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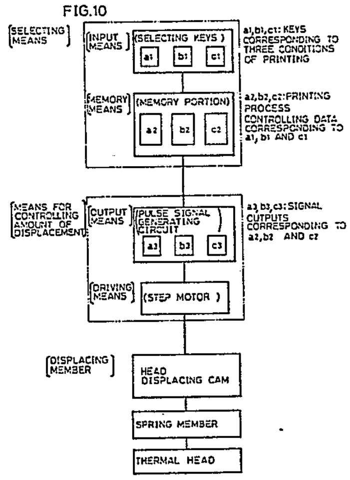
(54) **Thermal recording apparatus.**

(57) A thermal recording apparatus comprises a platen, a thermal head for carrying out thermal recording by pressing a recording paper onto the platen, a spring member for pressing the thermal head onto the platen by the spring force, a displacing member displacably provided while being in contact with the spring member for changing the force of the spring member by the displacement, selecting means having a plurality of printing process controlling data for selecting therefrom specific printing process for controlling data corresponding to the state of printing, and displacing amount controlling means for controlling the amount of displacement of displacing member in accordance with the specific printing process condition selected by the selecting means. The pressure of the thermal head onto the recording paper can be controlled corresponding to the conditions of printing and to the types of the recording paper by the above described structure.

FIG.10



EP 0 345 079 A2

Description

Thermal Recording Apparatus

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a thermal recording apparatus and, more specifically, to a thermal recording apparatus in which pressure of a thermal head can be controlled in accordance with various conditions of printing and with various types of recording paper.

Description of the Background Art

Thermal recording apparatuses have been widely used as output apparatuses of a computer and the like. A structure of a typical conventional thermal recording apparatus is shown in Fig. 1.

Referring to Fig. 1, the conventional thermal recording apparatus carries out recording when a transfer printing method employing an ink ribbon is applied, by selectively melting ink of an ink ribbon 1 by a thermal head 2 and by transferring the melt ink onto a sheet of recording paper 4 running along a platen 3.

If a thermosensitive recording paper is used as the recording paper 4, the ink ribbon 1 is removed, and recording is carried out by the thermal head 2 which is in direct contact with the recording paper 4 to heat the same.

The thermal head 2 which is rotatably supported about an axis 5 as shown in detail in Fig. 2, is pressed against the platen 3 with the ink ribbon 1 interposed therebetween, by means of a spring 6. The thermal head 2 and the ink ribbon 1 are held on a carriage 7. The carriage 7 is supported by a shaft 8 so as to be slid along the platen 3. The sliding of the carriage 7 is realized by a driving belt 9.

As described above, the conventional thermal recording apparatus is used both for recording on a plain paper by using the ink ribbon 1 and for recording by direct contact of the thermal head 2 with the thermosensitive recording paper.

The most suitable pressure of the thermal head 2 onto the recording paper 4 in printing is different in the above described two methods of recording. Namely, when a thermosensitive recording paper is used, the sheet of the thermosensitive recording paper 4 is brought into direct contact with the thermal head 2, so that if the pressure is too high, the paper will be soiled or made glossy. When printing is to be carried out by means of the ink ribbon 1, the heat may not be well transmitted when the pressure is low, and the desired patterns or characters may not be printed clearly. However, in the above described conventional structure, the same constant pressure is applied to the thermal head 2, so that optimal printing cannot be realized in either of the two printing methods.

In view of the foregoing, an apparatus such as shown in Figs. 3 and 4 has been proposed in Japanese Patent Laying-Open No. 288054/1987. Referring to Figs. 3 and 4, a lever is held by a carriage 7 rotatable around an axis 10a. The left end of the lever 10 is biased by a spring 11 so as to apply pressure on a rib 12 provided on a rear surface of the thermal head 2.

In the following, changes of the pressure in printing of the thermal head 2 in the thermal recording apparatus structured as above will be described.

When the ink ribbon is not mounted on the carriage 7 as shown in Fig. 3, the right end of the lever 10 is free, and the thermal head 2 is forced in the direction shown by the arrow B by the spring 11. In addition, it receives the force of the spring 6 in the direction of the arrow C, so that the thermal head is pressed on the platen 3 in the direction shown by the arrow A by the forces of the springs 11 and 6.

Since the springs 11 and 6 provide moments of force around the axis 5 in opposite directions, respectively, to the thermal head 2, the total moment of force by which the thermal head is rotatably biased is the difference therebetween.

When the ribbon cassette 13 is attached as shown in Fig. 4, the right end of the lever 10 is pressed by the ribbon cassette 13, so that the lever 11 is turned against the force of the spring 11. Therefore, the lever 10 is separated from the thermal head 2 and the thermal head 2 is pressed on the platen 3 in the direction shown by the arrow D only by the force of the spring 6 in the direction of the arrow E.

As described above, in this apparatus of the prior art, the springs 6 and 11 offset the forces of each other in printing on a thermosensitive recording paper, so that the pressure in printing is rather weak. When the printing is to be carried out employing the ink ribbon, the thermal head 2 is pressed on the platen 3 with relatively strong force applied only by the spring 6 to carry out printing.

A prior art driving mechanism for turning the thermal head 2 about the axis 5 will be described in the following. A thermal recording apparatus such as shown in Figs. 5 to 8 is disclosed in Japanese Patent Laying-Open No. 288057/1987. In this apparatus, rolling up of the ink ribbon 1 and turning of the thermal head 2 are carried out by the same driving source, and the turning of the thermal head 2 is carried out by using a head displacing cam formed of a plate cam.

Referring to Figs. 5 and 6, rotation of a step motor 14 which is the common driving source of the head displacing mechanism and the ink ribbon rolling up mechanism is transmitted from a prime gear 15 provided on the motor axis through an intermediate gear 16 engaged therewith to a gear 17 with the rate of rotation reduced. The gear 17 is fixed to a rotary axis 18 so that the rotation of the gear 17 is selectively transmitted to a head displacing cam 19 and to a ribbon rolling up gear 20.

The head displacing mechanism will be described at first. A head driving gear 21 is rotatively supported on the rotary axis 18 by means of a bearing (not shown), and the rotation of the head driving gear 21 is transmitted to a head displacing gear 23 through an intermediate gear 22. The head displacing cam 19 formed of a plate cam is fixed on the same axis as the head displacing gear 23 to be rotated together.

A ribbon driving gear 24, which is the ribbon rolling mechanism, is rotatively supported about the rotary axis 18 by means of a bearing, at an upper portion of the rotary axis 18.

An inner periphery of the lower half of the ribbon driving gear 24 also constitutes a gear (not shown). This apparatus of the prior art comprises means (not shown) for selectively locking rotation of the head driving gear 21 and of the ribbon driving gear 24. A mechanism for selectively transmitting the rotary driving power of the stepping motor 14 to either one of the head driving gear 21 and the ribbon driving gear 24 whose rotation is not locked is realized by means of an epicyclic gear (not shown) or the like engaging with the gear of the inner periphery of the ribbon driving gear 24.

The mechanism for turning the thermal head 2 about the axis 5 will be described in the following. Referring to Figs. 7 and 8, a head holder 25 holding the thermal head is rotatable about the axis 5 and is in contact with the head displacing cam 19 by the rotary force in the clockwise direction by the weight of itself, as the center of the gravity is on the right side of the axis 5. When the head displacing cam 19 is rotated and a portion thereof having a larger diameter is brought into contact with the head holder 25, the head holder 25 turns from the state of Fig. 7 to the state of Fig. 8. Consequently, the thermal head 2 is brought into pressure contact with the recording paper 4 with the ink ribbon interposed therebetween, by the head pressure applied from the spring 26.

Now, the most suitable pressure of the thermal head 2 against the recording paper 4 in printing changes widely in accordance with the method of printing and with the types of the printing paper 4. Let us consider a case in which a recording is to be carried out on a single sheet of the recording paper 4 such as a post card, which is wound around the platen 3 by a roller 27 and the pressure of the thermal head 2, as shown in Fig. 9. When the recording paper 4 is wound around the platen having a circular cross section, there is a force derived from flexual rigidity of the recording paper 4 forcing the recording paper 4 to go in the direction of the arrow G. This force becomes stronger as the flexual rigidity of the recording paper 4 becomes higher and as the recording paper 4 becomes thicker, provided that the paper has the same quality. Therefore, if the thermal head 2 presses the recording paper 4 with the ink ribbon 1 interposed therebetween with a constant force, the force of the recording paper 4 to go outward may be stronger than the pressure of the thermal head 2 when printing is to be carried out on a single sheet of thick paper. Therefore, there is a possibility of the recording paper 4 being lifted away from the platen 3, and the pressure in printing being neither uniform nor sufficient. The most suitable pressure in printing differs very delicately dependent on the types of the thickness of the sheets of paper employed.

Therefore, it is difficult to adjust delicately the pressure in printing, and it was impossible to provide optimal pressing force corresponding to the types of recording papers and to various conditions of printing in the method shown in Figs. 3 and 4 in which the pressure is switched between two steps by means of springs. In the conventional apparatus shown in Figs. 5 to 8, the head displacing cam 19 is regulated by a stopper such that it reciprocates in a prescribed angle of rotation. Accordingly, the pressing force of the thermal head is always constant, and there is no mechanism for adjusting the force.

SUMMARY OF THE INVENTION

The present invention was made to solve the the above described problems and its object is to provide a thermal recording apparatus capable of delicately controlling pressure in printing in accordance with arbitrary conditions of printing and to various types of recording paper by further developing the conventional method of turning the thermal head by means of a head displacing cam formed of a plate cam.

The thermal recording apparatus in accordance with the present invention comprises a platen and a thermal head carrying out thermal recording by pressing the recording paper onto the platen. The thermal head is pressed against the platen by the force of a spring member. A displacing member provided displacably is kept in contact with the spring member, and the force of the spring member can be changed by an amount of displacement of the displacing member. The apparatus further comprises selecting means having a plurality of printing process controlling data for selecting specified printing process controlling data therefrom in accordance with the state of printing. The amount of displacement of this displacing member is controlled by displacing amount control means in accordance with the specified printing process controlling data selected by the selecting means.

In the thermal recording apparatus of the present invention, the selecting means comprises memory means for storing a plurality of displacing amount controlling data corresponding to a plurality of conditions of printing and input means for applying instructions to operate the said displacing amount controlling means in accordance with the displacing amount controlling data corresponding to the selected specific conditions.

The displacing amount controlling means of the thermal recording apparatus of the present invention comprises driving means for driving the displacing member and output means for applying outputs to the said driving means in accordance with the selected specific printing conditions.

The thermal recording apparatus of the present invention structured as described above operates in the following manner. Arbitrary control data selected in accordance with the condition of printing out of the printing processing data stored in advance in the memory means are inputted through the input means. An output signal based on the selected control data is outputted from the output means, whereby the driving means is driven. The displacing member is displaced by the driving means to apply pressing force to the thermal head, and consequently the thermal head is brought into pressure contact with the platen.

In accordance with a preferred embodiment of the thermal recording apparatus of the present invention, a cam rotating about a rotary axis is used as the displacing member. The outline of the cam profile comprises two areas. The thermal head is moved from a rest position, that is, non-printing position, to a position near the platen by a first area, and the thermal head is moved to a printing position by a second area. The second area of the outline of the cam profile changes more moderately than in the first area. Therefore, delicate adjustment of the pressing force of the thermal head onto the platen is made possible by controlling the angle of rotation of the cam.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a plan view of a conventional typical thermal recording apparatus;

Fig. 2 is a side view partially in cross section of the apparatus shown in Fig. 1;

Figs. 3 and 4 are side views partially in cross section for illustrating the operation of a conventional thermal recording apparatus having a function of adjusting pressing force of a thermal head in two steps in correspondence with different methods of printing;

Fig. 5 is a plan view of a mechanism of swinging the thermal head by means of a cam in a conventional thermal recording apparatus;

Fig. 6 is a front view of the mechanism shown in Fig. 5;

Figs. 7 and 8 are side views showing, in an enlargement, the proximity of the thermal head of the apparatus shown in Fig. 5;

Fig. 9 is a side view illustrating drawbacks of the conventional thermal recording apparatus;

Fig. 10 is a block diagram showing basic structure of the thermal recording apparatus of the present invention;

Figs. 11 to 13 are plan views of main portions for illustrating the operation of the thermal recording apparatus in accordance with one embodiment of the present invention;

Fig. 14 shows the proximity of the thermal head of the apparatus shown in Figs. 11 to 13 viewed from the side of the platen;

Fig. 15 is a perspective view of a spring holder of the apparatus shown in Fig. 14;

Fig. 16 is a perspective view showing main portions of the apparatus shown in Fig. 14;

Figs. 17 and 18 show relation between the pressing force of the thermal head and the displacement of the spring in the same embodiment;

Figs. 19 and 20 show a change of diameter corresponding to the angle of rotation of the cam in the same embodiment; and

Figs. 21 and 22 show relation between the angle of rotation of the cam and the pressing force of the thermal head.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

One embodiment of the present invention will be described in the following with reference to Figs. 10 to 22.

The whole structure of the present embodiment is as shown schematically in the block diagram of Fig. 10. Referring to Fig. 10, selecting means of a thermal recording apparatus of the present embodiment comprises selecting keys (input means) having three keys a_1, b_1 and c_1 corresponding to three different conditions of printing. The selecting means further comprises a memory portion (memory means) storing printing process controlling data a_2, b_2 and c_2 corresponding to the keys a_1, b_1 and c_1, respectively. Displacing amount controlling means of the present embodiment comprises a pulse signal outputting apparatus (output means) outputting signals corresponding to the data a_2, b_2 and c_2, and a step motor (driving means). The thermal recording apparatus of the present embodiment further comprises a head displacing cam (displacing member) driven by the step motor, a spring member which is transformed by the head displacing cam, and a thermal head which is brought into pressure contact with a platen upon receiving the force of the spring member.

An operation of a mechanism for driving the thermal head in the present embodiment, namely, the operation of the head displacing cam, the spring member and the thermal head will be described in the following.

Referring to Figs. 11 to 16, a thermal head 2 formed of a head chip 32 having a heating element 31 and a heat radiating plate 33 is rotatably held on a carriage 35 by a head holder 25 with an axis 34 serving as a fulcrum. It is rotatably biased in a direction away from the platen 3 which is a direction for non-printing by means of a tension spring 36 suspended between the thermal head 2 and the carriage 35.

A spring holder 37 for holding the spring 26 is rotatably provided near the rear surface side of the thermal head 2 on the carriage. As is also shown in Fig. 15, the spring holder 37 comprises a holding plate 37a on which the torsion spring 26 is held and a cylindrical boss 37b formed integrally therewith, and an axis 38 of the carriage 35 inserted through the boss 37b so that the holder can be rotated with the axis 38 serving as the fulcrum. Side walls 37c and 37d are provided integrally erected on both side portions, and opposing ends of the torsion spring 26 fitted around the boss 37b are abutting the respective side walls 37c and 37d. One end of the torsion spring 26 is projected from one side wall 37c to be engaged and in contact with a receiving piece 39 of the thermal head 2. A piece 37e for pressing the torsion spring 26 is provided inward from one side wall 37c and a projecting piece 37f is provided outward from the other side wall.

A displacing cam 19 of the thermal head 2 is arranged near the spring holder 37, which cam is rotatable about a cam axis 40. The projecting piece 37f of the spring holder 37, which is rotatably biased in the clockwise direction in the figure by the thermal head 2 in contact therewith, which is in turn biased in the non-printing direction by a tension spring 36, is in contact with the outline of the cam profile of the cam 19. Accordingly, the cam displaces the thermal head 2 through the spring holder 37 which is serving as a follower. The profile of the cam 19 comprises a cam surface 19a for non-printing having a diameter of R_a shown in Fig. 11, a cam surface 19b for normal printing having a diameter of Rb shown in Fig. 12 and a cam surface 19c for high head pressure having a diameter of Rc shown in Fig. 13 formed continuously. As is apparent from Figs. 11 to 13, the diameters of Ra, Rb and Rc satisfy the relation of Ra $<$ Rb $<$ Rc.

The function of the present embodiment will be described in the following. When printing is to be carried out on sheets of thin plain paper and an operator selects a format for printing on plain paper prior to the printing operation, the cam 19 is rotated in the forward direction and in the reverse direction repeatedly in an angle between the state shown in Fig. 11 and the state shown in Fig. 12. When the cam 19 is rotated in the forward direction, i.e., clockwise direction as viewed, from the state of Fig. 11 to the state of Fig. 12, the cam surface 19b for normal printing having larger diameter than the cam surface 19a for non-printing is brought into contact with the projecting piece 37f. Consequently, the spring holder 37 is turned in the counter clockwise direction as viewed, and the thermal head 3 is pressed by the torsion spring 26 which is stronger than the tension spring 36. Accordingly, the thermal head 2 is turned about the axis 34, and the spring holder 37 is turned a little from the point at which the thermal head 2 is brought into contact with the platen 3 with the paper (not shown) interposed therebetween. The torsion spring 26 is deflected and a pressure is applied on the thermal head 2 by the force of the torsion spring 26 generated corresponding to the deflection, thereby enabling printing on the paper.

After the end of the printing operation, the cam 19 is rotated in the reverse direction, that is, the counter clockwise direction as viewed, from the state of Fig. 12. The thermal head 2 is moved away from the platen 3 by the tension spring 34 to be returned to the position of Fig. 11. The operation is repeated for printing.

When printing is to be carried out on a sheet of paper which is thick and of high flexual rigidity such as a post card and the operator selects a format for printing on a thick sheet of paper, the cam 19 is turned in the forward direction and in the reverse direction repeatedly in an angle between the state of Fig. 11 and the state of Fig. 13. When the cam 19 is turned from the state of Fig. 11 to the state of Fig. 13 and the cam surface 19c for high head pressure is in contact with the projecting piece 37f, the cam surface 19c for high head pressure having larger diameter than the cam surface 19b for normal printing. Therefore, the deflection of the torsion spring is larger than in the above described case of printing on plain paper as is apparent from Fig. 13. Accordingly, the head pressure of the thermal head 26 becomes higher, enabling clear printing on a thick sheet of paper with the corresponding high head pressure.

As described above, according to the present embodiment, the pressure on the thermal head can be switched at least by two steps, so that clear printing on a thick sheet of paper such as a post card can be carried out with optimal head pressure. In addition, the controllable range of the head pressure can be arbitrarily selected only by changing the shape of the cam.

The relation between the angle of rotation of the cam 19 and the pressure in printing of the thermal head 2 in the present embodiment will be described in the following.

The relations among the deflection x of the torsion spring 26, the force F_1 of the torsion spring 26, the force F_2 of the tension spring 36 and the head pressure P are as shown in the graph of Fig. 18. The deflection of the torsion spring 26 at the point at which the thermal head 2 is brought into contact with the recording paper 4 is represented by $x = x_0$ in the graph. As is apparent from the graph, there is a relation of $P = F_1 - F_2$, and the head pressure P increases approximately linearly when the thermal head 2 is in contact with the recording paper 4.

The relation between the angle of rotation θ and the diameter R of the cam 19 is shown in Figs. 19 and 20. The angle of rotation θ of the cam 19 is assumed to be zero at the position where the thermal head 2 is in contact with the torsion spring 26 in the non-printing state, and the angle of rotation corresponds to θ_1 at a position where the thermal head 2 is about to be in contact with the platen 3. As is apparent from Fig. 20, the diameter R in the range of $0 < \theta < \theta_1$ changes more rapidly compared with that in the range of $\theta > \theta_1$. Therefore, when the cam 19 is rotated at a constant speed, the thermal head 2 is moved rapidly from the non-printing position to the proximity of the platen 3. The thermal head 2 is moved slower from that position to the point of contact with the platen 3 and the diameter R changes moderately, so as to absorb shock at the time of contact.

By selecting a proper angle of rotation in the range of $\theta_1 < \theta < \theta_3$, a position on the outer periphery of the cam 19 is set which position is to be brought into contact with the torsion spring 26 in the printing operation in which the thermal head 2 is pressed onto the recording paper 4. Consequently, the deflection x of the torsion spring 26 in the printing operation is selected, whereby the head pressure P of the thermal head 2 can be adjusted. For example, by storing most suitable pressure is in printing corresponding to the types of the recording paper 4 in advance and by selecting an angle of rotation θ corresponding to the recording paper employed, the pressure in printing can be delicately adjusted corresponding to the types of the recording paper. The relation between the angle of rotation θ of the cam 19 and the pressure P of the thermal head 2 onto the recording paper 4 is as shown in Figs. 21 and 22.

Although a plate cam whose diameter is changed corresponding to the angle of rotation is used as the cam 19 serving as a displacing member in the present embodiment, other types of cams such as a translation cam or means other than the cams providing deflection may be used as the displacing member.

Although a torsion spring 26 having an operating surface parallel to the cam 19 was used as the spring member applying force onto the thermal head 2 when it is in contact with the cam 19, other resilient member capable of changing pressure onto the thermal head 2 corresponding to the displacement of the displacing member may be used alternatively.

Although the present invention was applied to a transfer printing method employing an ink ribbon, the application is not limited thereto. For example, the present invention may be applied for adjusting pressure in printing when the method of printing is changed between the transfer method employing the ink ribbon and the directly heating method employing thermosensitive recording paper, and for adjusting pressure in printing corresponding to the types of the thermosensitive recording paper in the directly heating method.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

There are described above novel features which the skilled man will appreciate give rise to advantages. These are each independent aspects of the invention to be covered by the present application, irrespective of whether or not they are included within the scope of the following claims.

Claims

1. A thermal recording apparatus, comprising:
a platen;
a thermal head for carrying out thermal recording by pressing a sheet of recording paper onto the platen;
a spring member for pressing the thermal head on said platen by a force of a spring;
a displacing member displacably provided while being kept in contact with the spring member for changing the force of said spring member by an amount of displacement;
selecting means having a plurality of printing process controlling data for selecting a specific printing process controlling data therefrom corresponding to a state of printing; and
controlling means for controlling the amount of displacement of said displacing member in accordance with the specific printing process condition selected by the selected means.

2. A thermal recording apparatus according to claim 1, wherein
said selecting means comprises storing means for storing a plurality of displacing amount controlling data corresponding to the plurality of printing process conditions and input means for applying an instruction for operating said displacing amount controlling means in accordance with displacing amount controlling data corresponding to the selected specific printing condition.

3. A thermal recording apparatus according to claim 2, wherein
said displacing amount controlling means comprises:
driving means for driving said displacing member; and
output means for applying an output signal to said driving means in accordance with the selected specific printing process condition.

4. A thermal recording apparatus according to claim 1, wherein
said displacing member comprises an axis and a cam rotating about the axis.

5. A thermal recording apparatus according to claim 4, wherein
an outline profile of said cam comprises a first area by which the thermal head is moved from a non-printing position spaced from the platen to a proximity of the platen, and a second area by which the thermal head is moved from the proximity of the platen to a printing position at which the head is in contact with the platen.

6. A thermal recording apparatus according to claim 5, further comprising:
retracting means for retracting the thermal head away from the platen when the force of said spring member becomes lower than a prescribed value.

7. A thermal recording apparatus according to claim 5, wherein
ratio of increase per unit angle of rotation in the second area of the outline profile of said cam is smaller than that in said first area.

8. A thermal recording apparatus according to claim 5, wherein
the amount of displacement of said displacing member is adjusted by changing the angle of rotation of said cam in the second area of the outline profile of said cam.

9. A thermal recording apparatus according to claim 7, wherein
the amount of displacement of said displacing member is adjusted by changing the angle of rotation of said cam in the second area of the outline profile of said cam.

10. A thermal recording apparatus according to claim 1, wherein
said selecting means comprises a plurality of printing process controlling data corresponding to types of recording papers.

11. A thermal recording apparatus according to claim 1, wherein
said selecting means has printing process controlling data corresponding to whether or

not an ink ribbon is employed.

12. A thermal recording apparatus according to claim 4, wherein

said spring member is formed of a torsion spring supported rotatably around a fixed axis, having one end in contact with said displacing member and the other end in contact with the thermal head.

13. A thermal recording apparatus according to claim 12, wherein

an operational surface of said torsion spring is parallel to a surface of said cam.

14. A thermal recording apparatus according to claim 13, further comprising a carriage, wherein

said cam and said torsion spring are rotatably supported on an axis vertically fixed on said carriage.

15. A recording apparatus which has a platen for supporting a recording sheet, a thermal recording head which is displaceable toward and away from the platen, and a spring member arranged to be stressed so as to urge the recording head onto the platen, for recording on a said sheet supported on the platen, and means for altering the degree of stress in said spring member so as to alter the force applied thereby to said recording head.

FIG.1

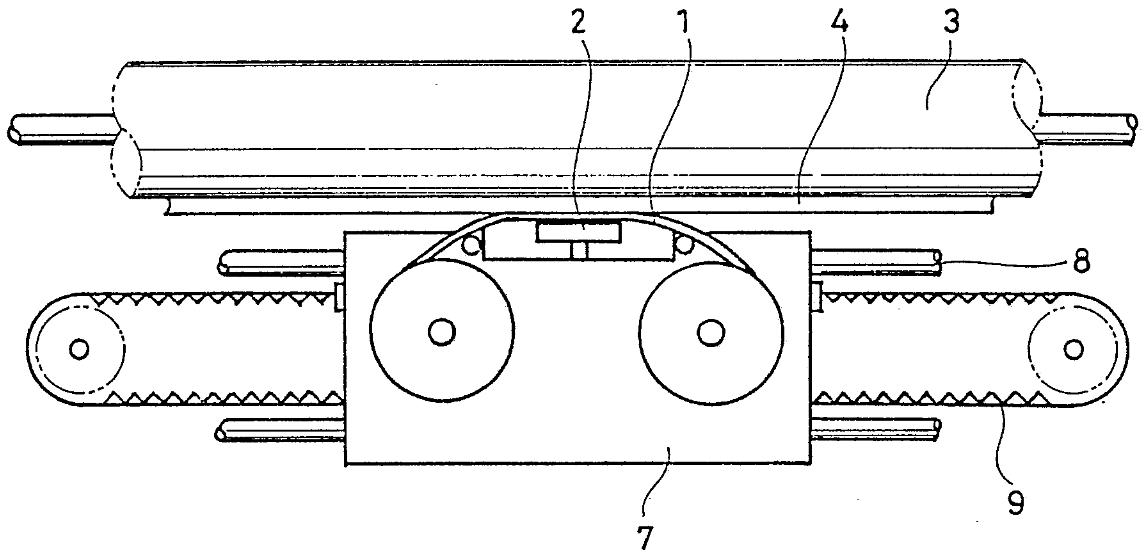


FIG.2

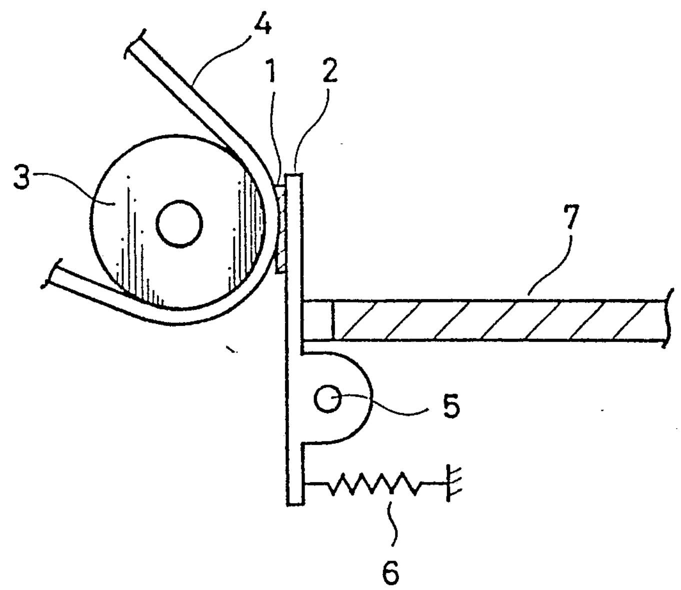


FIG.3

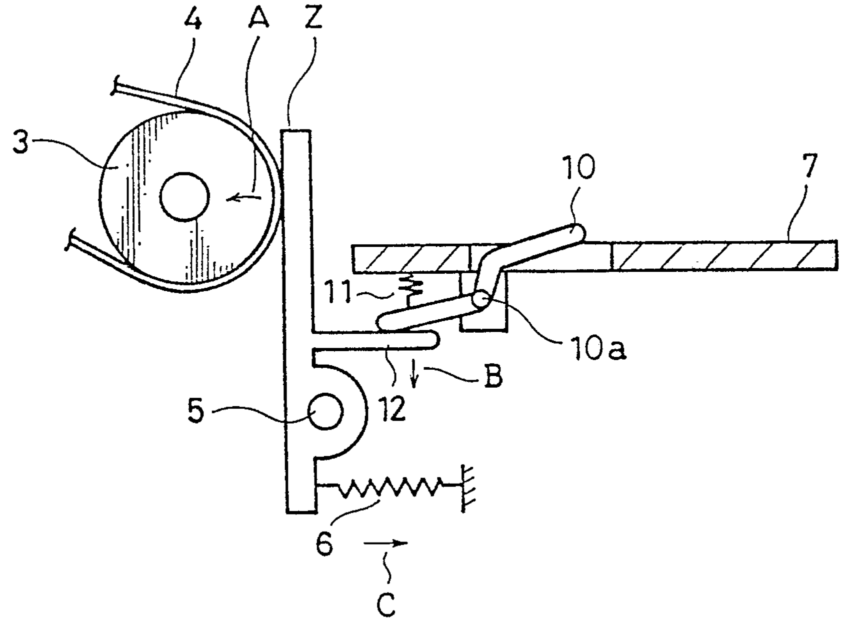


FIG.4

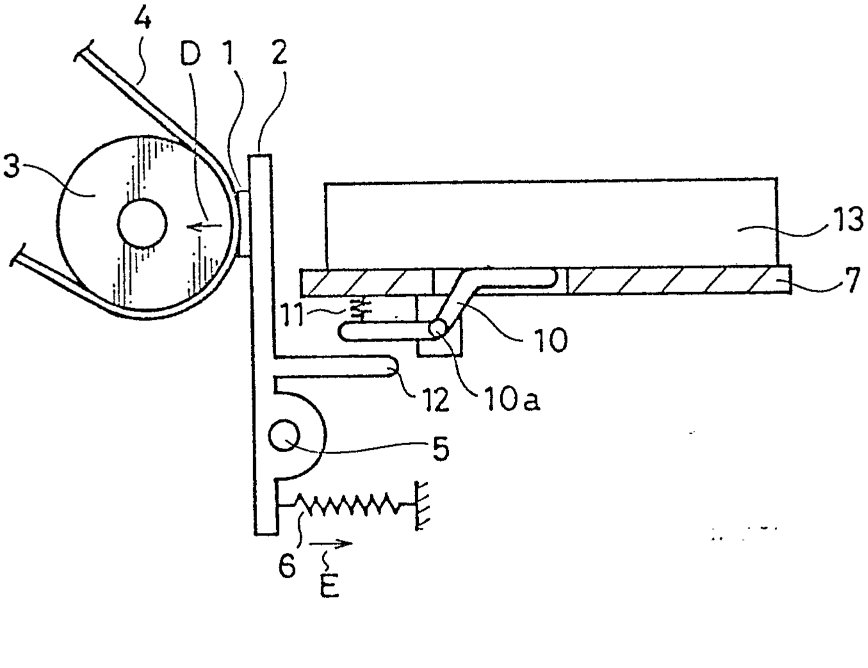


FIG.5

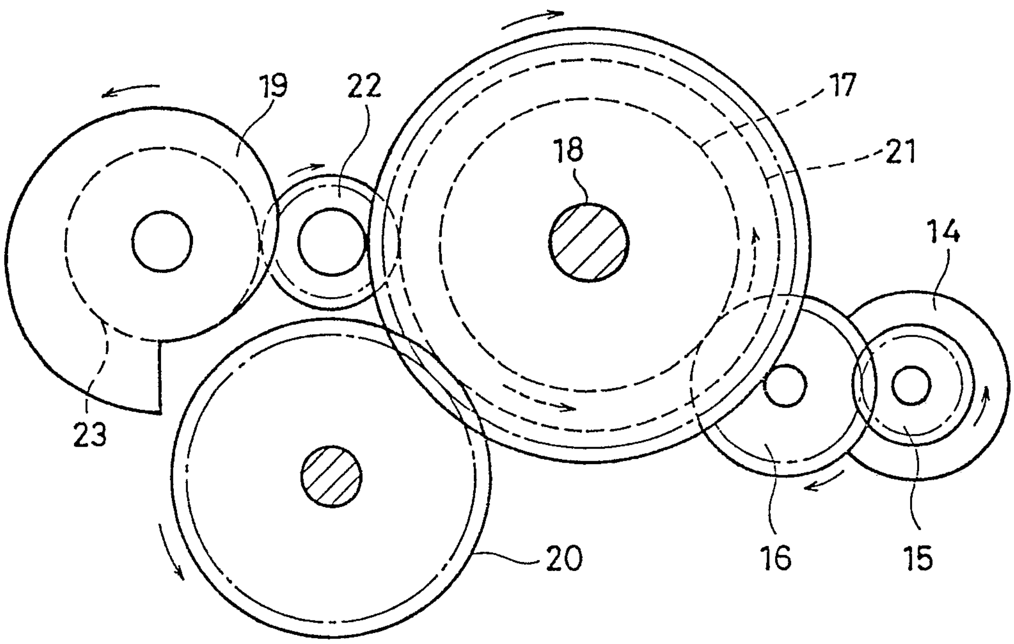


FIG.6

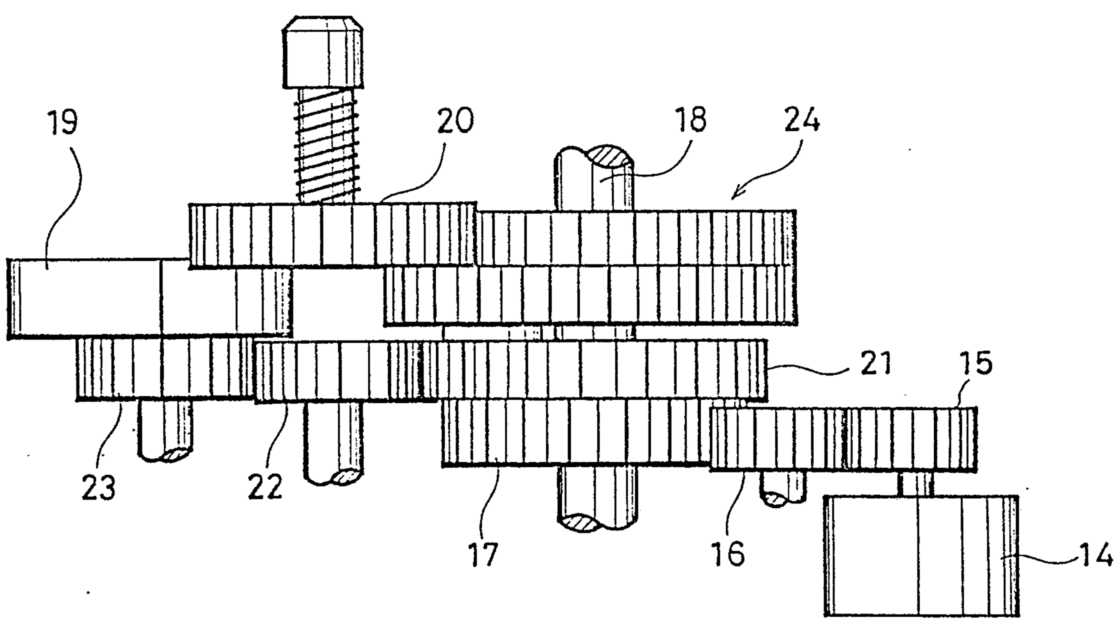


FIG.7

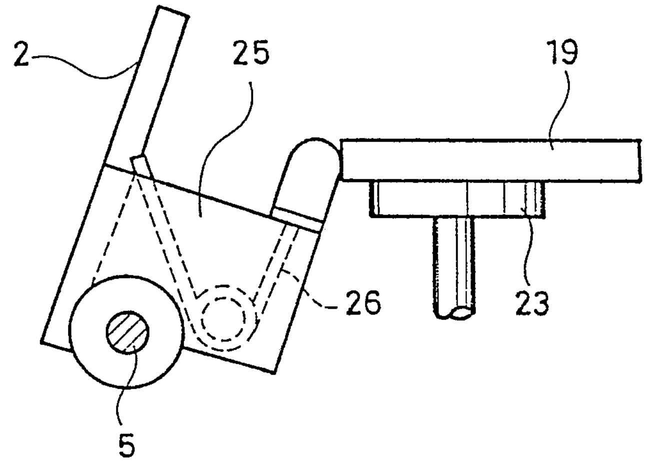


FIG.8

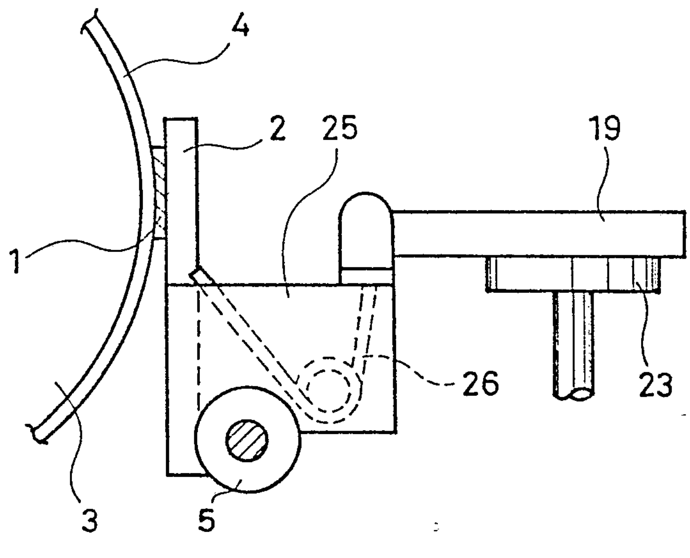


FIG.9

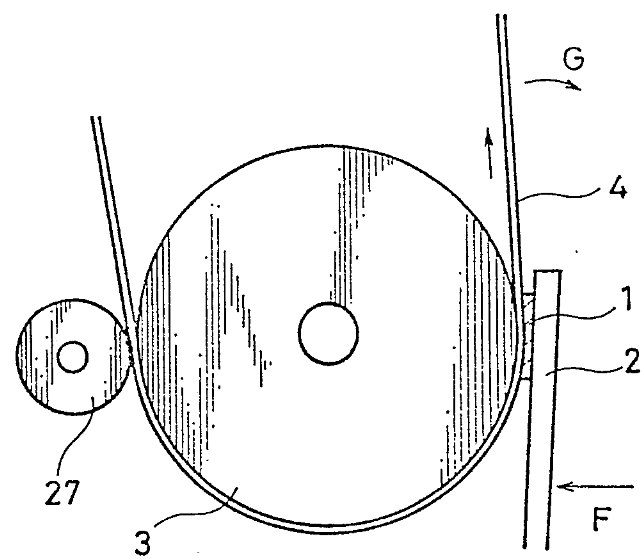


FIG.10

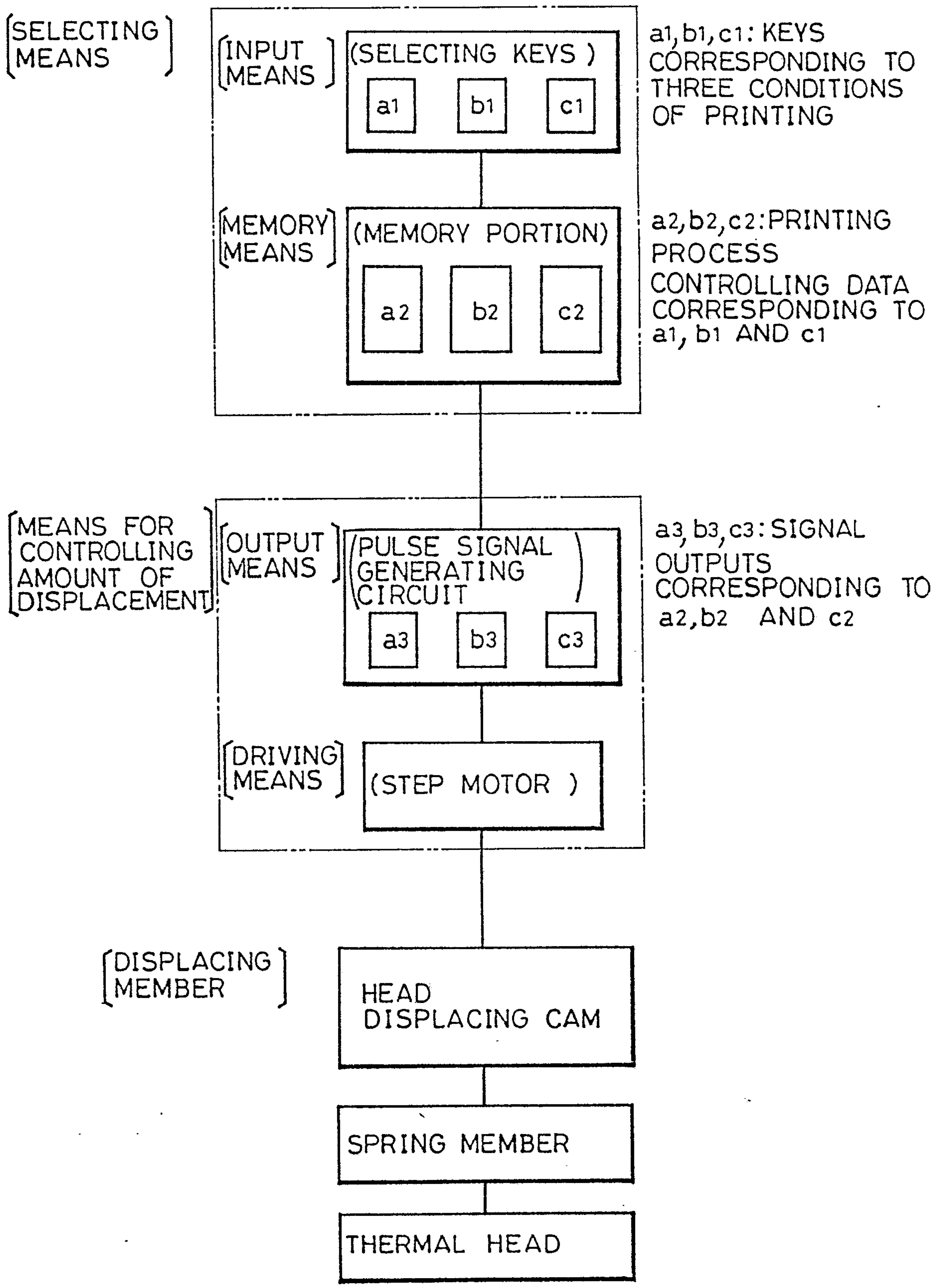

SELECTING MEANS
INPUT MEANS
(SELECTING KEYS)
a1
b1
c1
a1, b1, c1: KEYS CORRESPONDING TO THREE CONDITIONS OF PRINTING
MEMORY MEANS
(MEMORY PORTION)
a2
b2
c2
a2, b2, c2: PRINTING PROCESS CONTROLLING DATA CORRESPONDING TO a1, b1 AND c1
MEANS FOR CONTROLLING AMOUNT OF DISPLACEMENT
OUTPUT MEANS
(PULSE SIGNAL GENERATING CIRCUIT)
a3
b3
c3
a3, b3, c3: SIGNAL OUTPUTS CORRESPONDING TO a2, b2 AND c2
DRIVING MEANS
(STEP MOTOR)
DISPLACING MEMBER
HEAD DISPLACING CAM
SPRING MEMBER
THERMAL HEAD

FIG.11

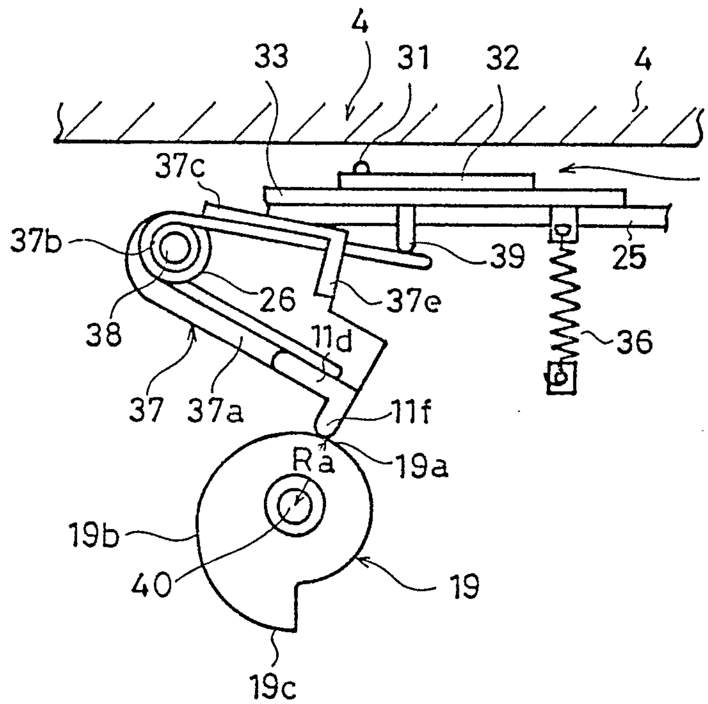

4
33
31
32
4
2
37c
37b
39
25
26
37e
38
11d
36
37
37a
11f
Ra
19a
19b
40
19
19c

FIG.12

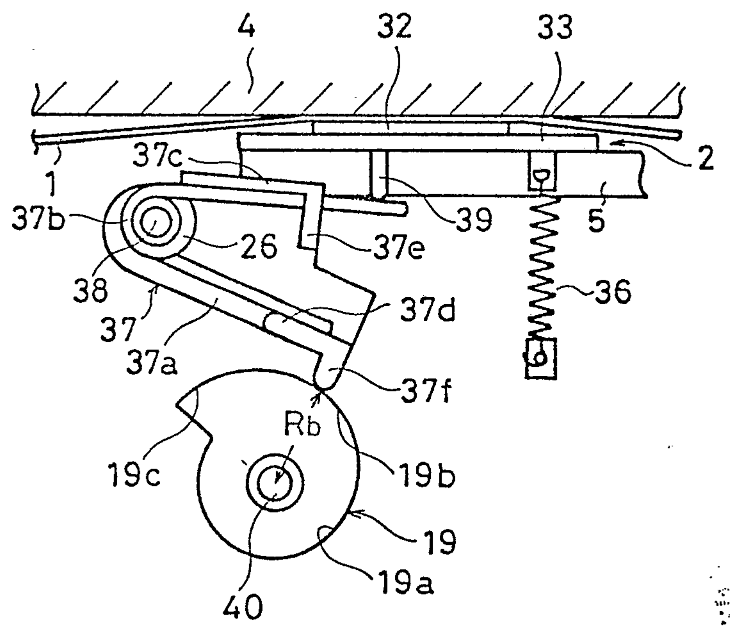

4
32
33
2
1
37c
37b
39
5
26
37e
38
36
37d
37
37a
37f
Rb
19c
19b
19
40
19a

FIG.13

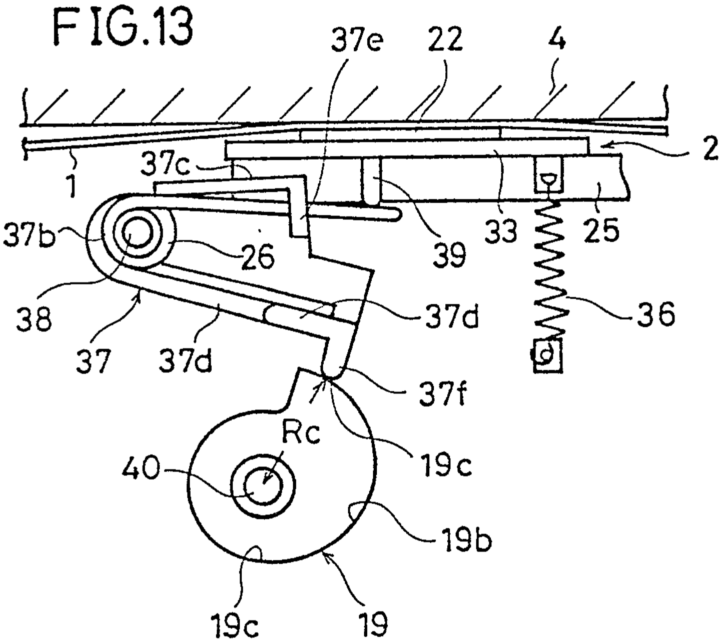


FIG.14

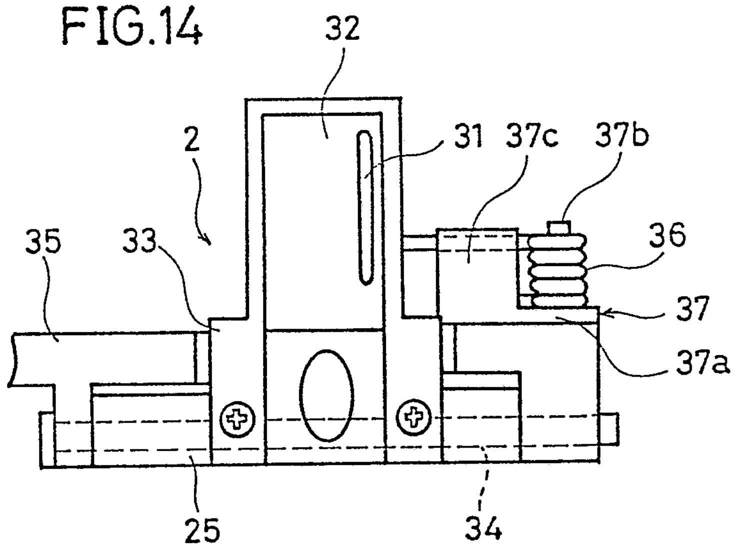


FIG.15

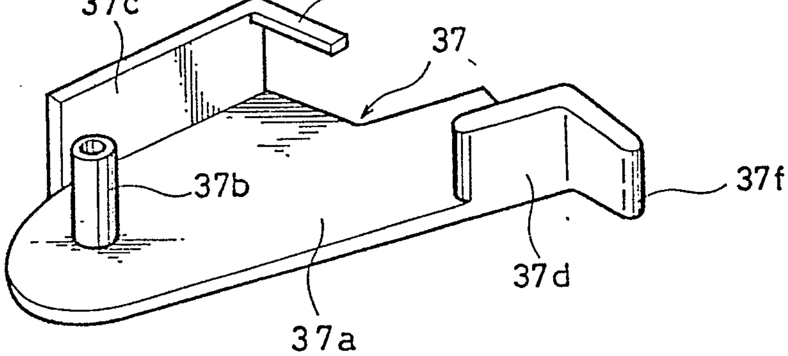


FIG.16

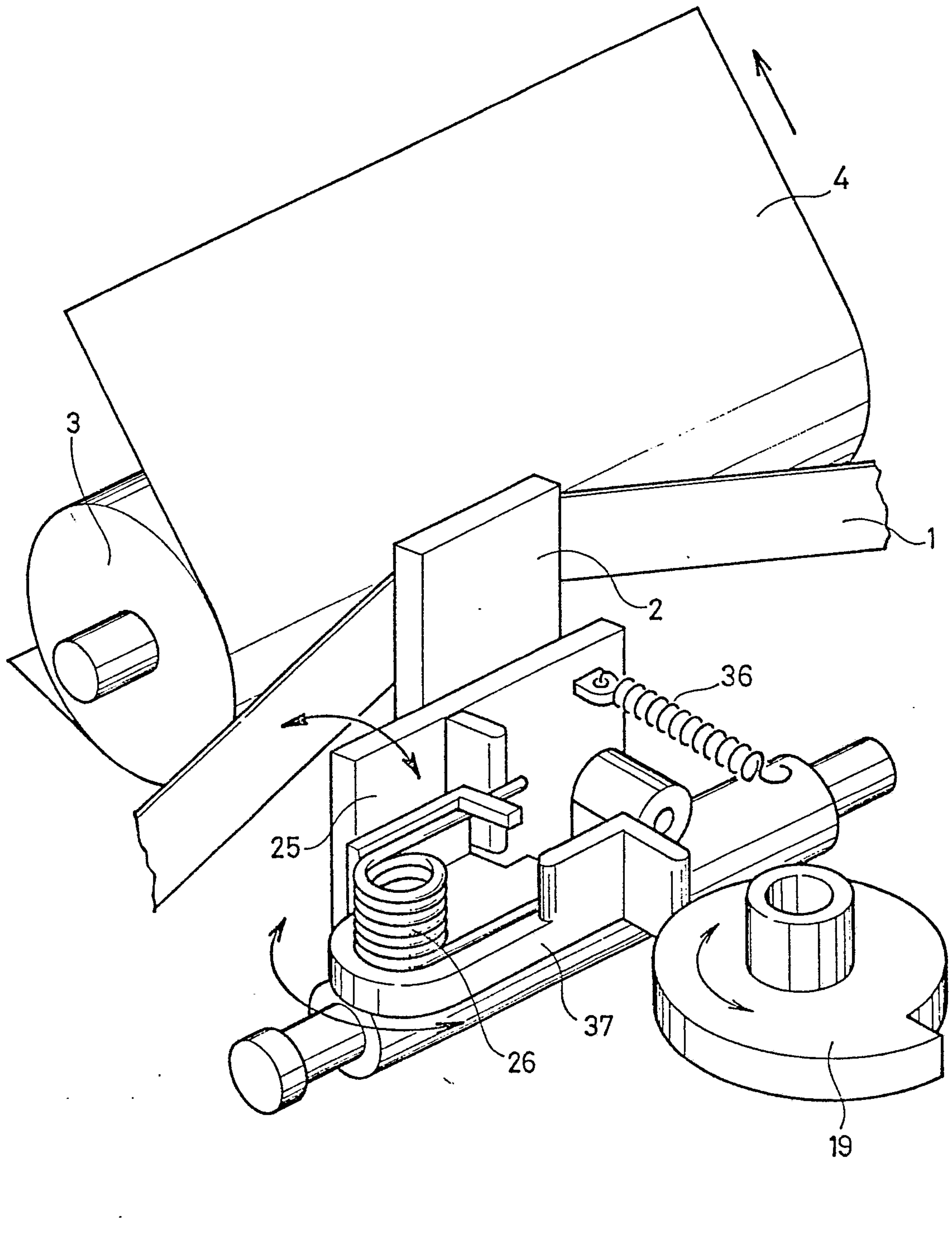


FIG.17

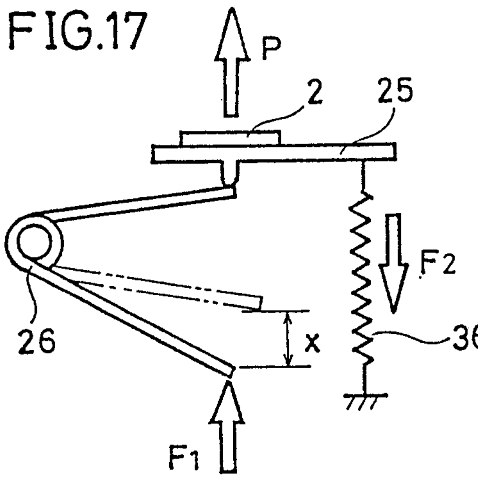


FIG.18

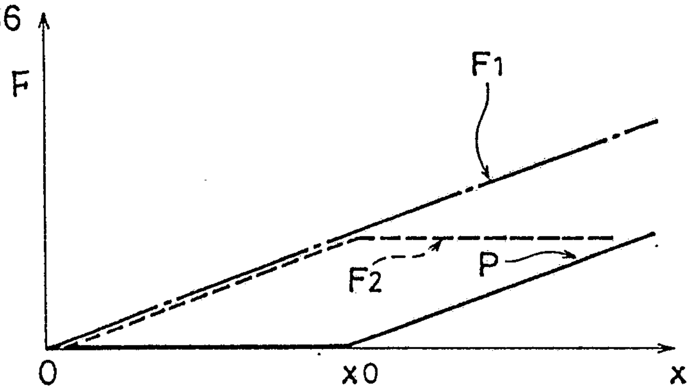


FIG.19

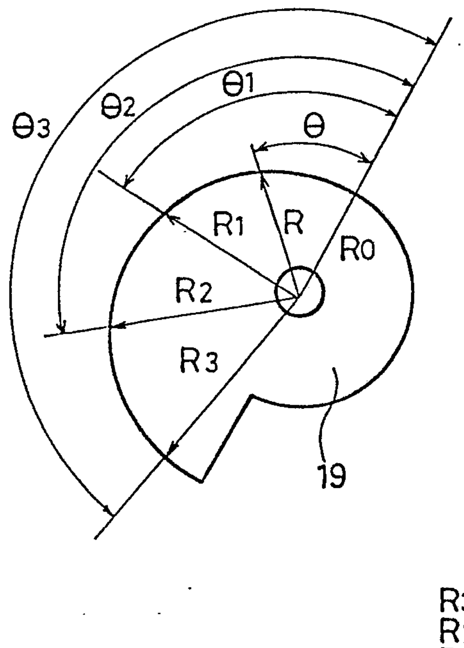


FIG.20

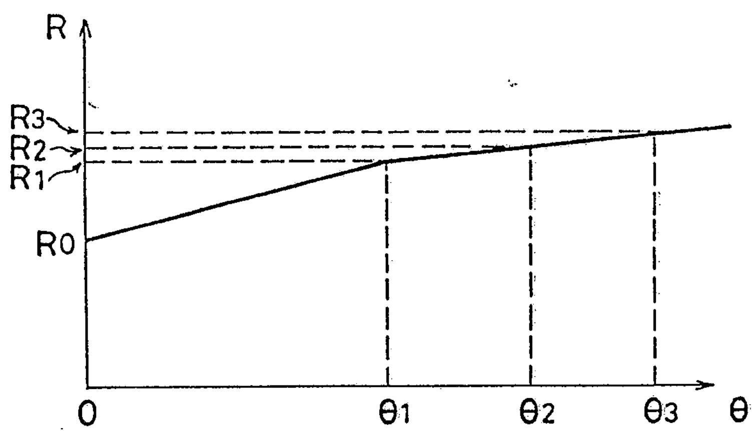


FIG. 21

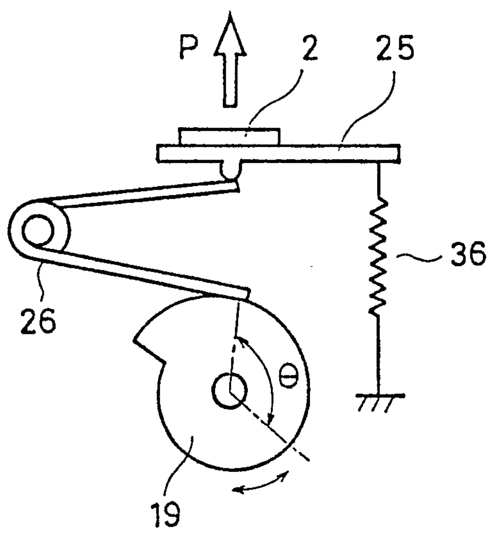


FIG. 22