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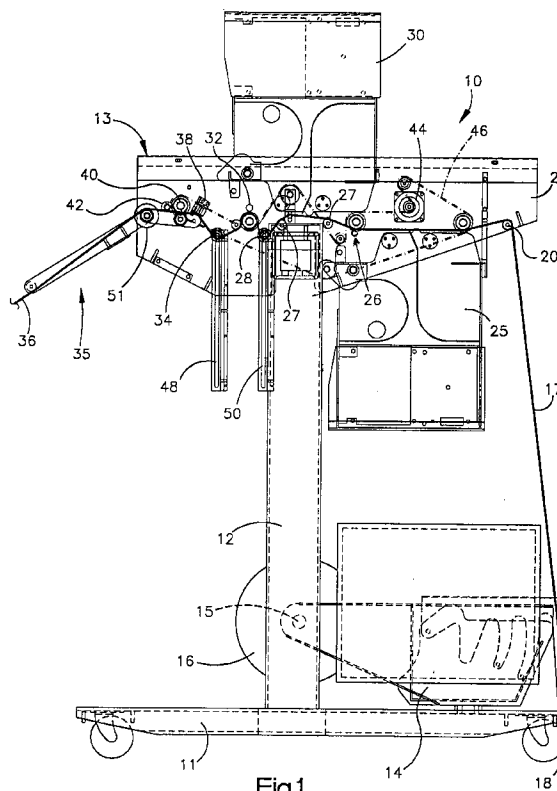
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(54) **Web imprinting apparatus and method.**

(57) An improved printer (10) is disclosed which has upright and inverted printers (25,30) for printing either or both faces of a flat web. A stepper motor driven nip (40,42) is provided to feed the web along a path of travel past the two imprinters. The web is driven at a relatively high feed speed until sections of the web to be imprinted are registered with the imprinters, whereupon the feed speed is reduced to a slower imprinting speed. Upon completion of the imprinting, web feed is returned to the higher rate providing a downstream dancer (35) is in condition to accept the web at the higher rate. If the amount of web accumulated in the downstream dancer exceeds a predetermined level, the motor (44) is stopped until the dancer is in condition to receive the web at the higher feed speed rate.



This invention relates generally to web processing equipment and more particularly, but not exclusively, to a method and apparatus of imprinting a web for subsequent use in packaging or other applications.

In packaging and other operations, it is often desirable to imprint information on a section of a web before that section is made into a package or put to other use. The information may be such things as a part number, instructions for use of a product to be packaged or identification of applications where a packaged product is suitable for use.

Thermal imprinters for imprinting such information on a web are now well known. One such imprinter is described and claimed in the present applicants' co-pending European Patent Application No. 93302583, filed April 1, 1993 under the title "Packaging Machine with Thermal Imprinter and Method", the content of which is herein incorporated by reference (the Teeter-Totter Imprinter). With the Teeter-Totter Imprinter, a web is fed from a supply along a path of travel to an output until registration of a section to be imprinted with an imprinter is achieved and then the feed is stopped. Thereupon a rocking mechanism--the teeter-totter--is actuated to feed the web section past the imprinter while feed of the web is otherwise stopped. Next, the web is again advanced until another section to be imprinted is registered with the imprinter and feed is again stopped.

While the Teeter-Totter device has enjoyed commercial success and is ideal for certain applications, it nonetheless has certain drawbacks. One of these is that the feed is an on-off feed. Each time the feed is stopped, there is some amount of delay before a supply dancer mechanism reaches an equilibrium achieving desired tension on the web. Further, on initiation of feed, inertia of rest of the supply must be overcome and further dancer delay in response may result in momentary tension on the web at levels in excess of the desired tension.

The Teeter-Totter device due to its start and stop mode of operation is relatively slow and can limit the cycling rate of, for example, a packaging machine such as that described and claimed in the present applicants' European Patent Application No. 93306802, filed August 26, 1993 under the title "Packaging Machine and Method" (the HS-100 application) the content of which is also incorporated herein by reference.

It is an object of the present invention to provide an improved web imprinting apparatus and method of web imprinting.

According to the invention, there is provided a machine for processing a web, including performing a work operation on the web, the machine comprising

- a) a mechanism for performing a work operation cyclically on a web;
- b) structure delineating a path of travel from a supply past the mechanism to an output location;

c) the structure including a web feed drive means along the path and downstream from the mechanism for pulling the web to feed it from the supply along the path; characterized by

d) position sensing means along the path and adapted to sense registration of a web section to be worked on with the mechanism and to emit a drive feed control signal upon sensing such registration; and.

e) said drive means being responsive to such control signal to reduce the speed of web travel from a relatively high feed speed to a relative low work performance feed speed and re-establish the relatively high feed speed upon completion of a work cycle.

The invention also provides a method of processing an elongate web, comprising:

a) feeding the web along a path of travel at a relatively high feed rate;

b) sensing registration of a web section to be processed relative to a processing mechanism positioned along the path; characterized by

c) slowing the web feed to a processing speed and imprinting the web section with a pre-determined display;

d) sensing the completion of the imprinting step; and

e) thereafter re-establishing the high feed rate.

Preferred features of the invention are set out in the accompanying claims.

In the machine to be described, rollers are mounted on a frame structure to define a web path of travel from a supply to an output. A dancer assembly corresponding to that described and claimed in the HS-100 application is positioned adjacent the supply. The web is fed from the supply dancer along a path past an inverted imprinter and thence, an upright imprinter. A stepper motor driven nip is downstream from the two imprinters and selectively driven to pull a web to feed it along the path. An output dancer assembly is positioned downstream from the nip and adjacent an output from which the web is fed to a bagging machine or other downstream apparatus.

In operation, the nip is fed at a relatively high feed speed until a position sensing detector senses that sections of a web to be imprinted are registered with the imprinters. Thereupon a signal from the detector causes the stepper motor to slow to an imprinter feed speed and imprinting on either or both faces of a web is performed by either one or both imprinters. Upon completion of the imprinting, a return to feed speed signal is supplied to the stepper motor and the stepper motor will immediately return to the higher feed speed unless disabled by an output dancer produced signal.

The output dancer serves as an accumulator or looper to collect the web as it is fed by the nip. The output dancer serves to maintain tension on the web downstream from the nip as it is intermittently taken

by a downstream bagger or other device.

An output dancer condition sensor is provided. The output sensor emits signals which disable a high-speed web feed operation whenever the accumulated length of web in the output dancer exceeds a predetermined level. Thus, when an imprinting cycle is completed, the stepper motor will return to the high speed feed rate if but only if the output dancer is in condition to accept additional web at the higher rate for accumulation in the output dancer. If the length of web accumulated in the output dancer exceeds the predetermined level, the stepper motor will stop and feed will be terminated until a feed enabling signal is received from the output dancer sensor.

The detector for determining registration of a section to be imprinted on the imprinter may be either a well known spark gap detector for detecting transverse lines of perforations in a web or alternatively a detector such as that described and claimed in U.S. Patent 4,392,056, issued July 5, 1983, under the title "Control Marking Detector," which senses normally invisible indicia along the web.

In order that the machine may appropriately register web sections to be imprinted with the imprinters over a relatively wide range of spacings of successive imprintings, path length adjustment mechanisms are provided. One of these adjustment mechanisms is along the path between the two imprinting locations while the other is between the downstream imprinting location and the powered nip.

One embodiment of the invention will now be described in more detail, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 is a side elevational view of an imprinting machine embodying the invention;

Figure 2 is a top plan view, on a reduced scale, of the machine of Figure 1;

Figure 3 is a front elevational view of the machine of Figures 1 and 2 on the scale of Figure 2;

Figure 4 is a flow diagram showing the operation of the machine of Figure 1; and

Figures 5a and 5b are timing charts showing operation of web feed with the machine of Figure 1.

Referring to the drawings and Figures 1 - 3, in particular, the improved imprinting machine shown generally at 10 includes a housing and frame structure including a base 11, a supporting post 12 and a cantilever supported imprinting section 13. A supply dancer 14 is carried by the base 11. The supply dancer 14 is the supply dancer described more fully in the HS-100 application. The supply dancer 14 includes a supply mandrel 15 for supporting a web supply in the form of a coil 16.

A web is fed from the supply coil 16 carried by the mandrel 15 along a path of travel which is initially defined by the supply dancer 14. The path of travel is upwardly from the supply dancer along a feed section

17. The feed section 17 is delineated by an output roller 18 of the supply dancer and a first idler roller 20 carried by an imprinting section 13. The path continues laterally, to the left as viewed in Figure 1, past an inverted imprinter 25. The path goes over an inverted imprinter print head 26, over a pair of idler rollers 27 and thence, under an imprinter path length adjustment roller 28.

An upright imprinter 30 is provided. The upright imprinter 30 like inverted imprinter 25 is an imprinter of the type described more fully in the Teeter-Totter Imprinter. The upright imprinter 30 has a print head 32 for printing a display on an upper face of a web as opposed to a display printed on the lower face by the inverted imprinter head 26.

The path extends from the upright imprinter head 32 under a feed path length adjustment roller 34 and thence, to a slack absorber in the form of an output dancer 35. The web extends from the output dancer along an output path 36 to a downstream packager or other apparatus which will utilize a web imprinted by the printer mechanism 10.

A registration detector 38 is provided downstream from the feed path length adjustment roller 34 and upstream from the output dancer 35. Where the web has periodic transverse lines of perforations, the detector 38 may be a well known spark gap detector. Alternatively, it may be a detector of the type described in the Control Marking Detector patent which senses normally, invisible indicia.

A feed roll 40 and a co-acting nip roll 42 are provided along the path between the detector 38 and the output dancer 35. The feed roll 40 is drivingly connected to a stepper motor 44 by a suitable drive chain or belt 46. Operation of the stepper motor 44 causes rotation of the driven roll 40 and of the coating nip roll 42 such that the rollers 40, 42 together provide a powered-feed nip.

Operation

After a web has been threaded through the machine from the supply 15 along the path of travel to the output 36, the machine will be jogged until a registration perforation or indicia is identified by the detector 38. Next, the feed path length adjustment roller 34 will be moved up or down along its support guide 48 to bring a section of an upper face of the web to be imprinted in registration with the upper imprinter print head 32.

After the upper face section of the web is in registration with the upright print head 32, the imprinter path length adjustment roller 28 will be moved up or down in its support guide 50 until a to be imprinted section of a lower face of the web is in registration with the inverted imprinter head 26. The machine is then ready for operation.

From the flow diagram of Figure 4 showing the

operation of the control, it will be recognized that a mechanic skilled in the art can readily provide a suitable control to perform the steps represented by the flow diagram. As the diagram shows when the machine is turned on, the control first checks for an enabling signal from an output dancer sensor 51, which indicates the output dancer is in a position to function as an accumulator or looper as the web is fed. Assuming the output dancer is in a ready condition as indicated by the dancer ready line 52 of Figures 5a and 5b, the stepper motor commences to operate at a relatively high so-called index feed rate as indicated at 54 in Figures 5a and 5b.

When the detector 38 senses perforations or normally invisible indicia, the stepper motor slows to print speed as indicated at 55 in Figures 5a and 5b. Assuming both printers are to operate to print messages concurrently the imprinters are energized to commence printing on both the upper and the lower faces of the web. The web will continue to be fed at print speed until each of the imprinters has completed its task.

The imprinters are indicated on the flow diagram of Figure 4 as master and slave respectively and the control can be programmed to cause either or both to imprint. Again, if both master and slave are imprinting, both must complete their printing before the print speed feed is discontinued. Once the control receives signals indicating both master and slave have completed their printing chores, it once again checks the condition of the output dancer 35. Assuming the output dancer is still in a feed ready condition as indicated by the line 52 of Figures 5a and 5b, the stepper motor will immediately return to the indexing or high speed rate and continue until the detector 38 again signals it is time to print. Thereupon, the stepper will slow to the printing speed 55 in Figures 5a and 5b. If the output dancer is not in a condition to absorb further web as indicated by the line 56 of Figures 5a and 5b, the stepper motor operation is stopped as indicated by the line 58 and will remain stopped until a dancer ready signal is received.

Whether the output dancer is prepared to receive further web is a function of the rate at which the downstream packaging machine or other apparatus is utilizing the web. Assuming it to be a bagger using web at a relatively high rate, the speed of the imprinter mechanism 10 becomes the limiting factor on the throughput of the system. While it is the limiting factor it is nonetheless far faster than the Teeter-Totter Imprinter. Tests of given size chain of bags have shown that the imprinter mechanism of this invention can feed at a rate of 88 bags a minute as contrasted with 45 bags a minute with the Teeter-Totter Imprinter.

In that situation where the imprinter mechanism becomes the limiting factor, a further output dancer sensor, not shown, is coupled to the downstream bagger or other device to prevent downstream device activation unless an adequate length of web has accu-

mulated in the output dancer.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims

1. A machine (10) for processing a web, including performing a work operation on the web, the machine comprising
 - a) a mechanism (25,30) for performing a work operation cyclically on a web;
 - b) structure delineating a path of travel (14,18,20,27, 40,48,50) from a supply (16) past the mechanism to an output location (35);
 - c) the structure including a web feed drive means (40,42) along the path and downstream from the mechanism for pulling the web to feed it from the supply along the path; characterized by
 - d) position sensing means (38) along the path and adapted to sense registration of a web section to be worked on with the mechanism and to emit a drive feed control signal upon sensing such registration; and,
 - e) said drive means being responsive to such control signal to reduce the speed of web travel from a relatively high feed speed to a relative low work performance feed speed and re-establish the relatively high feed speed upon completion of a work cycle.
2. A machine according to Claim 1, wherein the mechanism (25, 30) is an imprinter.
3. A machine according to Claim 1 or Claim 2, further including a web slack-absorbing means (35) downstream from the feed drive (40,42) for tensioning a web between the feed drive and the output.
4. A machine according to Claim 3, further including slack-sensing means (51) connected to the slack-absorbing means (35) and operatively con-

- nected to the drive means (40,42) the sensing means being adapted to sense a condition of the slack-absorbing means (35) and emit a feed control signal to the drive means upon sensing the slack-absorbing means condition. 5
5. A machine according to any of Claims 2 to 4, wherein there are two imprinters (25,30) respectively positioned on opposite sides of the path for imprinting opposed faces of a web. 10
 6. A machine according to Claim 5, wherein one of the imprinters is upright (30) and the other is inverted (25). 15
 7. A machine according to Claim 5 or 6, wherein each of the imprinters (25,30) is responsive to said signals to initiate concurrent imprinting of the opposed faces of such a web as such web is fed at the slower feed rate. 20
 8. A machine according to any of the preceding Claims, wherein a path length adjustment means (48,50) is positioned along the path for adjusting the path length. 25
 9. A machine according to any of the preceding Claims, wherein an output dancer (35) is positioned along the path and wherein an output dancer condition sensor (51) is connected to the output dancer and the web feed drive means (40,42) for emitting drive means feed control signals when a predetermined output dancer condition is sensed. 30 35
 10. A machine according to Claim 9, wherein the sensed output dancer condition is that the length of web in the output dancer is relatively long such that the output dancer cannot accommodate a high feed rate, and the output signal is a disabling signal. 40
 11. A method of processing an elongate web, comprising:
 - a) feeding the web along a path of travel (14,17,25,30, 48,50) at a relatively high feed rate; 45
 - b) sensing registration of a web section to be processed relative to a processing mechanism (25,30) positioned along the path; characterized by 50
 - c) slowing the web feed to a processing speed and imprinting the web section with a predetermined display; 55
 - d) sensing the completion of the imprinting step; and,
 - e) thereafter re-establishing the high feed rate.
 12. A method according to Claim 11, further including the step of collecting portions of a web with an accumulator (35) near an output end of the path downstream from a location where the web is imprinted and delaying the re-establishment of the high feed rate when the quantity of web collected exceeds a predetermined amount.
 13. A method according to Claim 11 or 12, further including the step of concurrently imprinting opposed faces of the web.
 14. A method according to Claim 13, wherein the concurrent imprinting is performed at spaced locations along the path.
 15. A method according to any of Claims 11 to 14, further including adjusting the length of the path between a location where registration is sensed and a location where the web is imprinted to provide appropriate registration of the web at the imprinting location.
 16. A method according to any of Claims 11 to 15, further including the steps of:
 - a) threading the web along a path of travel (14,17,25,30, 48,50) through the machine to set up the machine for operation;
 - b) jogging a powered nip (40,42) until at least one registration indicium is detected by a detector (38);
 - c) adjusting the length of the web path to bring a section of one face of the web to be imprinted into registration with an upright imprinter (30) and to bring a section of a lower face of the web to be imprinted into registration with an inverted imprinter (25); and
 - d) thereafter repetitively feeding the web at a high rate of speed until a registration condition is sensed, slowing the web feed to an imprinting speed, imprinting the web and thereafter cyclically and sequentially returning to the high and then the low feed rate for repetitive imprintings.
 17. A method according to any of Claims 13 to 16, wherein the slower imprinting speed is maintained until each of the imprinters (25,30) has completed its application of printing to the web.
 18. Any novel subject matter or combination including novel subject matter disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

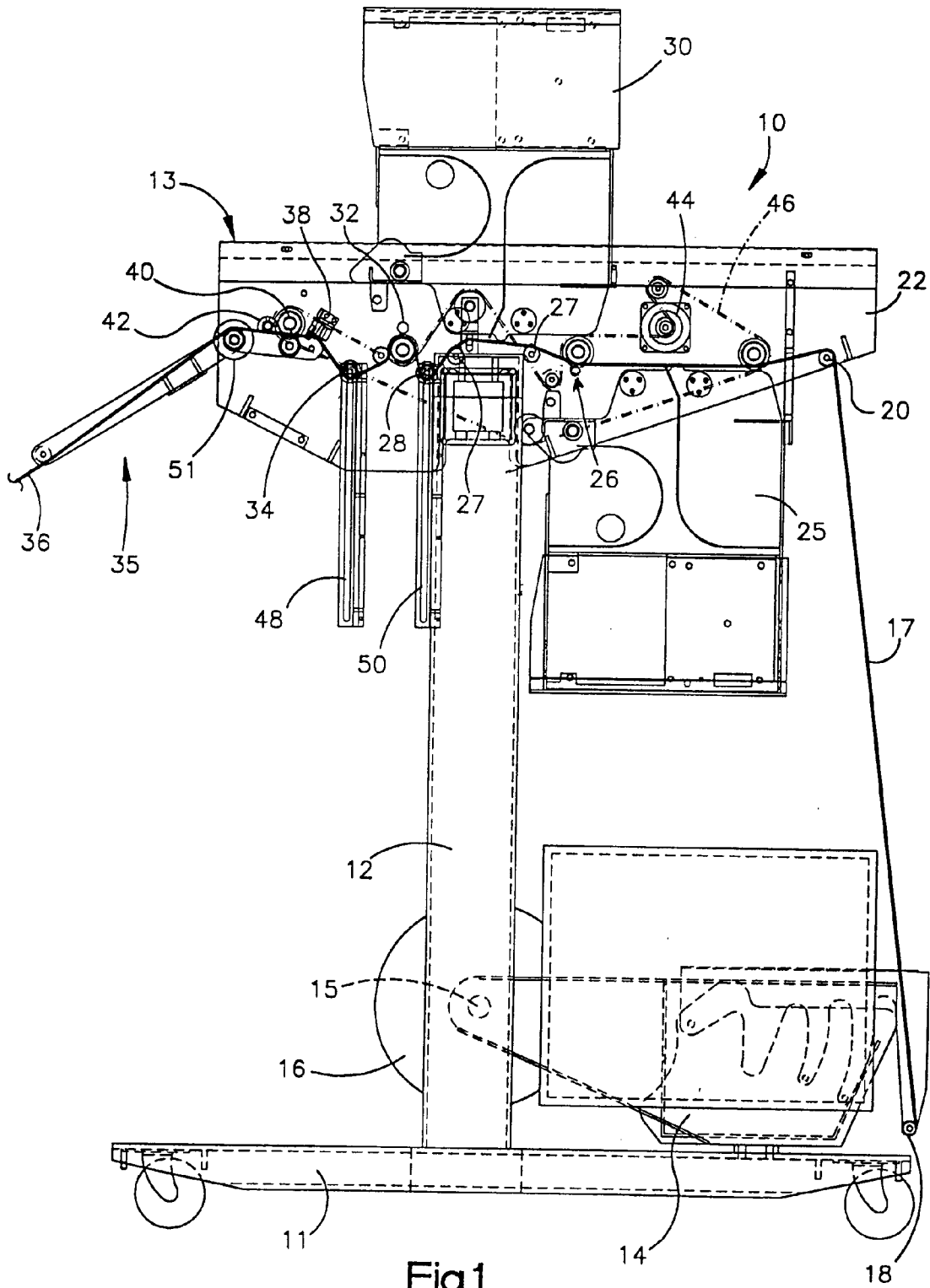
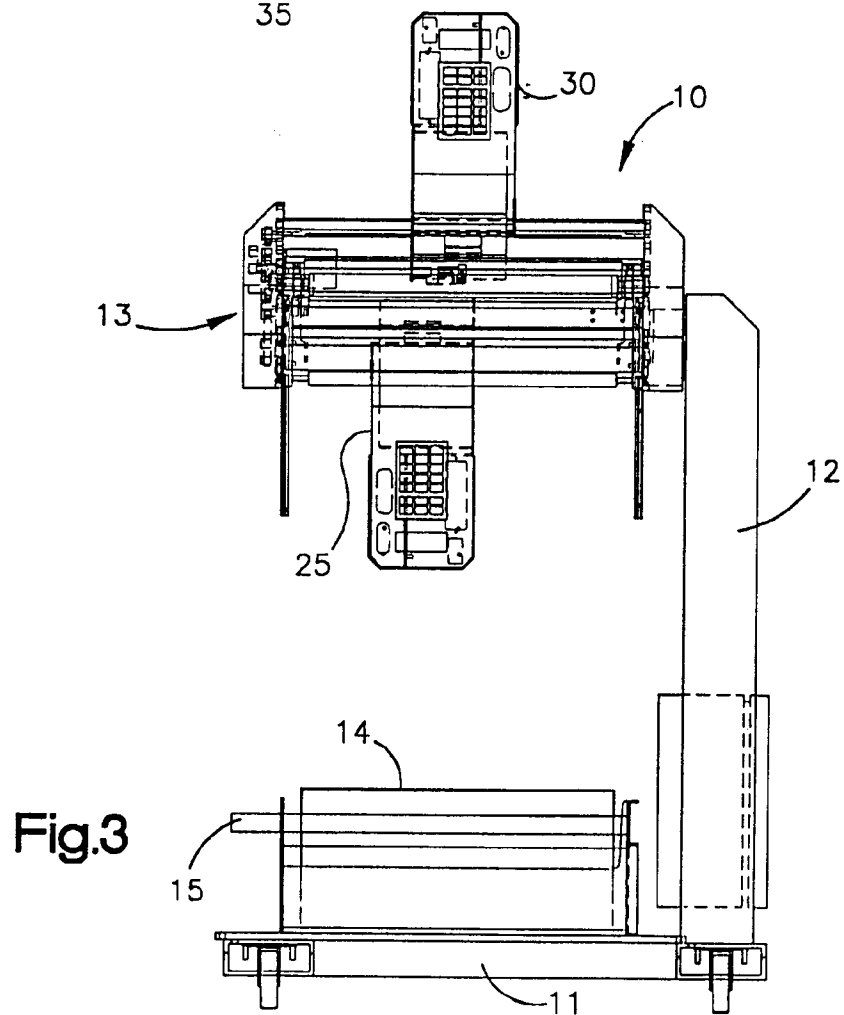
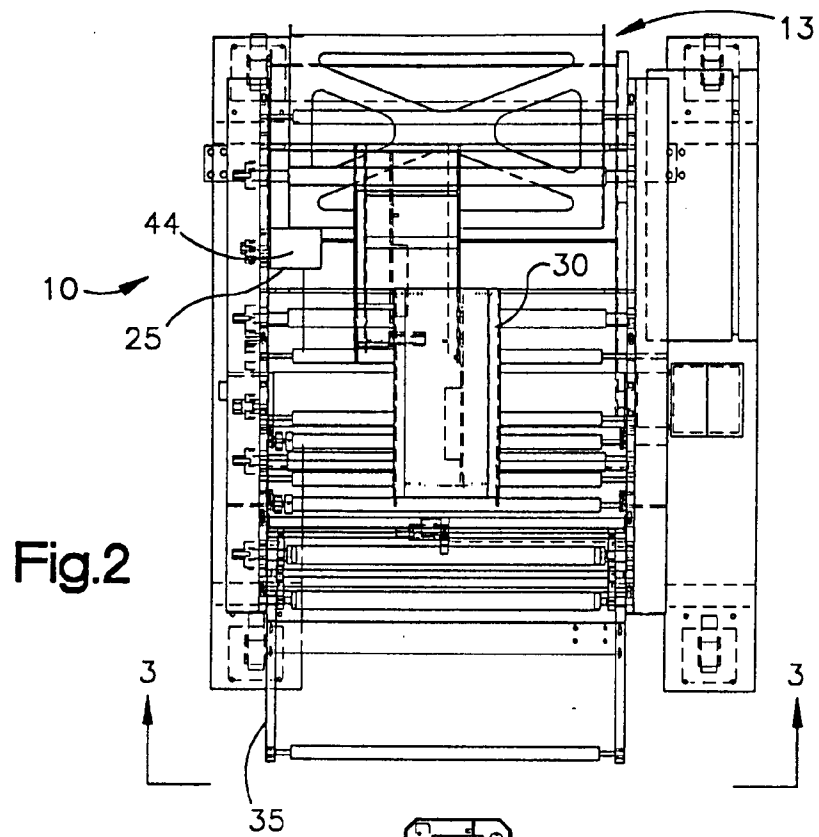


Fig.1



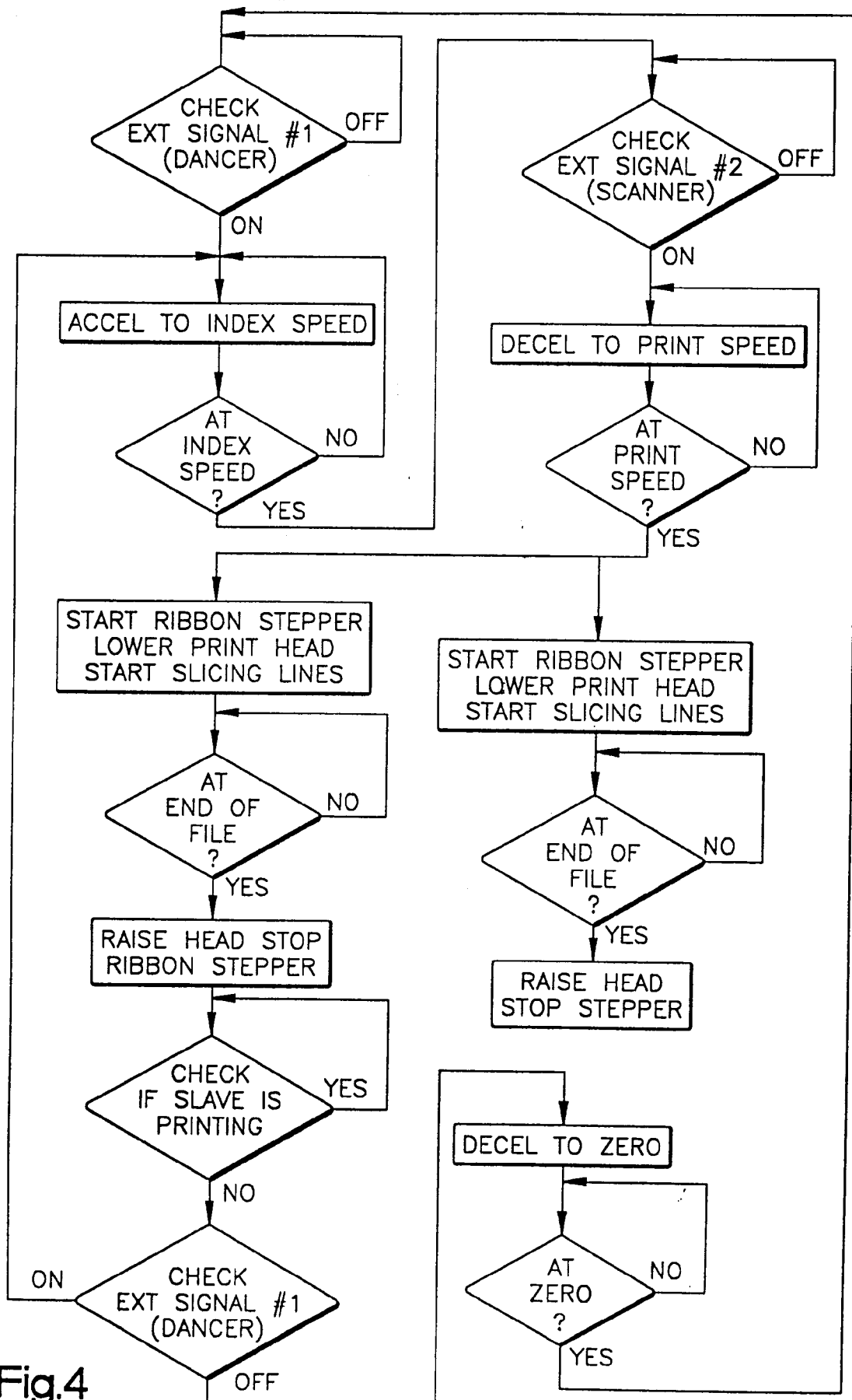


Fig.4

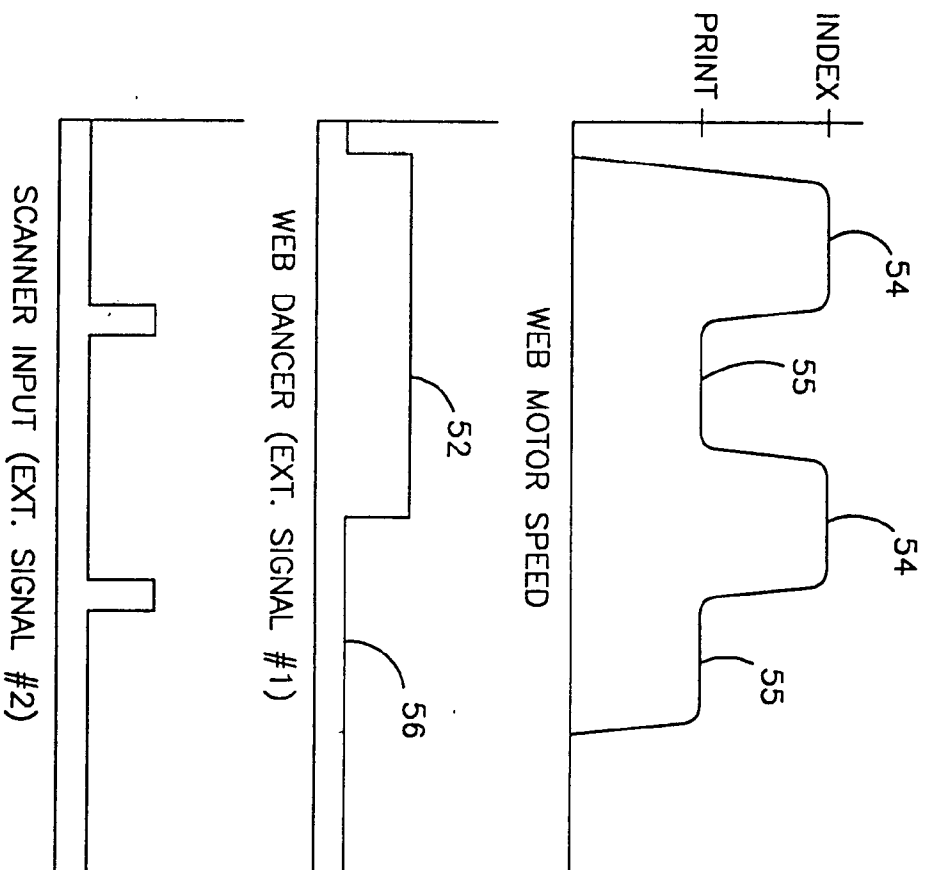


Fig.5A

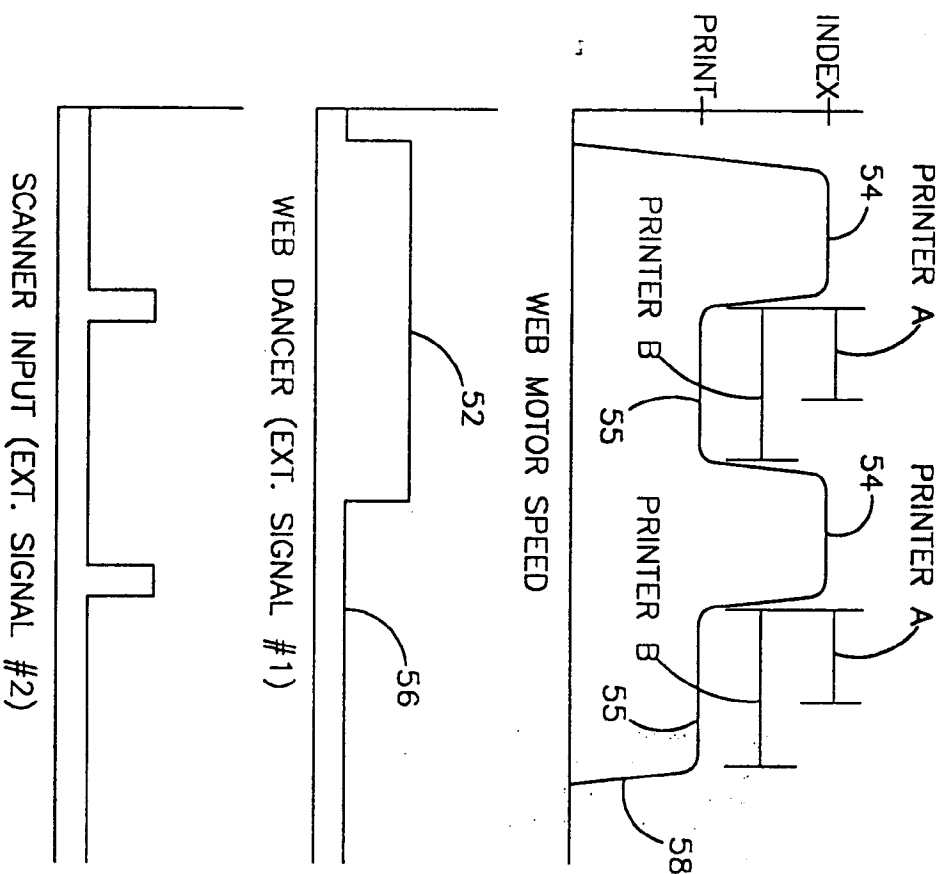


Fig.5B



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 4675

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP-A-0 225 727 (MOORE BUSINESS FORMS, INC.) * page 16, line 16 - page 18, line 23; claims; figures *	1-4, 11-14	B65H23/188
Y	EP-A-0 128 858 (FRAVER S.A.) * page 6, line 32 - line 37; claims; figures *	1-4, 11-14	
A	GB-A-2 088 340 (HAUNI-WERKE KORBER & CO. K.G.) * abstract; figures 2,4,5 *	1	
A	US-A-3 116 032 (PACKAGE MACHINERY COMPANY) * the whole document *	3,4	
A	PATENT ABSTRACTS OF JAPAN vol. 7, no. 244 (M-252) 28 October 1983 & JP-A-58 131 084 (TOKYO SHIBAURA DENKI K.K.) 4 August 1983 * abstract *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65H B41J
Place of search		Date of completion of the search	Examiner
THE HAGUE		20 October 1994	Thibaut, E
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