(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 412 720 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90308512.4**

(51) Int. Cl.5: **B41F 7/16**, B41F 21/12

(22) Date of filing: **02.08.90**

(30) Priority: **09.08.89 GB 8918175**

(43) Date of publication of application:
13.02.91 Bulletin 91/07

(84) Designated Contracting States:
DE FR GB NL

(71) Applicant: **CRABTREE OF GATESHEAD LIMITED**
Kingsway, Team Valley Trading Estate
Gateshead, Tyne & Wear NE11 OSU(GB)

(72) Inventor: **Southworth, Christopher John Morrison**
82, Woodlands Road
Shotley Bridge, County Durham(GB)

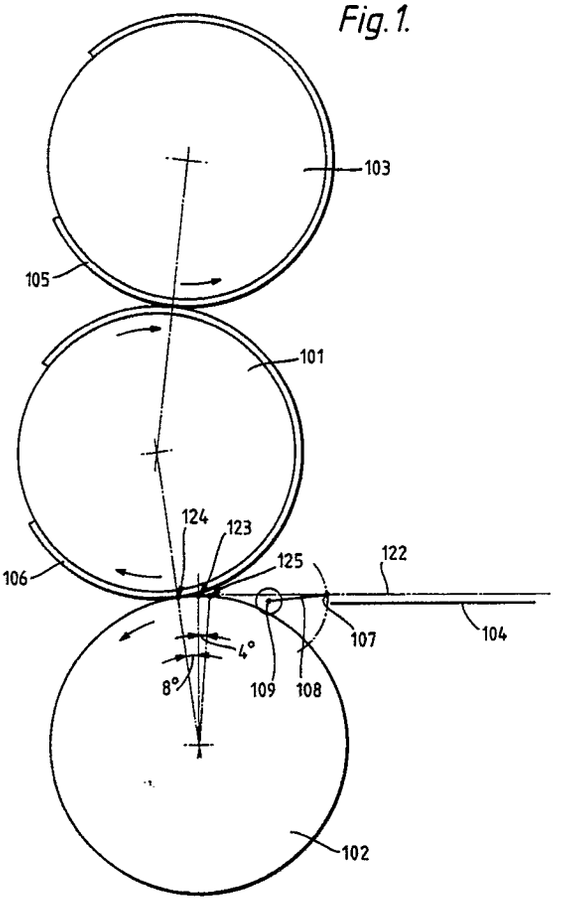
(74) Representative: **Norcliffe, Kenneth Adrian**
33, Delph Lane Netherton
Huddersfield West Yorkshire, HD4 7JA(GB)

(54) A method of and apparatus for printing on metal sheets.

(57) Sheet-fed metal decorating presses, which pass sheets successively between cylinders in mutual rolling contact, have pushed the sheets at virtually the same speed as the constant peripheral speed of the cylinders into contact with cyclically-moveable stops on one of the cylinders which stops are so pivoted inside the periphery of the cylinder that as they retract their tangential speed is appreciably less than the peripheral speed of the cylinders. The sheets are therefore abruptly decelerated and must be pushed with high force to accelerate them back to the speed of the cylinders before entering the nip, causing several disadvantages.

These are avoided by pushing the sheets at a higher speed than the constant peripheral speed of the cylinders (101, 102), and by pivoting the stops (107) about an axis (109) outside the periphery of the cylinder (102) so that they move relative to the cylinder in a substantially involute path whereby their tangential speed as they retract is substantially the same as the peripheral speed of the cylinders. As there is then no need to accelerate the sheets they can advantageously be pushed with lower force.

Fig. 1.



EP 0 412 720 A2

A METHOD OF AND APPARATUS FOR PRINTING ON METAL SHEETS

This invention relates to a method of and apparatus for printing on metal sheets. Such apparatus is commonly known as a sheet-fed metal decorating press.

Known apparatus for printing on metal sheets comprises impression and blanket cylinders in rolling contact with each other, between which the sheets are passed successively, and a plate cylinder in rolling contact with the blanket cylinder. All three cylinders are geared together so that adjacent cylinders contra-rotate at the same constant peripheral speed. The plate cylinder carries a printing plate which is pre-inked in known manner and which transfers ink to the blanket cylinder which transfers it in turn to each metal sheet. The blanket cylinder carries a rubber blanket which is, say, 2 mm. thick. In order accurately to register, that is to say locate in position, each sheet relative to the impression cylinder, said cylinder carries two axially-spaced cyclically-moveable stops, which are known as front lays, for the front edge of the sheet. These stops comprise the free ends of respective levers which are pivoted on the impression cylinder inside its periphery. The levers are actuated by stationary cam means which cause them to extend and retract during the appropriate part of each revolution of the impression cylinder. The action of the cam means is such that during the operative part of their retraction the stops travel substantially tangentially towards the impression cylinder. However, due to the location of the lever pivots, the path of the stops relative to the impression cylinder is such that when the sheet makes contact with the stops at the start of the operative part of their retraction, the speed of travel of the stops is appreciably less than the peri pheral speed of the impression and blanket cylinders. Each sheet is fed towards the nip of said cylinders on a flat table known as an infeed by chain-driven spring-loaded pusher means at substantially the same speed as said peripheral speed until it contacts a location face on the stops, when it is abruptly decelerated to the speed of the stops at that point in their cycle and then allowed to accelerate progressively back to said peripheral speed as the stops return to their retracted position. The table is normally horizontal but need not be. With this arrangement, comparatively high forces must be exerted by the pusher means in order to accelerate the sheet and avoid its being left behind by the stops, just before it is clamped to the impression cylinder and then enters the nip, by a distance which may be of the order of 0.15 mm.

The object of the present invention is to avoid the disadvantages caused by the need to accelerate the sheet subsequent to its deceleration.

According to one aspect of the invention, a method of printing on metal sheets by successively pushing them on a table towards the nip of impression and blanket cylinders which contra-rotate at the same constant peripheral speed; causing the front edge of each sheet to make contact, prior to entering the nip, with cyclically-moveable stop means carried by the impression cylinder; and finally passing each sheet between said cylinders whilst maintaining it in contact with the stop means; is characterised in that each sheet is pushed, prior to contacting a location face on the stop means, at a speed faster than the constant peripheral speed of said cylinders, and thereafter until it enters the nip is restrained by the stop means to travel at a speed substantially the same as said constant peripheral speed.

According to another aspect of the invention, apparatus for printing on metal sheets comprising impression and blanket cylinders which contra-rotate at the same constant peripheral speed, means for successively pushing the sheets on a table towards the nip of said cylinders, and cyclically-moveable stop means for the front edge of each sheet which stop means are carried by the impression cylinder, is characterised in that the stop means are constrained to extend and retract relative to the impression cylinder during the appropriate part of each revolution thereof in a substantially involute path the base circle of which is the periphery of the impression cylinder.

Preferably, the stop means comprise the free ends of two cam-actuated levers pivoted on the impression cylinder outside its periphery, so that the stop means are constrained to move relative to said cylinder in an arcuate path approximating to an involute curve.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings of which:-

Fig. 1 is a diagrammatic end view of a sheet-fed metal decorating press;

Fig. 2 is a detailed end view of stop means for the front edge of each sheet and of an arrangement for moving the stop means cyclically;

Fig. 3 is a view of the stop means in the direction of the arrow 3 in Fig. 2;

Fig. 4 shows the positions of the stop means at one degree intervals during the operative part of their retraction;

Fig. 5 is a graph showing the speed of each sheet relative to the angular position of an impression cylinder of the press;

Fig. 6 is a view corresponding to part of Fig. 1

of such a press as arranged hitherto; and

Fig. 7 is a graph corresponding to Fig. 5 for such a press as arranged hitherto.

Referring now to Fig. 1 (and Fig.6) of the drawings, a sheet-fed metal decorating press comprises a blanket cylinder 101 in rolling contact with an impression cylinder 102 and a plate cylinder 103. The cylinders 101, 102 and 103 are geared together so that adjacent cylinders contra-rotate at the same constant peripheral speed. Sheets are successively fed towards the nip of the blanket cylinder 101 and the impression cylinder 102 on a horizontal flat table 104 known as an infeed by chain-driven spring-loaded pusher means (not shown). The plate cylinder 103 has secured on its periphery a curved printing plate 105 which is pre-inked in known manner and which transfers ink to the blanket cylinder 101 which transfers it in turn to each metal sheet. The blanket cylinder 101 has secured on its periphery a rubber blanket 106. In order accurately to register, that is to say locate in position, each sheet relative to the impression cylinder 102, said cylinder carries two axially-spaced cyclically-moveable stop means indicated generally at 107, which are known as front lays, for the front edge of the sheet. Devices (not shown) for gripping the front edge of the sheet but lacking stops are also provided in known manner. As thus far described, the press is conventional.

Referring now to Figs. 2 and 3 of the drawings, each stop means 107 is disposed at the free end of a lever 108 which is pivoted about a common axis 109 on the impression cylinder 102 outside its periphery. The stop means 107 has an inclined face 110, a location face 111, and a gripper blade 112 one end of which projects beyond the location face 111. The stop means is mounted on the lever 108 by means of an adjustment device 113 so that the distance between its location face 111 and the axis 109 can be varied. The two levers 108 are cyclically moveable in unison by an arrangement including a shaft 114 journalled in the impression cylinder 102 parallel to its axis and inside its periphery, and having secured at one of its ends an arm 115 carrying a cam follower in the form of a roller 116. Said roller engages with a stationary cam (not shown) in known manner. Each lever 108 is pivotally connected by a link 117 to another link 118 which is pivotally connected to one of two arms 119 secured to the shaft 114. The link 118 and the arm 119 are urged together by spring means (not shown) against an adjustable stop 120 so that they tend to move as one. Conventional cut-outs 121 are provided in the impression cylinder 102 to accommodate the levers 108 and stop means 107 when in the retracted position shown in Fig. 2. Pusher means (not shown) of conventional construction comprise three mechanisms operating in series to advance each sheet along the table 104 - first of all belt means; then a first chain drive moving faster than the belt means and having dogs which positively engage the rear edge of the sheet; and lastly a second chain drive having spring-loaded pushers which resiliently engage the rear edge of the sheet to allow it to decelerate when it contacts the location face 111, and when it has been clamped as hereinafter described are then lowered, returned towards the table 104, and raised to engage the next sheet. The sur face of the table 104 is disposed parallel to, and lower by say 8 mm. than, the tangent 122 to the impression cylinder 102. As shown in Fig. 1 the point 123, hereinafter referred to as top dead centre, where said tangent touches the impression cylinder 102 is disposed in advance, by say eight degrees, of the nip, that is to say the point 124 where the blanket cylinder 101 touches the impression cylinder 102.

In operation, the profile of the stationary cam is such that it acts as hitherto to cause extension and retraction of the stop means 107 through a suitable radial distance during the appropriate part of each revolution of the impression cylinder 102, said stop means travelling substantially along the tangent 122 towards top dead centre during the operative part of their retraction. However, the location of the axis 109 outside the periphery of the impression cylinder 102 constrains the stop means 107 to move relative to said cylinder in an arcuate path closely approximating to the ideal path which is an involute curve the base circle of which is the periphery of said cylinder. Thus, due to the novel location of the axis 109, the speed of travel of the stop means 107 along the tangent 122 during the operative part of their retraction is substantially the same as the constant peripheral speed of the cylinders. The second chain drive of the pusher means, although conventionally constructed, is caused in novel manner to feed each sheet towards the nip of the blanket cylinder 101 and the impression cylinder 102 at a speed faster by, say, 13 per cent than the constant peripheral speed of the cylinders.

Referring now to Fig. 4, the sheet is approximately at position 45, that is to say at approximately 45 degrees before top dead centre, when the stop means 107 moves through the plane containing the surface of the table 104. The sheet contacts the inclined face 110 of the stop means 107 approximately at position 32 and rides up the face 110 until it contacts the location face 111 at approximately 15 degrees before top dead centre, when it is abruptly decelerated to the speed of the stop means 107, that is to say to substantially the constant peripheral speed of the cylinders, and then continues to advance at that speed until it has been subsequently gripped and then rolled through

the nip. As shown in Fig. 5, there is still an initial shock as the sheet contacts the location face 111 but thereafter there are no further changes in the speed of the sheet, in contrast to the situation hitherto which is shown in Fig. 7. At a point 125 (see Fig. 1) approximately four degrees before top dead centre, the sheet is clamped by the retraction of the stop means 107 between the periphery of the impression cylinder 102 and the projecting end of the gripper blade 112. This causes the link 118 and the arm 119 to pivot slightly apart at the adjustable stop 120, against the action of the spring means urging them together, by an amount which is dependent on the thickness of the sheet and may be of the order of 0.2 mm. The sheet is additionally clamped at point 125 by the action of four gripper devices without stops which are also provided on the impression cylinder 102 but not shown as they are conventional.

One advantage of not needing to accelerate the sheet is that high pusher forces are no longer required. This enables thinner or softer sheets to be fed to the press, for example steel sheets only 0.12 mm. thick, or aluminium sheets. Another advan tage resulting from the lower pusher force is that sideways location of the sheets, which is particularly difficult when the sheets are not square or rectangular, is rendered easier. A further advantage resulting from each sheet travelling at its correct speed and position for a significant length of time prior to entering the nip is that accurate registration of the sheets is achieved, enabling higher printing speeds to be employed.

It should be understood that the ambit of the invention includes stop means moveable relative to the impression cylinder in a true involute path as well as in an arcuate or other path approximating closely to an involute curve.

Claims

1. A method of printing on metal sheets by successively pushing them on a table (104) towards the nip of impression and blanket cylinders (102, 101) which contra-rotate at the same constant peripheral speed; causing the front edge of each sheet to make contact, prior to entering the nip, with cyclically-moveable stop means (107) carried by the impression cylinder (102); and finally passing each sheet between said cylinders whilst maintaining it in contact with the stop means;
characterised in that each sheet is pushed, prior to contacting a location face (111) on the stop means (107), at a speed faster than the constant peripheral speed of said cylinders (102, 101), and thereafter until it enters the nip is restrained by the stop means to travel at a speed substantially the same as said constant peripheral speed.

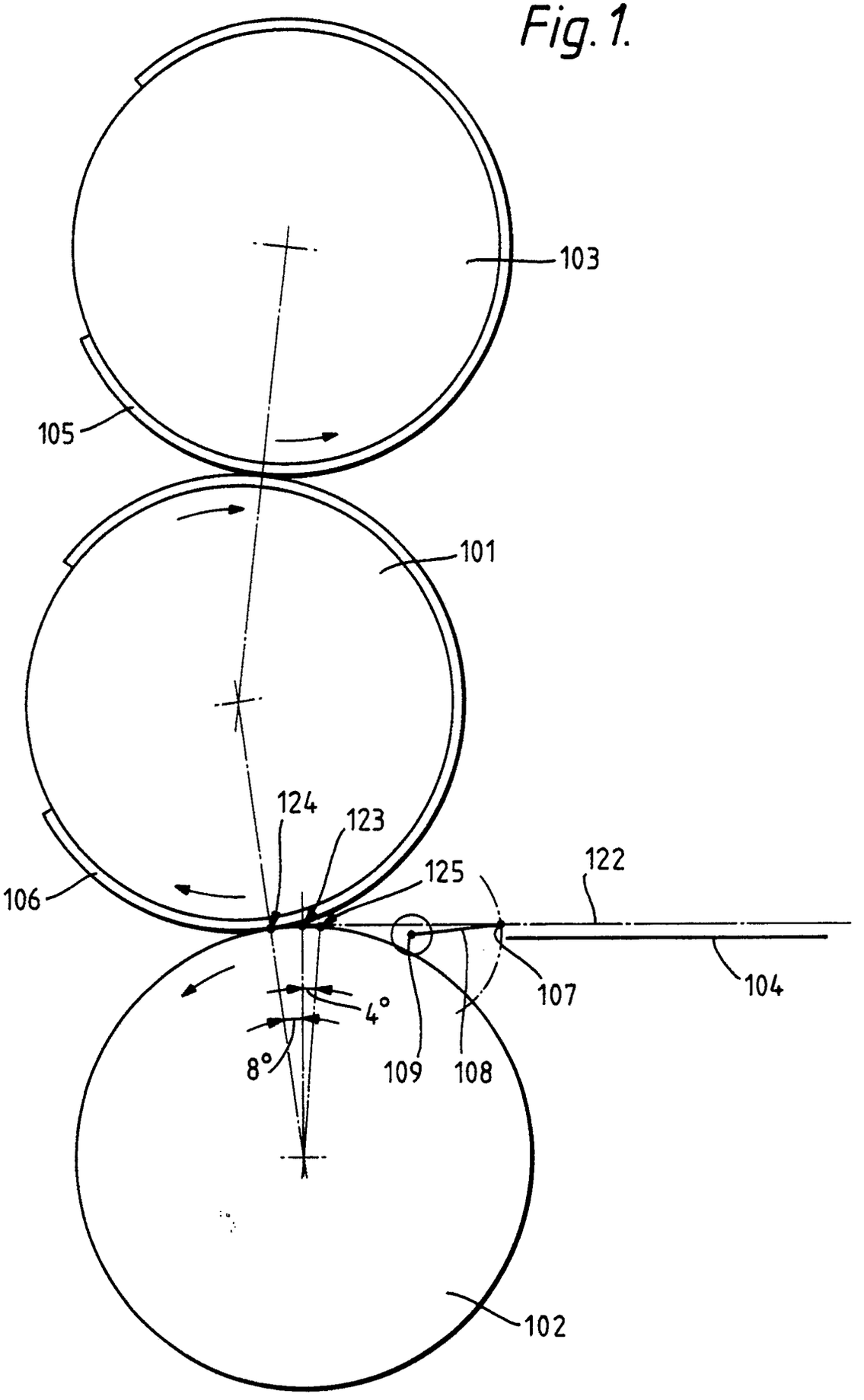
2. Apparatus for printing on metal sheets comprising impression and blanket cylinders (102, 101) which contra-rotate at the same constant peripheral speed, means for successively pushing the sheets on a table (104) towards the nip of said cylinders, and cyclically-moveable stop means (107) for the front edge of each sheet which stop means are carried by the impression cylinder (102), characterised in that the stop means (107) are constrained to extend and retract relative to the impression cylinder (102) during the appropriate part of each revolution thereof in a substantially involute path the base circle of which is the periphery of the impression cylinder.

3. Apparatus according to claim 2, wherein the stop means (107) comprise the free ends of two camactuated levers (108) pivoted on the impression cylinder (101) outside its periphery, so that the stop means are constrained to move relative to said cylinder in an arcuate path approximating to an involute curve.

4. Apparatus according to claim 3, wherein each lever (108) is connected by a linkage to one arm (119) secured on a shaft (114) journalled in the impression cylinder (102) parallel to its axis and inside its periphery, another arm (115) secured on the shaft carrying a follower (116) for a stationary actuating cam and the linkage being extendable against the action of resilient means.

5. Apparatus according to claim 4, wherein the linkage comprises a link (117) pivotally connected to the lever (108) and to another link (118) pivotally connected to said one arm (119), said other link (118) and said one arm (119) being urged together by spring means against an adjustable stop (120).

Fig. 1.



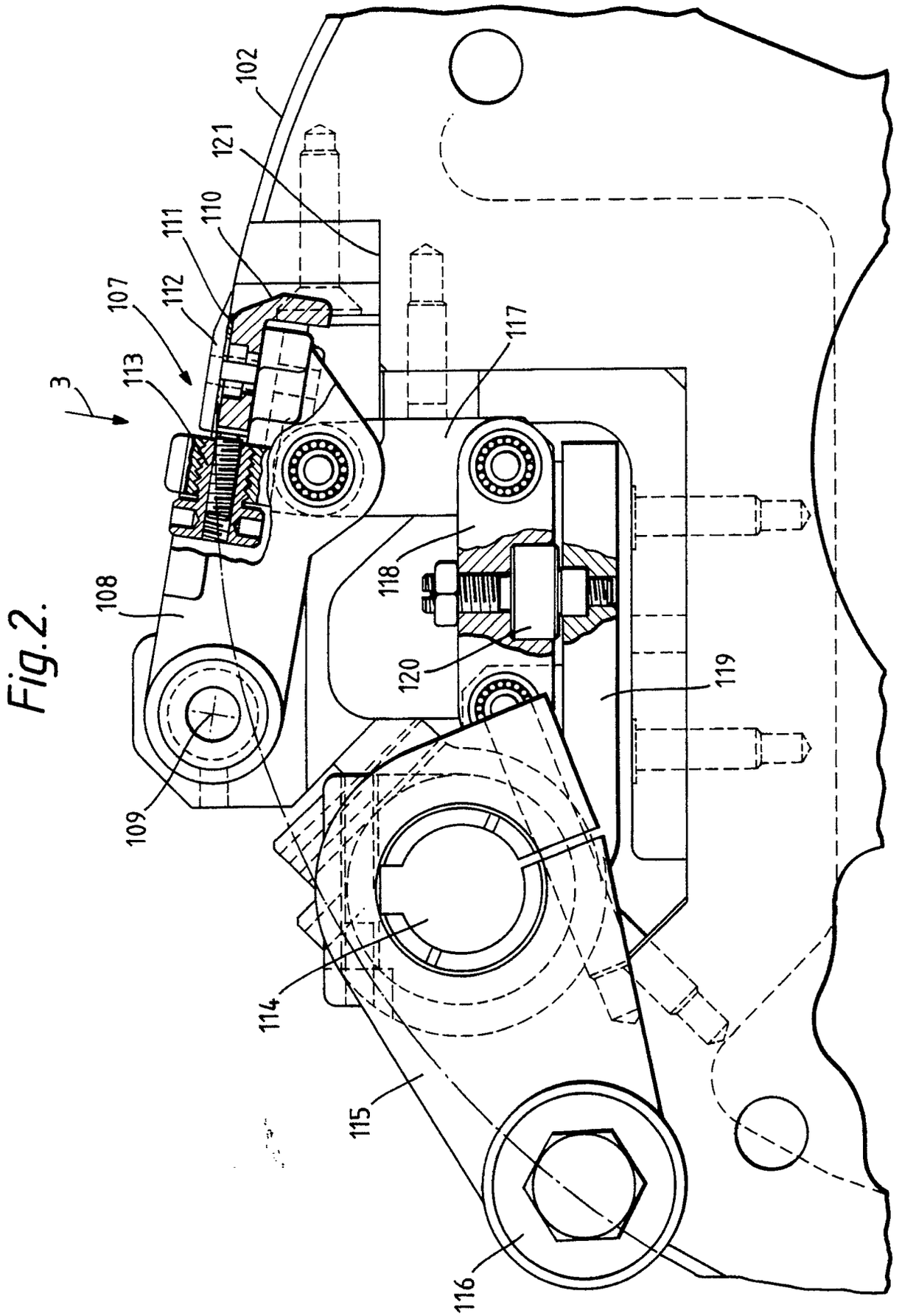


Fig.2.

Fig.3.

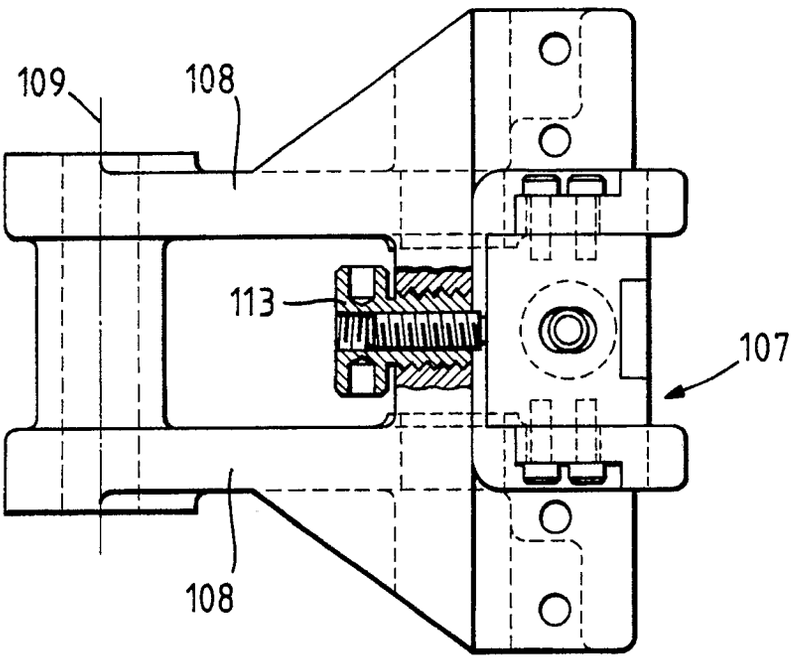
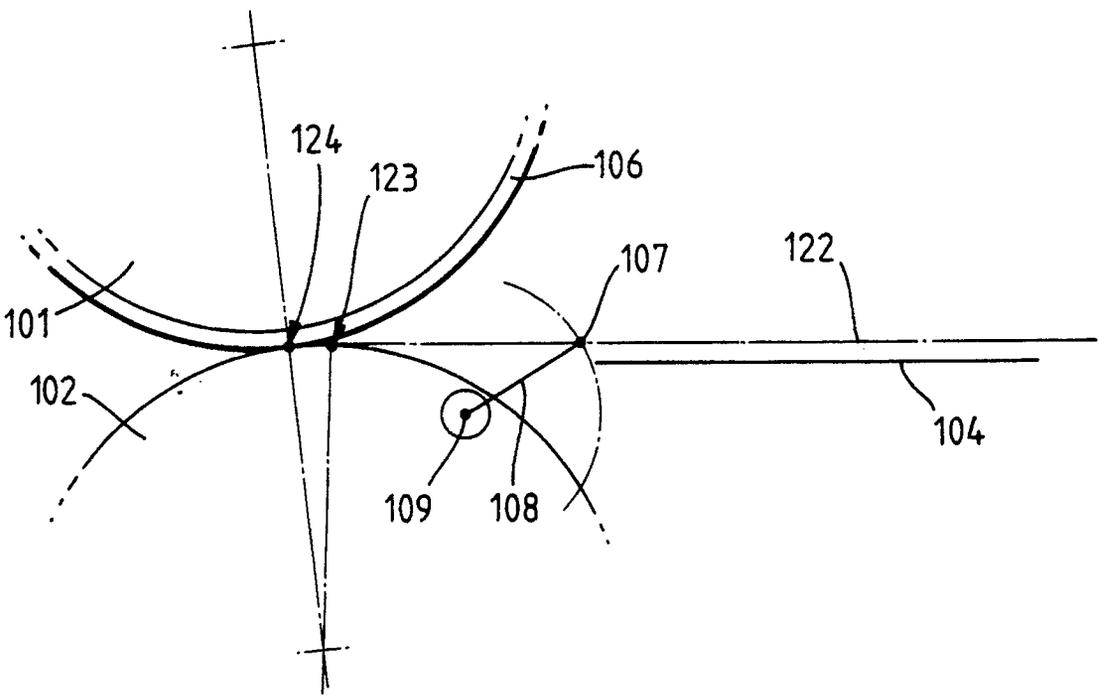


Fig.6.
(PRIOR ART)



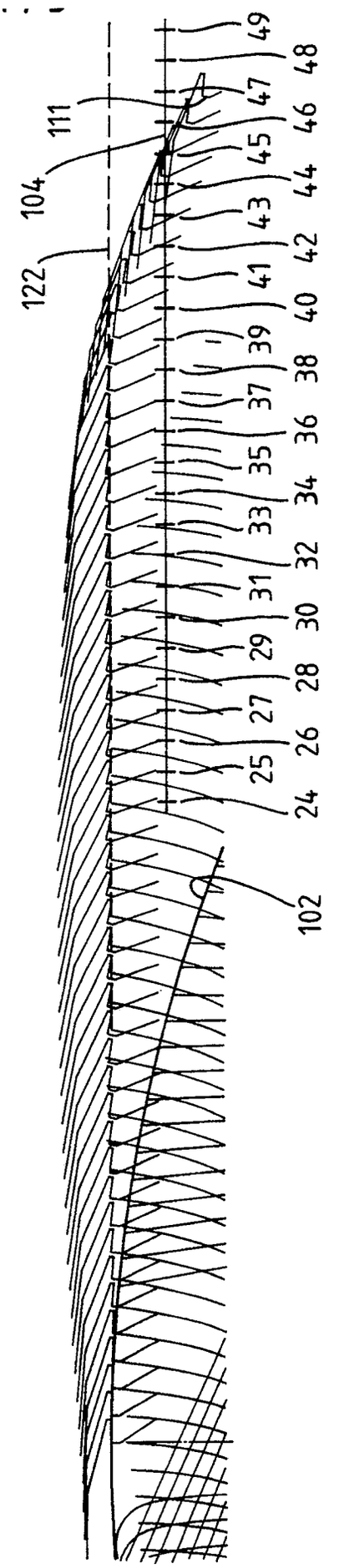

122
104
111
102
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

Fig. 4.

Fig. 5.

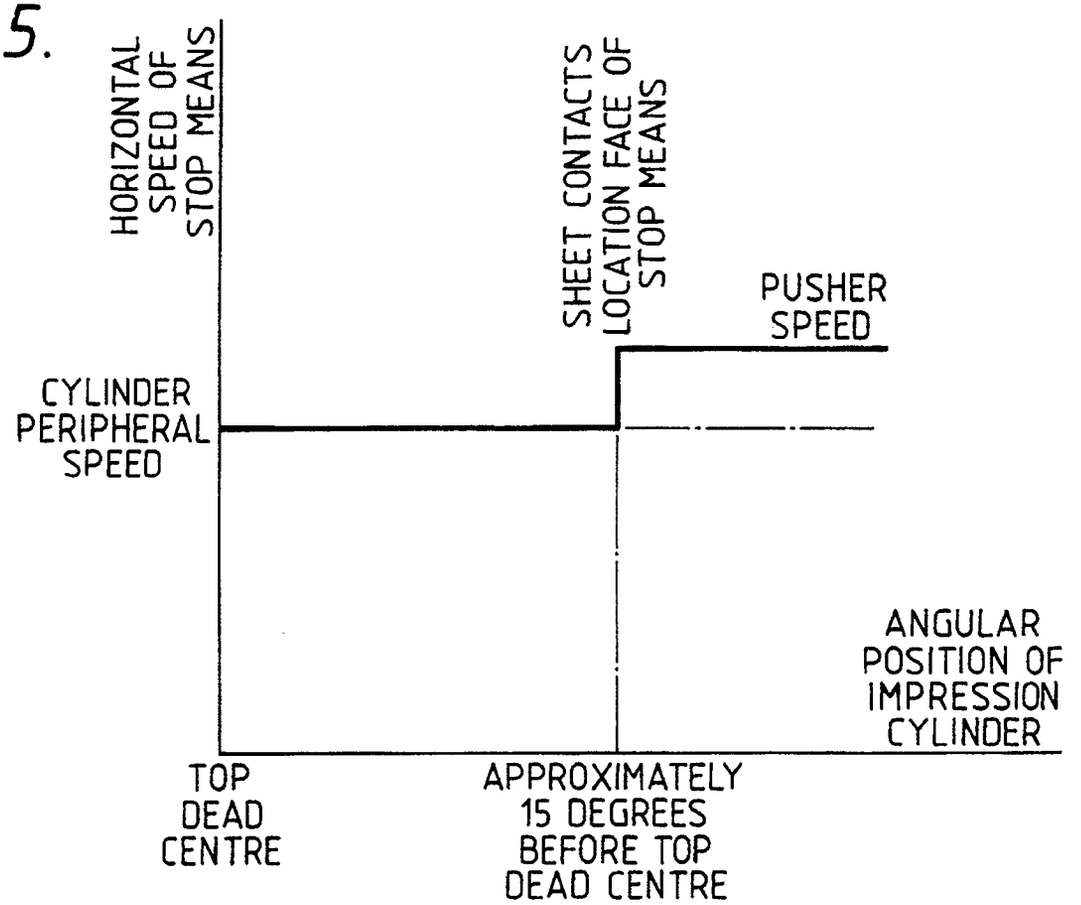


Fig. 7.
(PRIOR ART)