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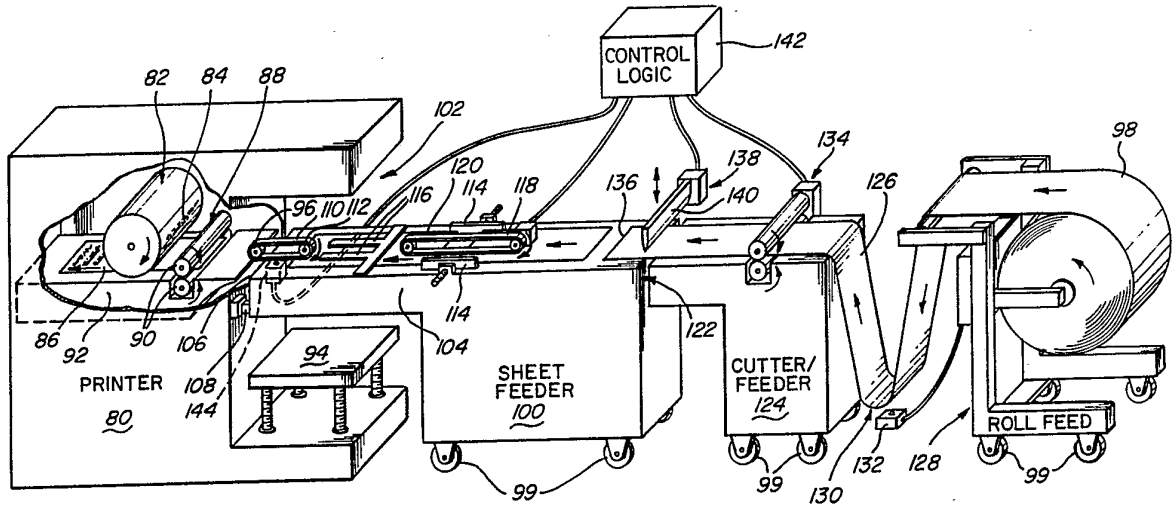

(57) Abstract

A unique system and method for directly feeding sheets into a printing device (80) having a moving image conducting element (82) with a plurality of images (84) placed thereon for transfer to sheet paper and having a wait station (88) for controlling the timimg of paper transfer to the image conducting element (82) provides a feeding table (104) to transfer sheets from a source to a printer stack deshingler (96) while bypassing and, thus, eliminating any need for sheet stacks. The movement of each sheet by the wait station (88) into the image transfer element signals the cutting of a sheet from a roll of continuous web (98) on the input side (122) of the feeding table (104). Once the sheet has moved into the image transfer element the absence of a sheet at the detector (144) signals transfer by the feeding table of the cut sheet to the stack deshingler (96). Simultaneously, a source of web presents and end of the web representing another sheet to a cutting unit (124). This sheet is cut when the current sheet at the wait station (88) begins movement into the image transfer element.

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SYSTEM AND METHOD FOR DIRECTLY FEEDING PAPER TO PRINTING DEVICES

Related Applications

This application is a continuation-in-part of copending U.S. patent application Serial No. 07/536,214 filed June 11, 1990.

1. Field of the Invention

This invention relates to a novel system and unique method for feeding a continuous stream of paper to a printing device without any need for stacking and deshingling individual sheets of paper.

2. Background of Invention

It is desirable to input materials such as paper to a printing operation in continuous form such as fan folded or roll form. The use of a roll, rather than sheets, allows longer intervals between reloading of the paper source. Roll fed paper, cut just prior to feeding, allows sheets to be various sizes without the need to change the size of the paper loaded in the stack. The use of a paper

source roll also reduces packaging waste since stacked paper sheets must be stored in a large number of individual boxes. However, many printing devices are specifically designed to accept only stacked, pre-cut sheets of paper. The stack is fed by a deshingler that removes sheets from the stack and delivers them to the printing element. This deshingler operates slowly enough to accommodate the necessary timing of print operations. However, without the deshingler to regulate feeding, the printer cannot generally operate continuously unless some other method of regulating paper feed is provided.

Previous devices, by for instance, Hunkler of Switzerland, have dealt with the problem of providing a continuous roll source of paper to a printer, designed only for use with stacked paper sheets, by continuously cutting and adding additional sheets from the roll to this input paper stack feed unit. This method has been particularly adapted for the Xerox™ 87xx and 97xx series such as the 9700 Laser Printer, and for various duplicators. The problem with this method is that the printer must still deshingle and individually feed sheets of paper from the stack feed unit. The result is increased, rather than decreased overall complexity and a greater chance of system failure due to the need to now accurately cut and stack

paper sheets from the roll as well as to subsequently unstack the sheets of paper to feed them to the printer.

Other prior art devices also particularly directed toward the Xerox™ 9700 have eliminated the need for shingling and deshingling of paper, thus allowing direct feeding, by modifying the operating software of the printer so that its timing of operation will match that of the feeding device. The problem with such an approach is that the feeding device has lessened versatility with respect to other machines while installation time and expense are increased due to the need to modify software in the printer.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a unique system and method for continuously feeding a printing device from a continuous roll of paper material.

It is another object of this invention to provide a system and method for feeding a printing device that requires no alteration to the operating software of the device.

It is another object of this invention to provide a system and method for feeding a printing

device that allows sheets of various sizes and shapes to be accurately fed and printed upon.

It is another object of this invention to provide a system and method for feeding a printing device that requires no shingling or deshingling of the paper between the source and the printer's image conducting belt or drum.

It is another object of this invention to provide a system and method for feeding a printing device that may be attached and detached from the printing device quickly and forms part of a modular system that includes a plurality of different feeding devices.

It is yet another object of this invention to provide a system and method for feeding a printing device that is specifically applicable to the Xerox™ 9700 Laser Printer, but may also be adaptable to a variety of other printers.

This unique invention provides a system and method for directly feeding unstacked paper sheets into a printing device having movage image conducting element with a plurality of images for transfer to the paper placed thereon and also having a wait station for controlling the timing of paper transfer to the image conducting element. The system comprises a means for directing a continuous stream of paper sheets to a printing device wait

station. There is a means for controlling the rate of movement of the paper sheets into the wait station to present each paper sheet at a programmed or otherwise predetermined time relative to the operating speed of an image conducting element of the printing device. Means are provided for regulating the spacing of a leading edge of each paper sheet as it is presented to the wait station. This spacing is relative to the spacing between consecutive images on the image conducting element.

In one embodiment, the printing device is a laser printer and the image conducting element is one of either a constant speed belt or drum, upon which, images are placed for transfer. This system may be particularly adapted to a Xerox™ 9700 series laser printer. There may be provided a means for controlling the rate of paper sheet feeding that includes a predetermined rate equal to approximately 20 inches per second and a means for regulating the spacing of fed paper sheets that includes a spacing equal to approximately 10 inches. The system may also comprise a means for cutting the paper sheets to predetermined sizes from the input of a continuous paper web. This continuous paper web may be input from a roll. There may be included in this system a means for driving the roll in synchronization with the means for directing the

paper sheets so that each cut paper sheet proceeds without delay to the wait station. The means for regulating paper spacing may include a means for detecting the leading edge of each paper sheet.

In an alternative embodiment a system for directly feeding sheets to a printing device according to this invention provides a means for bypassing a printer stack feeding storage unit that includes a table for guiding sheets in a downstream direction into the stack deshingler. The stack deshingler itself is a unit that removes sheets one at a time and positions the sheets within a wait station means which, itself, feeds these sheets to an image transfer element upon demand of the image transfer element. The table includes a means for detecting movement of each sheet upon the table through the stack deshingler and into the image transfer element and/wait station. There is additionally provided on the table a means for sensing the absence of a sheet proximate the stack deshingler. The table further includes a means for driving sheets therealong from an upstream side to the stack deshingler in response to the absence of a sheet at the means for sensing. Sheets are provided at the upstream side of the table to the means for driving in response to at least one or both of the means for sensing absence of sheets and means for

detecting movements of sheets. In particular, the sheets provided to the upstream side of the table may originate from a roll source of continuous web that is cut on demand in response to the detection of movement of sheets through the deshingler. Sheets are continuously driven into the cutter to lay partially upon the table in response to the sensing of the absence of sheets as they are fed to the image transfer element. The roll source, the cutter feeder, and particularly the table may include wheels to allow their motion to and from the printer. Each of these units is modular and may be operated without any specific electronic interconnection with the printer.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and advantages of the present invention will be more clearly understood in connection with the accompanying drawings in which:

FIG. 1 is a schematic illustration of a prior art method of feeding paper requiring deshingling of stacked sheets;

FIG. 2 is a schematic illustration of a direct feeding system according to this invention;

FIG. 3 is a schematic illustration of the direct feeding system of FIG. 2 including a paper feeding

roll and sheet cutting device for increased production volume;

FIG. 4 schematically illustrates an edge detector used with the feed mechanism in accordance with the present invention;

FIG. 5 is schematic illustration of another embodiment of a modular direct feeding system according to this invention; and

FIGS. 6-9 show schematically the movement of sheets during different operating states of the modular feeding system of FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A photoreprographic printing system of the prior art is generally depicted in FIG. 1. This type of printing system is used, for example, in the Xerox™ 9700 Series Laser Printer. It generally consists of an image conductor element 22 comprising either a belt or drum upon which printing toner is placed in the form of the desired print images. The image conductor belt 22 shown herein contains several images 28 that are laid down at 24 upon a piece of paper 26 as it passes under the contacting surface of the belt. Each piece of paper is fed to the image element by means of a "wait station" 30. This wait station includes a pair of rollers that

forcibly drive a sheet of paper into the image element at a given time corresponding to the motion of the image conductor belt. The wait station 30 is synchronized to drive the leading edge 31 of a sheet of paper 32 into the image conductor belt each time an image on the image conductor belt 22 is aligned to properly print upon the sheet of paper when it reaches the image conductor belt. The feeding of the wait station, as shown in FIG. 1, is accomplished in most printer systems by deshingling a stack of paper 46, one sheet at a time, and feeding each sheet 44 at a predetermined rate to the wait station 30, using a feed driving belt and pinching roller 40 and 42, respectively. As each sheet is fed to the wait station it is held for a small interval until the image element is again ready to receive a new piece. If the wait station does not receive a new piece of paper by the time the next image is ready to be printed, the system will shut down displaying a jam or paper refill signal.

Any feeding system that correctly interfaces with this type of printer must be able to directly feed the wait station of the printing element so that it receives a sheet of paper within the correct period of time to prevent the wait station from indicating an error. Also, it must not feed too

quickly since this would cause a feeding backlog at the wait station.

Reference is now made to a direct feeding system as depicted in FIG. 2 and as in accordance with the present invention. In this schematic drawing, paper sheets 70 are fed to a conveying or feeding 60 that moves paper at a specific rate R 68 to the wait station 30. Each sheet is delivered to the station 30 at a specific point of time in order to insure that it be fed to the image conducting belt 22 in synchronization with the print images laid down on the belt. In order to insure that this precise synchronization be obtained, the parameters of image conducting belt speed S 50 and the distance between the leading edge of each new image d 52 on the image conducting belt is determined. These parameters are directly relative to the feeding speed. In the example of a Xerox™ 9700 Laser Printer, the image belt speed is 20 inches per second and the distance between each image leading edge D is 10 inches. As such, the system 60 is designed to separate each leading edge of input paper sheets by a distance D 62 that equals the image conducting belt image distance d 52. In this case, the distance is 10 inches.

In FIG. 2 the leading edges 64 and 66 of each paper sheet 61 are separated by the distance D.

This spacing may be accomplished by detecting at 72 the leading edge of a sheet each time a sheet is presented to a feeding mechanism or conveyor 60. Each sheet is motioned down the feeding mechanism 60 when the appropriate distance from the preceding leading edge has been attained. Furthermore, each sheet of paper driven at this distance D travels down the feeding mechanism at a fixed rate R 68. In this example, the rate R will equal 20 inches per second, or the rate of the image conducting belt. The advantage of such a leading edge detect system is that various sizes of paper may be aligned to print accurately since each sheet is fed accurately with timing of feed based solely upon its own leading edge. As shown in FIG. 2, the second sheet 61 and third sheet 63 are of different sizes while each sheet's leading edge is aligned at precisely the same distance from the preceding one. This novel system only allows the next sheet to begin motion when the preceding leading edge has traveled exactly a distance D from the next sheet's leading edge. Since printing may occur without regard to size, the printing of unfolded envelopes, among other applications, is possible in large unstacked volume.

A significant feature of the direct feeding concept is the ability to input a continuous web of

paper to the printing system. A roll 90 of paper web 92 is shown in FIG. 3. This paper web 92 is fed in a continuous manner into a cutting unit 96. The cutting unit 96 cuts sheets to a programmed or otherwise predetermined size sheet 82 that are then driven down the feeding device 80 with the required spacing D 62. The sheets are then delivered by the feeding mechanism or conveyor 80 to the wait station 30 and printed upon in the manner described herein above. The feed rate of the roll 94 to the cutting device 96 is synchronized to the general feed rate of the feeding mechanism 80. If so, each time a sheet is cut it may proceed on to the feeding device without delay.

In accordance with the invention, the station 30 may operate continuously assuming that the spacing D is proper as introduced to the station 30. Alternatively, the station 30 may operate somewhat intermittently with a slight wait possible for proper synchronization. Sheets can be provided early to the station 30 but cannot be provided late as this would cause a malfunction and shut-down.

As indicated previously, in accordance with the present invention, each sheet of paper, such as illustrated in FIG. 2, is carried by the feeding mechanism or conveyor 60 once the appropriate distance from the preceding leading edge has been

attained. Assuming that the feeding mechanism 60 is set up for operation at a programmed or otherwise predetermined speed to match that of the image conducting belt 22, then one can employ a leading edge detector to determine the presence of a leading edge of a sheet being fed to the feeding device 60. Once this leading edge is detected, the input feed to the feeding mechanism 60 can be interrupted until the proper spacing occurs, namely the spacing D in FIG. 2 at which time the input feed proceeds so that all leading edges are spaced the proper programmed distance, namely distance D in FIG. 2.

By way of further example, there can be separate feeding mechanisms, including an origination feeding mechanism and a feeding mechanism such as the conveyor-like feeding mechanism 60 shown in FIG. 2. The leading edge detector would, in essence, be between these two feeding mechanisms and would in essence take input sheets fed in a serial course that might be unsynchronized positionally and essentially convert the sheets into a synchronized positional arrangement on the feeding mechanism 60. Again, this occurs by detecting leading edges on the input feed mechanism and then permitting the sheets to be fed to the feeding mechanism 60 but only once the proper spacing D has been achieved.

Now, with regard to the synchronization of

sheets onto the feeding mechanism or conveyor 60, refer to FIG. 4 which is a schematic diagram illustrating the conveyor 60 as well as an input feed 74, and edge detector 72, and a typical sheet 73. The sheet 73 is fed on the input feed. The edge detector 72 detects an edge of this sheet and essentially holds the sheet in readiness for the conveyor 60 moving to a particular position at which time the sheet 73 continues to be fed onto the conveyor 60 with the proper spacing between sheets as illustrated in FIG. 2 by the spacing D.

An alternative embodiment of a sheet feeding system according to this invention is depicted somewhat schematically in FIG. 5. The system includes a printer 80 such as the Xerox™ 9700 Laser Printer having an image element 82 that revolves to place toner in the form of text 84 upon sheets 86 passed thereunder. As described above, the image element 82 rotates continuously and when the text 84 on the element 82 is circumferentially positioned in alignment with a leading edge of a sheet, the sheet is then advanced through the image element by means of the "wait station" 88. The wait station 88 in this example is a pair of pinch rollers 90 that hold the sheet 86 until the proper synchronization of image element text to sheet position is obtained. The sheet 86 is then advanced

downstream by the wait station rollers 90 along a printer feeding table 92 so that it converges with the text-carrying portion of the image element at the proper time. In this way, text is accurately laid upon the appropriate section of the sheet. After a sheet passes from the wait station 88 through image element 82, the wait station 88 is then free to receive another sheet which it will hold until the image element again rotates to place the text in a proper position in which to begin driving the next sheet into convergence with the image element 82.

Normally, as depicted in FIG. 1, sheets are deshingled from a stack which, in this embodiment, is supported on an upwardly moving base 94 that is built into the printer 80. In this embodiment, the deshingler itself comprises elastomeric wheel 96 that projects over an edge of the printer feeding table. In a normal stack feeding operation, sheets would be driven upwardly by the base 94 to the level of the printer feeding table 92, as sheets were removed by the deshingler wheel 96, so that a top sheet in the stack would remain in contact with the deshingler wheel 96. The deshingler wheel 96 would be commanded to rotate to drive the sheet into the wait station 88 sometime soon after a prior sheet had moved downstream, clearing the wait station 88,

and had been driven through the image element 82. Thus, the wait station 88 would always have a reserve deshingled sheet to present to the image element 82 at the appropriate time.

As stated previously, however, a printer that utilizes only stack feeding must be refilled quite frequently. It would be desirable, instead, to continuously and directly feed sheets to the wait station from a much larger source than an integral stack feeder. In this embodiment, a source derived from a roll 98 of continuous web is utilized. Such a source may contain many times the number of sheets as a typical printer storage stack.

A modular system is utilized for feeding sheets from the roll source 98 according to this embodiment. Each separate unit of the system may, thus, be attached to and detached from the printer 80 and each other without substantial alteration of the printer's working components or operating software. Rollers or wheels 99 are provided for portability. In particular, a modular sheet feeder 100 according to this invention, having wheels for portability, is mounted into the preexisting stack feed access port 102 of the printer 80. The sheet feeder 100 is constructed with a table 104 that aligns with and is level with the printer feeding table 92 and has a downstream edge 106 that stands

directly below the deshingler wheel 96. Thus sheets may pass unimpeded from the sheet feeder's table 104 to the printer feeding table 92. The sheet feeder 100 may include guiding lugs 108 or similar locking elements that help to maintain the sheet feeder module 100 in alignment with the printer 80.

In this embodiment, the printer 80 has been modified to include an extended drive belt 110 and idler roller 112 that are rotatably connected to the deshingler wheel and that further overlap the table 104 of the feeder 100. Note that the feeder's table 104 is elevated in the region of the stack base 94 so that it effectively bypasses (bridges) the stack base 94 and enables the transfer of a horizontal stream of sheets one at a time directly to the deshingler assembly 96, 110, 112 and wait station 88 units from outside the normal bounds of the printer housing. The primary substantive alteration to the normal printer functioning in this embodiment is the extending of the deshingler wheel 96 which may be accomplished by a simple attachable and detachable component that includes the belt 110 and idler roller 112.

The sheet feeder 100 itself includes movable side edge guides 114 to maintain sheets in appropriate transverse alignment as they are fed. It further includes, in this embodiment, a pair of

spring loaded strips 116 to lightly maintain the sheets flatly against the table 104.

Operation of the sheet feeder 100 is accomplished by means of a drive or conveyor belt 118 disposed somewhat pressurably, opposite the surface of the table 104 to contact and transfer sheets (120) on demand from a sheet feeder upstream or input side 122 to the deshingler. The belt 118 may be slightly angled relative to the feeding direction to force sheets accurately up against an edge guide 114. The accurate driving of the belt 118 to transfer sheets downstream may be accomplished using, for example, a stepper or servo motor or a ratchet clutch. This process will be described further below.

Sheets are formed at the upstream input edge 122 of the feeder 100 by means of a cutter feeder apparatus 124 that draws a continuous web 126 from the roll feed/unwind unit 128. The roll feed/unwind unit 128 itself provides web upon demand of the cutter/feeder by means of a constant size loop 130 of web. This loop 130 is maintained at a constant size by means of a loop detector 132 that signals driving of the roll feed unit 128 as it becomes smaller due to cutter/feeder 124 drawing of web 126. One such roll feed unit for providing web upon demand is Applicant's Roll Support and Feed

Apparatus, U.S. Patent Number 4,893,763.

Continuous web 126 is drawn from the roll feed unit loop 130 specifically by means of a pair of driving rollers 134 or similar conveyors (such as pin feed conveyors) that bias the leading edge 136 of the web 126 downstream through a cutter 138. The precise distance of biasing depends upon the size of sheet selected. In general, the cutter/feeder 124 meters out a length of web equal to the programmed sheet length. The trailing (upstream) edge of this metered length finds itself under the blade 140 of the cutter 138 while the leading edge 136 is disposed upon the table 104 the sheet feeder 100.

The modular and independent functioning of the system, separate from any direct control by the printer, is based upon the controlling of each of the sheet feeder 100 and cutter/feeder 124 independently of the printer 80 using a separate control logic circuit 142 that interconnects each of the systems operating elements. Control is based primarily upon at least one table 104 mounted detector 144 that senses the state of a sheet relative to the image element 82 and wait station 88 in order to instruct the system. note that the sensing occurs without directly tapping into printer operating functions. The functioning of the system based upon the control logic circuit 142 is

described further in FIGS. 6-9.

The operation of the system according to FIGS. 6-9 is depicted at various states. These figures illustrate the process in an on-going manner in which the initialization of feeding has already occurred. Arrows show the operation of various elements and the timing of such operation.

FIG. 6 shows a sheet A being driven in a downstream direction by the rollers 90 of the wait station 88 into contact with the image element 82. The image element 82 contains text 84 along its circumference between two points 146, 148. In this embodiment, the image element 82 moves at a constant rate throughout the feeding process without stopping as long as it is instructed to continue printing. The trailing (upstream) edge of the sheet A passes under the deshingler roller and the attached belt and idler roller. Note that the deshingler roller usually includes a one-way clutch so that when the wait station rollers begin their rapid driving of the sheet, no resistive drag is imparted by the generally slower moving deshingler roller.

A second sheet B is positioned upstream of sheet A in a stationary position at the sheet feeder drive belt 118. This sheet is awaiting complete feeding of sheet A into the image element 82. A sheet C is also positioned on the sheet feeder table 104 near

the input side 122 thereof. This sheet (C) is stationary, resting partially within the cutter/feeder 124 and partially within the sheet feeder. It is in the process of being cut from a continuous web D and E which extends upstream of the cutter/feeder 124. The rest of the input web D and E is likewise, stationary while the sheet A is being transferred into the image element 82 by the wait station 88.

A detector 144, which in this example is positioned proximate the downstream end 106 of the sheet feeder table 104 detects movement of sheet A into the image element 82. As a result of the presence of a moving sheet, the detector signals a "GOING" condition to the control logic 142 of FIG. 5. The control logic 142, thus, signals the cutter 138 to immediately separate input sheet C from the remainder of the continuous web D and E. Sheet C is, thus, fully separated from the web and ready to be pulled by the upstream end of the drive belt 118 at the appropriate time.

The subsequent movement of each of the upstream disposed sheets following the transfer of sheet A is accomplished as shown in FIG. 7. Once sheet A has cleared the sheet feeder table 104 and has passed substantially through the image element 82 and wait station 88, the detector 144 of this embodiment

senses the absence of a sheet. This absence is translated into a "GONE" signal to the control logic 142. The control logic 142, in response to a "GONE", signals the cutter/feeder 124 and the sheet feeder drive belt 118 to translate over a distance sufficient to transfer sheet B into the deshingler belt assembly 96, 110, 112 and simultaneously transfer sheet C to the position formally occupied by sheet B, just upstream of the deshingler assembly. Similarly, the rollers 134 of the cutter/feeder 124 feed the leading (downstream) edge of the continuous web D and E onto the sheet feeder.

The completed repositioning (shown in progress in FIG. 7) of sheets is depicted in FIG. 8. Sheet B is now positioned within the wait station rollers 90 with its leading edge slightly (approximately one inch thereof) protruding downstream while sheet C stands in the belt 118, ready to be fed to the deshingler assembly 96, 110, 112 and sheet D now stands with its downstream leading edge partially under the feeder drive belt and its uncut upstream trailing edge located proximate the cutter. At this time, sheet D is still part of the continuous web E within the cutter/feeder. Note that while all other elements are stationary, the image element continues to rotate with the circumferential text image 84 not

yet in synchronization with the next sheet B. The printer will again signal driving of the wait station rollers 90 only when the image 84 has rotated to the proper position to effect synchronized convergence of a driven sheet B with the image 84. Since sheet A has been completed, it is shown exiting the printer feeding table 92.

In the system state depicted in FIG. 8, each module of the system of this invention remains stationary awaiting proper alignment of the image element 82. Until such time, the wait station rollers 90 hold sheet B in a stationary unfed position. Note that the wait station rollers 90 are dependent for their movement directly upon the positioning of the image element 82 and are an integral part of the printer mechanism. Thus, since sheet B's movement is now dependent upon the wait station movement, the sheet in this state is stationary. As such, the detector 144 senses the presence of a non-moving sheet therein. The detector, consequently, signals a neutral or "WAIT" state in which the logic control 142 (FIG. 5) directs each of the sheet feeder belt 118 and cutter/feeder unit 124 to neither advance nor cut sheets.

Once the image element 82 becomes positioned at the proper alignment point for printing text, the

printer then signals the wait station rollers 90 to begin driving sheet B as depicted in FIG. 9. As such, the detector 144 now again signals a "GOING" state to the control logic 142 which instructs the cutter 138 to cut sheet D from the previously positioned downstream end of the continuous web E. Again, once sheet B clears the detector 144, a "GONE" state is signaled which causes the logic 142 to instruct the system to feed sheets C, D and E downstream. This cycle continues until the printer image element 82 is instructed to cease printing operation. At this time a final fed sheet may remain at the ready in the wait station 88 until the next print instruction causes the image element 82 to restart.

The elements of the cutter/feeder 124 and driving belt 118, in general, operate fast enough to insure that sheets are delivered to the deshingler as fast or faster than they are required. Otherwise, the printer may signal a jam or out of paper condition and cease operation.

Note that while one sheet feeder drive belt is shown according to this embodiment, two or more drive elements acting in concert may be utilized according to this unique invention. Similarly, the sheet feeder may carry two or more sheets along its table at any one time between the cutter 138 and the

deshingler assembly 96, 110, 112. Each movement of a sheet into the image element would cause the advance of each of the plurality of sheets upon the table downstream by one, with a constant number of sheets always remaining on the table at any one time. Similarly, more than one detector may be utilized. The detectors may be positioned spaced from each other along the sheet feeder table. Each of the detectors would detect the presence or absence of a sheet, with the more upstream signaling a going state in the absence of a sheet and the more downstream signaling a gone state in the absence of a sheet. Detectors could function based upon infrared, ultrasonic or electromechanical mechanisms according to this invention. The system of this embodiment, in general, should detect the current operating state of the image element and wait station by means of its drawing of sheets and determine the position of each of the sheets fed thereinto in order to properly form and advance upstream sheets to the printer at the proper time.

It should be understood that the preceding is merely a detailed description of preferred embodiments. It will be obvious to those skilled in the art that various modifications can be made without departing from the spirit or scope of the invention. The preceding description is meant to be

taken only by way of example and to describe only preferred embodiments and not to limit the scope of the invention.

What is claimed is:

1. An apparatus for directly feeding sheets to a port of a printer or duplicator normally adapted for exclusively feeding stacked sheets comprising:

means for bypassing a printer stack feeding storage unit, including a table for guiding sheets in a downstream direction into a ordinary stack deshingler that normally removes sheets one at a time from a stack of sheets and positions the sheets within a wait station means for feeding an image transfer element;

means for detecting movement of a sheet upon the table through the stack deshingler into the image transfer element;

means for sensing absence of a sheet proximate the stack deshingler;

means for driving sheets relative to the table in response to the absence of a sheet at the means for sensing; and

means for providing sheets at the upstream side of the table to the means for driving in response to at least one of the means for sensing and means for detecting.

2. The apparatus as set forth in claim 1 further comprising means for providing a continuous web, including means for cutting the sheets from a continuous web.

3. An apparatus as set forth in claim 2 wherein the means for providing includes a roll support and means for driving .

4. An apparatus as set forth in claim 3 wherein the means for providing includes a cutter means that cuts sheets in response to signalling of a moving sheet by the means for detecting.

5. An apparatus as set forth in claim 4 wherein the cutter means includes a feeder means for transferring a leading edge of the continuous web onto the table a distance that allows the cutter means to cut an opposing edge of the web to form a sheet therefrom.

6. An apparatus as set forth in claim 5 wherein the means for driving comprises a conveyor belt means.

7. An apparatus as set forth in claim 6 wherein the table includes means for maintaining an interpositional relationship between the table and the printer.

8. An apparatus as set forth in claim 7 further comprising wheel means for allowing movement of the table toward and away from the printer.

9. An apparatus as set forth in claim 8 wherein the sheet feeder includes an extension roller and belt means interconnected with the deshingler and projecting toward the table to allow sheets to be drawn into the printer from a further upstream position upon the table.

10. A method for directly feeding a printing device having a port normally adapted exclusively for feeding stacked sheets comprising the steps of:

providing a feeding table proximate a stack sheet deshingler that normally forwards sheets to a wait station of an image transfer element, the table being positioned to allow sheets to be transferred in a downstream direction from an upstream side of the table to the deshingler in succession along the table;

detecting movement of sheets into an image transfer element of the printer;

sensing the absence of sheets proximate the deshingler following movement of the sheets into the image transfer element;

driving, from the upstream side of the table to the deshingler, sheets in response to the sensing of the absence of a sheet following its movement into the image transfer element; and

inputting sheets to the upstream side of the

table in response to at least one of the detecting of the movement of sheets and the sensing of the absence of sheets.

11. A method as set forth in claim 10 wherein the step of inputting includes directing an end of a source of continuous web onto the table and cutting a sheet therefrom.

12. A method as set forth in claim 11 wherein the step of directing occurs in response to the step of sensing of the absence of sheets.

13. A method as set forth in claim 12 wherein the step of cutting occurs in response to the step of detecting of the movement of sheets.

14. A method as set forth in claim 13 wherein each of the steps of detecting and sensing are performed at the same point upon the table.

15. A method as set forth in claim 14 wherein the step of inputting includes transferring a source of continuous web from a roll of continuous web.

16. An apparatus for directly feeding sheets from a roll of continuous web to a port of a printer

normally adapted exclusively for feeding stacked sheets comprising:

a table means extending from an upstream side to a printer stack deshingler, the deshingler being adapted for normally feeding sheets from a stack to an image element and image element wait station;

roll support means for directing continuous web in a downstream direction;

cutter feeder means for driving continuous web from the roll support means to the table means and for cutting sheets of predetermined size from an end of the continuous web as the sheets are positioned upon the table in succession;

conveyor means for driving sheets from an upstream side of the table means to the deshingler along the table means;

means for operating the means for cutting in response to movement of each of the sheets through the deshingler into the image transfer element; and

means for operating each of the means for directing continuous web and conveyor means in response to completed movement of a sheet out of the deshingler and into the image transfer element.

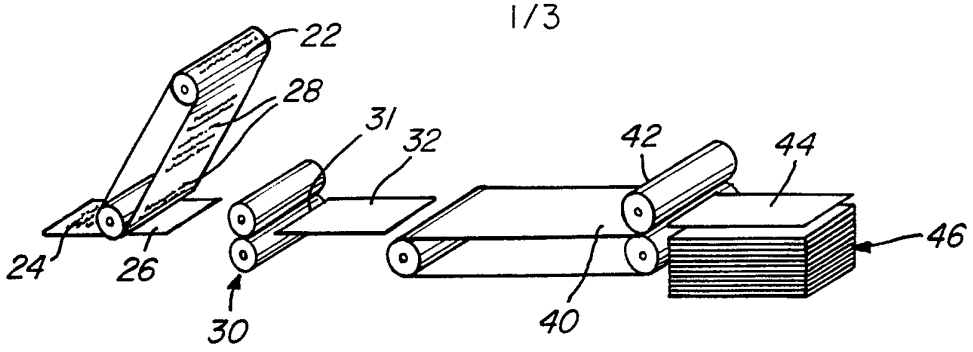


Fig. 1
(PRIOR ART)

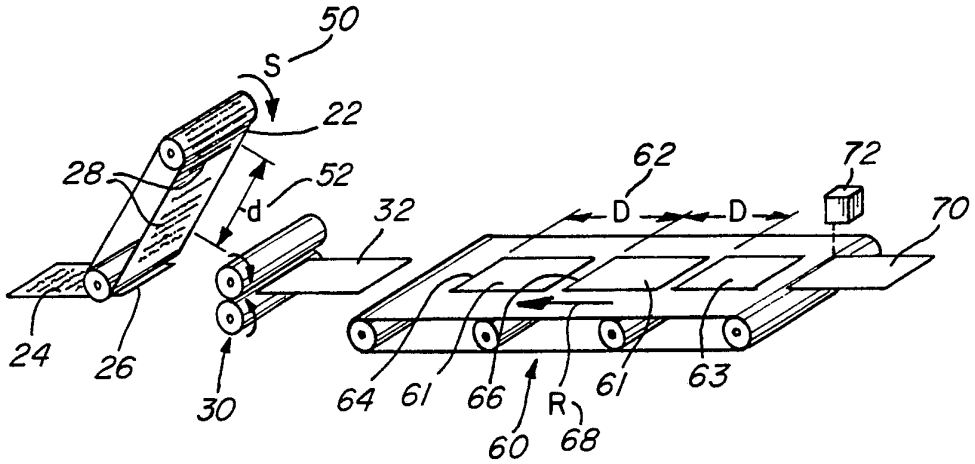


Fig. 2

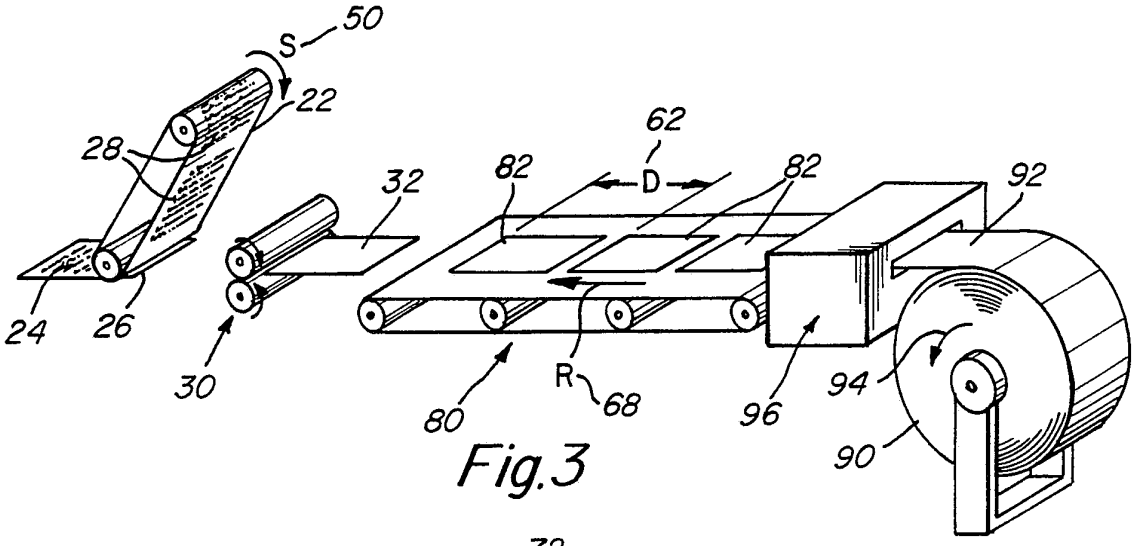


Fig. 3

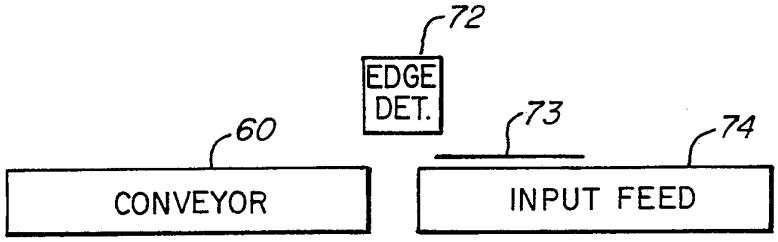
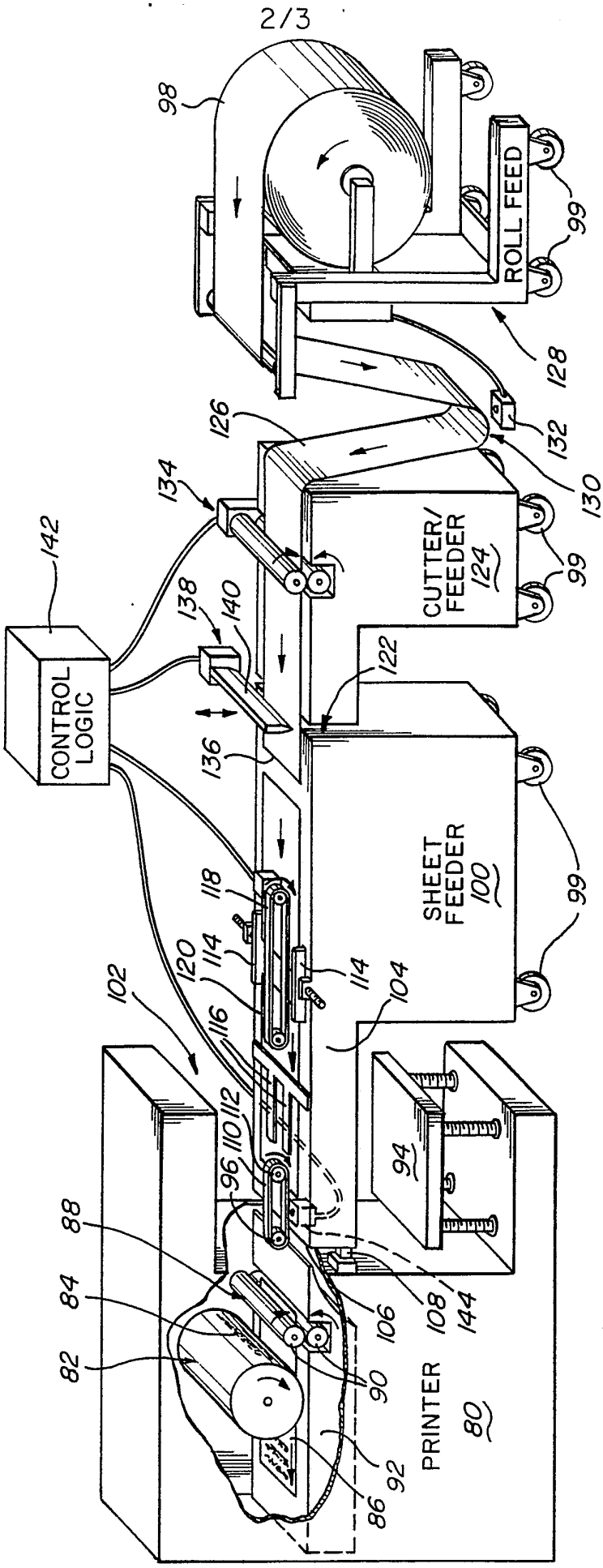


Fig. 4


98
ROLL FEED
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128
126
132
130
134
142
CUTTER/
FEEDER
124
138
140
CONTROL
LOGIC
122
136
SHEET
FEEDER
100
118
120
114
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144
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92
86
PRINTER
80

Fig. 5

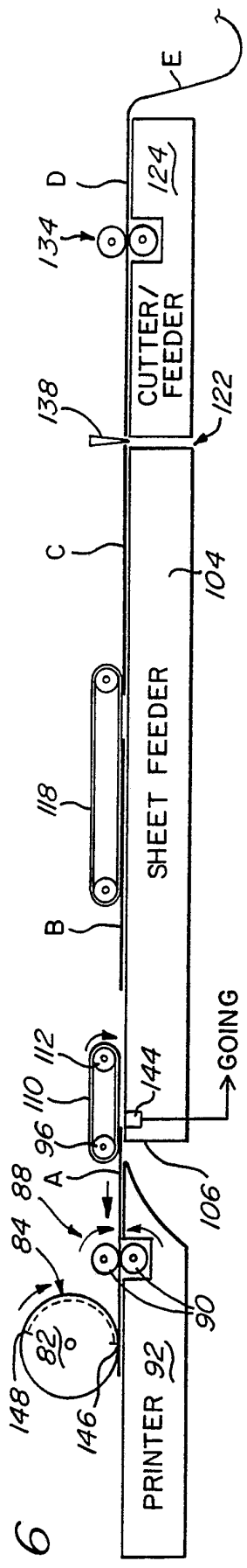

Fig. 6

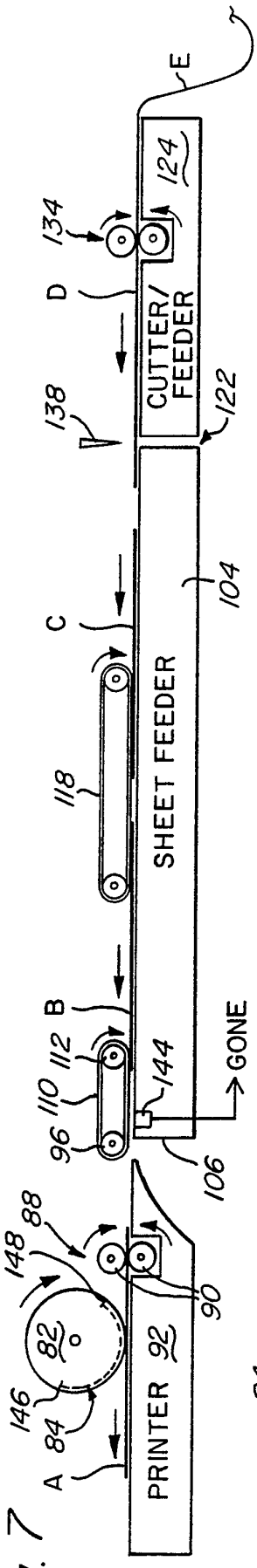

Fig. 7

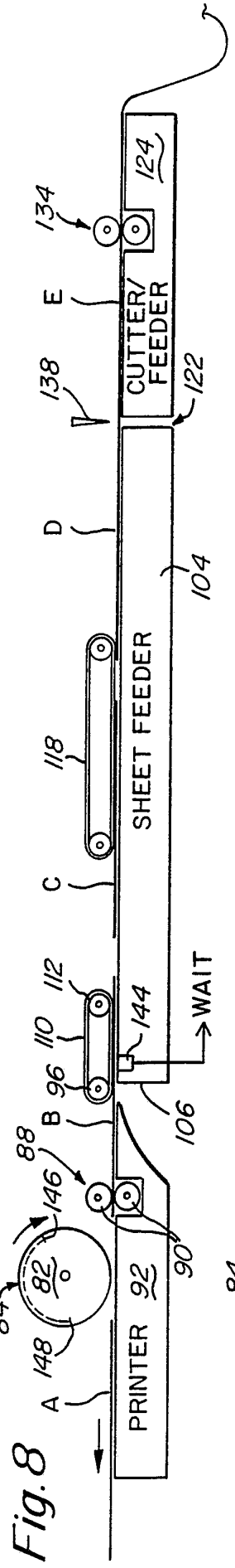

Fig. 8

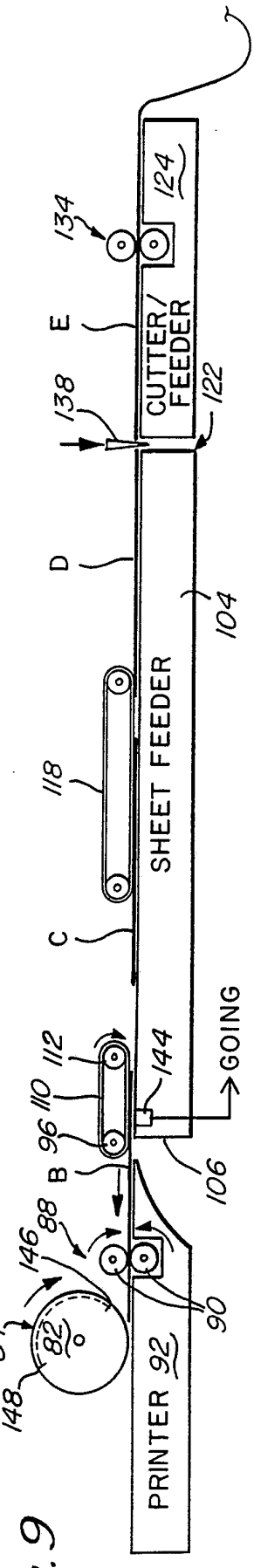

Fig. 9

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/03948

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5): G01D 15/34
U.S. CL: 346/134

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S. CL.	355/310,311,317 271/3,3.1,4,9,265 346/134,1.1,136

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 3,639,053 (SPEAR, JR.) 01 February 1972, see entire document.	1-16
Y	US, A, 4,009,957 (SUZUKI ET AL) 01 March 1977, see entire document.	1-16
X	US, A, 4,012,139 (WASHIO ET AL) 15 March 1977, see entire document.	1-16
A	US, A, 4,933,727 (MIZUMA ET AL) 12 June 1990, see entire document.	1-16

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 JULY 1989	19 AUG 1991
International Searching Authority	**Signature of Authorized Officer**
ISA/US	V. DEVITO