paper therebetween and to advance said paper positioned with each pulse from said trigger means.

6. A motion-transforming mechanism as defined in claim **3** wherein the shape of said cam member is such that when said electromagnet brings said engaging portion in contact with said rotor clearance remains between said electromagnet and said plate, thereby facilitating movement of said reciprocatable member.

7. A motion-transforming mechanism as defined in claim **1**, further comprising a stop of an engery-absorbing material suitably located for halting the rotation of said cam member under the influence of said first spring after disengagement of said cam member from said rotor, thereby preventing oscillation of said cam member.

* * * * *