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Gardner et al.

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[54] **CUT AND DEFLECT WEB DRIVE APPARATUS**

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[73] Assignee: **Xerox Corporation**, Rochester, N.Y.

[22] Filed: **Jan. 26, 1971**

[21] Appl. No.: **109,880**

Related U.S. Application Data

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[52] **U.S. Cl.** **83/106**, 83/262, 83/371

[51] **Int. Cl.** **B26d 5/20**

[58] **Field of Search**.....83/105, 106, 102, 83/110, 236, 262, 371; 355/13, 29

[56] **References Cited**

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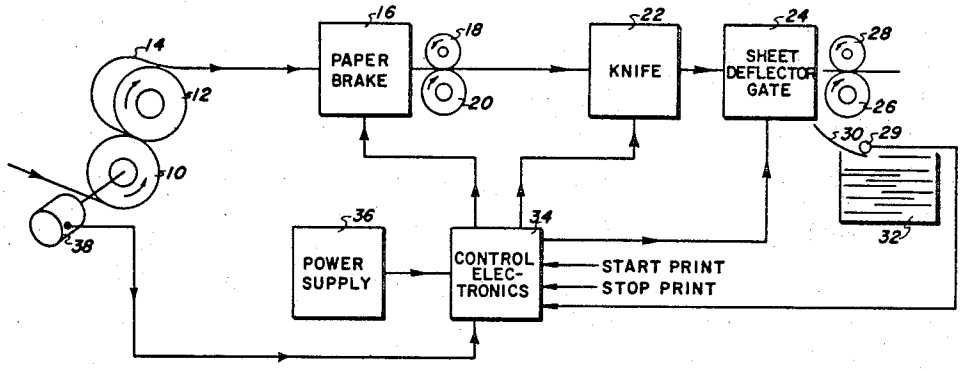
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[57] **ABSTRACT**

A cut and deflect paper system for allowing printed documents to be exited from the system while scrap paper ahead of, intermediate, or behind said printed documents are cut and deflected into a scrap or waste area within the system. In a continuous web document-printing system, under control of a control electronics, a brake halts the paper movement through the system and a knife cuts the paper into predetermined lengths of normal document sizes. A deflector system in the paper path following the cutter allows printed documents to pass out of the system while it deflects scrap sheets into said scrap area in the system.

2 Claims, 5 Drawing Figures



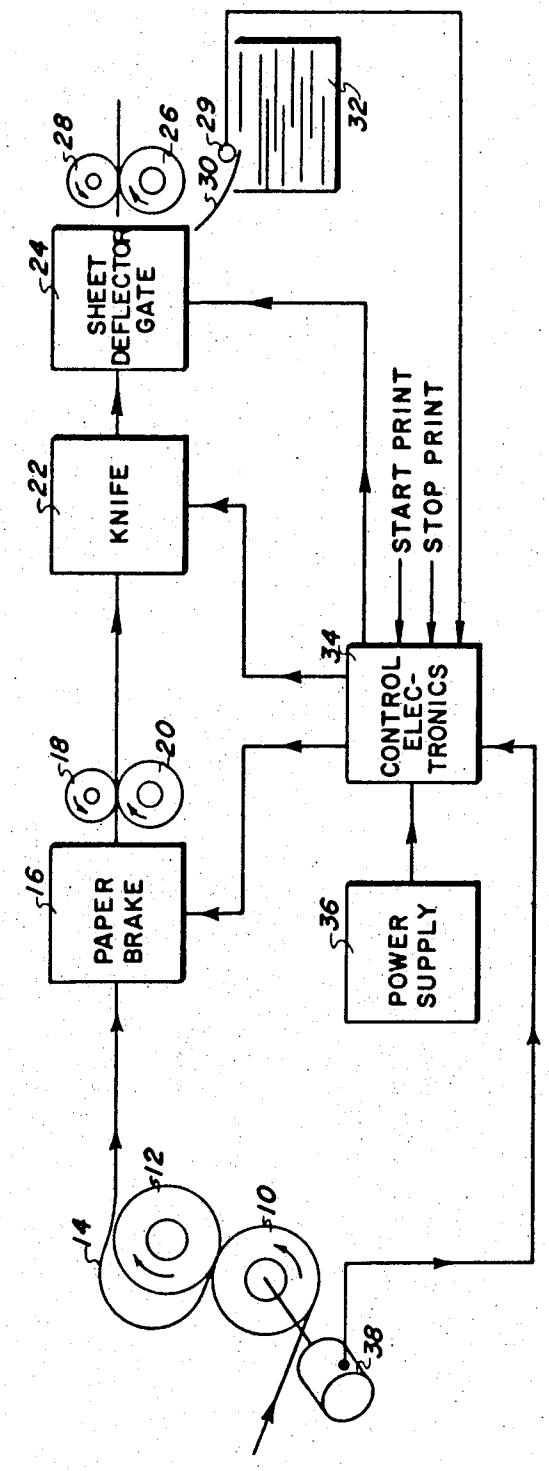


FIG. 1

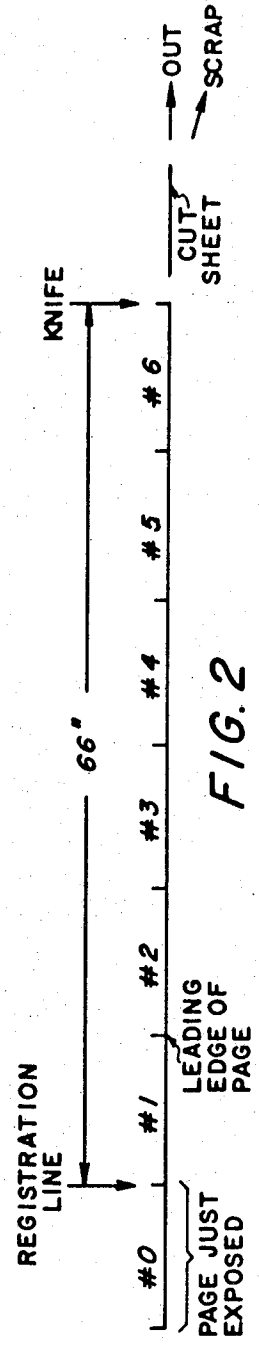


FIG. 2

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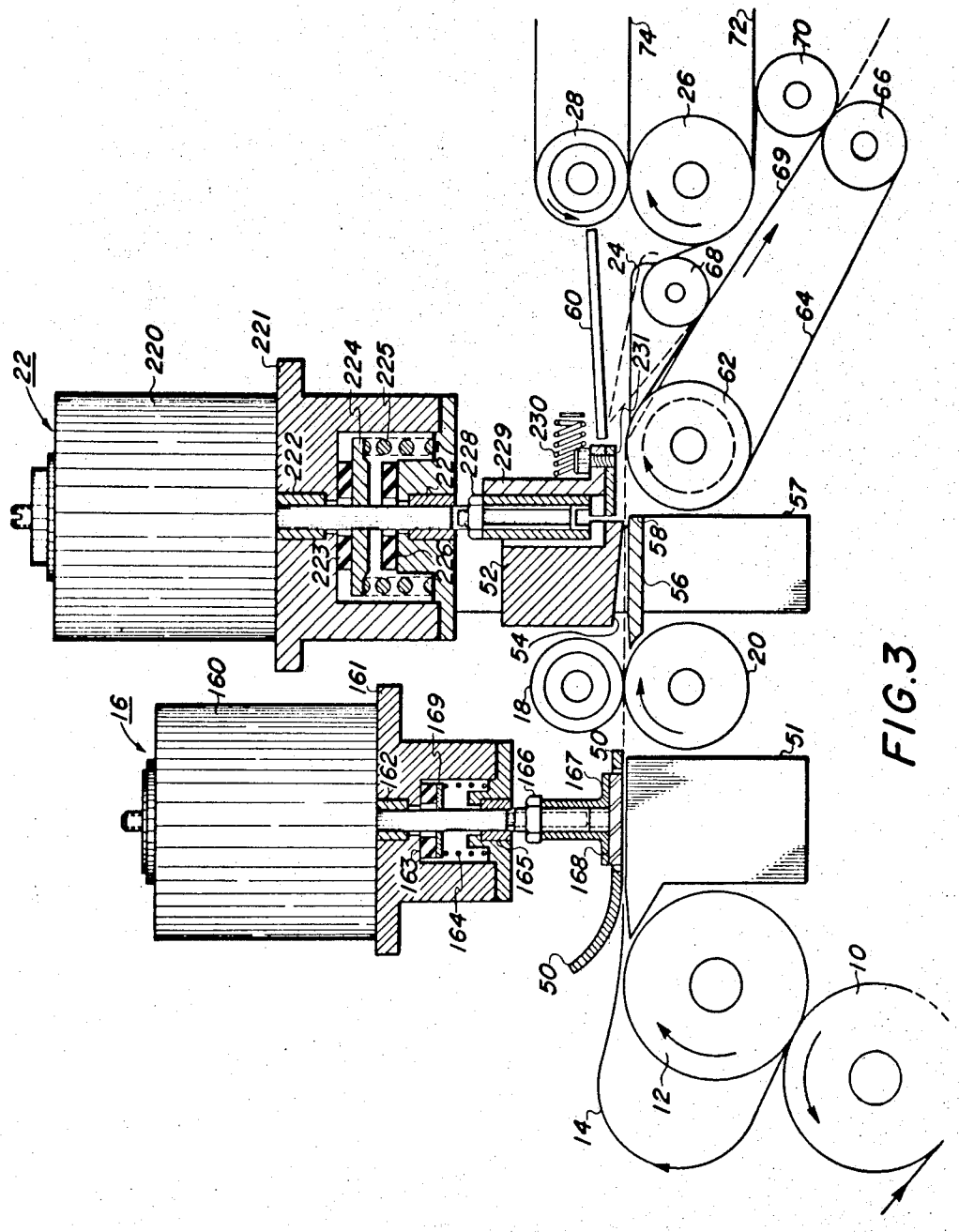

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FIG.3

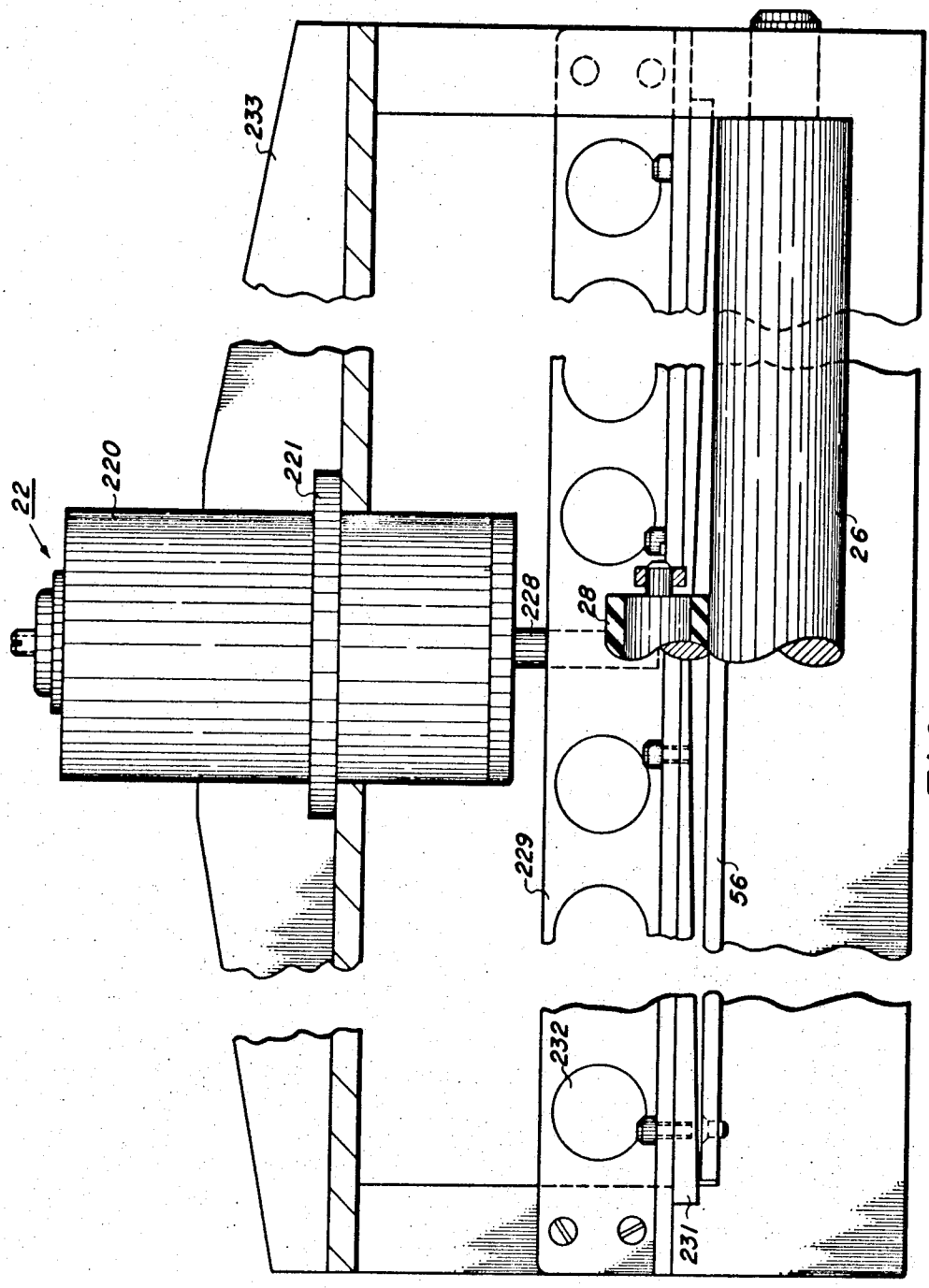


FIG. 4

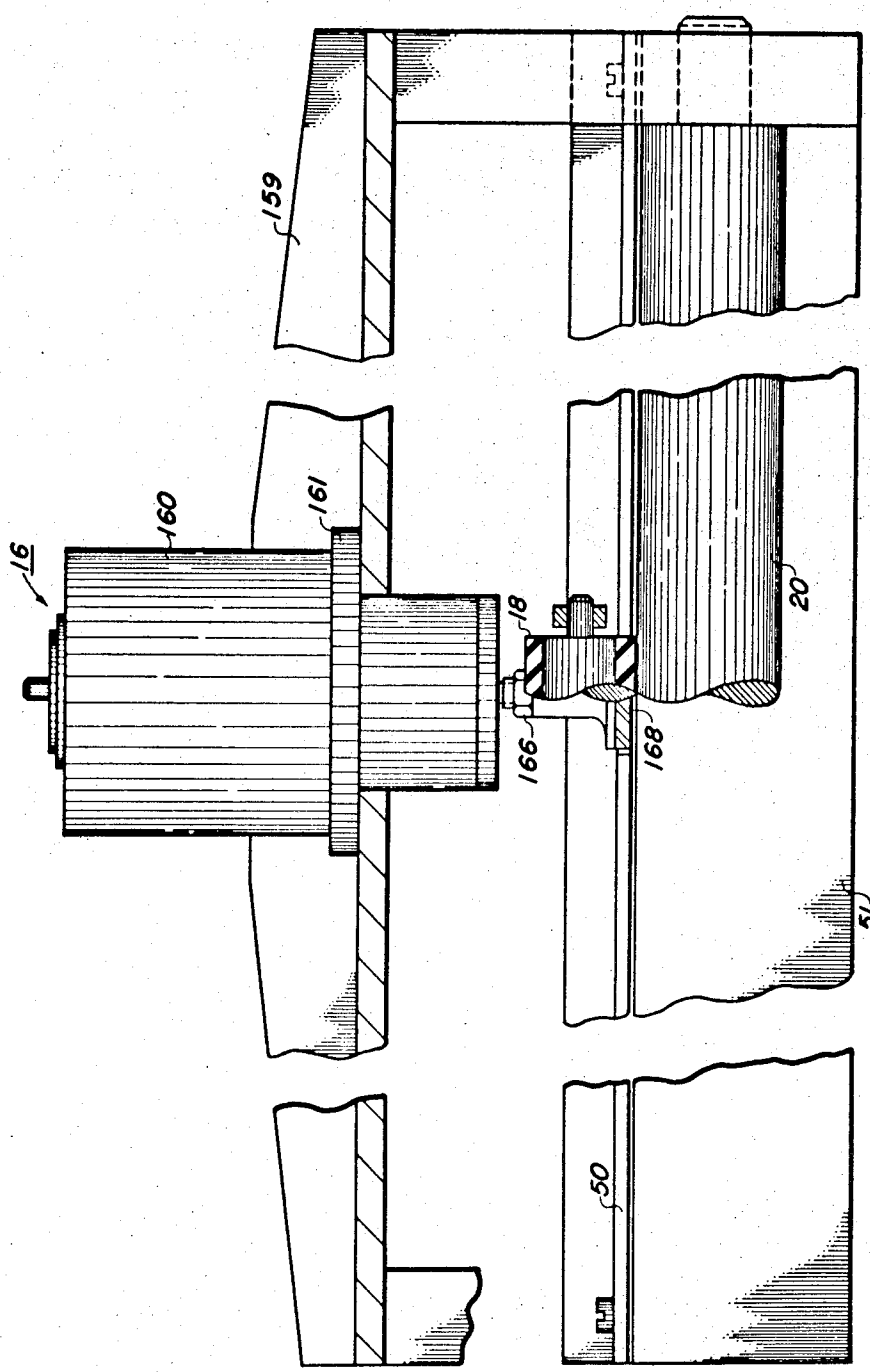


FIG. 5

CUT AND DEFLECT WEB DRIVE APPARATUS

This is a division of application Ser. No. 829,623, filed June 2, 1969, now U.S. Pat. No. 3,591,279.

BACKGROUND OF THE INVENTION

The data processing industry has progressed to the point that data processing equipment performs programmed instructions at such a rapid rate that the major limitation to the speed of the system is in the printing or recovery of the data from the data processing system. Many prior art methods are known for recovering the output information such as the use of magnetic tape units, magnetic disc files, or punched cards. Such techniques, however, are only intermediate steps for storing the output information so as not to slow down the operation of the data processing system. That is, subsequent printing must eventually take place to provide a hard copy output for visual observation and examination.

Present techniques of printing output information include many of the impact typewriting units or stylus scan electrographic apparatus for permanent retention of the information. Other systems might include cathode ray tube printing where the image on the face of the cathode ray tube is a direct readout from the computer in an on line mode or from said magnetic tapes or discs in an off line mode. The cathode ray tube image would be impinged on or transferred to a document in any of the known prior art xerographic or electrostatic techniques and subsequently developed and fixed for permanent retention. In such a cathode ray tube system, the speed of the paper movement must be such as to provide continuous readout from the computer with little or no buffering of the output information. As there usually is a discrete amount of unprinted or misprinted paper subsequent to the printing area, provisions must be made for exiting the valid printed information in the form of documents of standard or other size from the system in a bound, unbound or stapled, etc., condition. Because of the high speed of many such cathode ray tube printers, scrap paper ahead of, intermediate, and behind valid printed documents presents a disposal problem in that the volume of the printed information makes manual separation of scrap paper and valid printed documents unnecessarily time consuming and expensive, thereby limiting the effectiveness of the cathode ray tube printer or other type of output printing system in a data processing center or the like.

OBJECTS

It is, accordingly, an object of the present invention to provide an improved paper handling system in a data-printing system.

It is another object of the present invention to increase the efficiency of a data processing system utilizing high-speed paper printing apparatus.

It is another object of the present invention to separate valid printed documents and scrap paper in a data-printing system.

It is another object of the present invention to provide a cut and deflect paper handling system to deflect valid documents in one output direction and scrap paper or sheets in another output direction.

It is another object of the present invention to provide cut and deflect paper apparatus in a continuous web data printing system whereby valid documents will be exited from the system while scrap paper or sheets will be cut and deflected into a scrap area for subsequent disposal.

BRIEF SUMMARY OF THE INVENTION

In accomplishing the above and other desired aspects of the present invention, applicant has invented improved apparatus for cutting and deflecting those valid documents and scrap paper between said documents into discrete paths for separate operation. In a continuous web data-printing system a brake is provided for halting the movement of the paper prior to cutting into discrete documents. Once the paper has been halted, a cutter is energized to accurately cut the paper into predetermined lengths. To allow for continuous printing by a data processor, the paper therefrom continues to be moved into the system to form a loop around drive or tension rolls while the paper is braked for the cutting action. After the cut, higher speed loop cancellation rolls rapidly advance the paper, thereby removing the paper loop to allow for the next paper brake and cutting sequence.

Subsequent to the knife station, a sheet deflector gate is energized under control of a control electronics to deflect valid documents to an output stacker, binder, or stapler, etc. If the control electronics determines that the cut sheet is scrap paper, the sheet deflector gate is energized to deflect the scrap paper along a separate path to a scrap area or box within the system for later disposal at the operator's convenience.

DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention, as well as other objects and further features thereof, reference may be had to the following detailed description of the invention in conjunction with the drawings wherein:

FIG. **1** is a block diagram of the cut and deflect system incorporating the principles of the present invention;

FIG. **2** is a representative diagram of the number and position of documents in the system which is helpful in understanding the operation of the apparatus in FIG. **1**;

FIG. **3** is a side view section drawing of the apparatus incorporating the principles of the present invention;

FIG. **4** is an end view of the knife assembly seen in FIG. **3**; and

FIG. **5** is an end view of the brake assembly seen in FIG. **3**.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a partly schematic diagram showing the overall system of the present invention. The input paper is from a continuous roll of paper, which when applied to drive roller **10** is just coming from a document reproduction or printing system of any type known in the prior art. Of the embodiment disclosed in the present application, discrete documents of **8** one-half by 11 inches or of any other size are formed by the data printing system positioned ahead of the apparatus of the present invention. The paper path continues

around the drive roll **10** and around drive roller **12** past the paper brake assembly **16**. The paper is advanced past the paper brake assembly **16** by loop cancellation rolls **18** and **20**. From the loop cancellation rolls the paper passes the knife station **22** which cuts the document to the predetermined size as necessitated by the length of the document printed. If the paper now passing the knife station **22** is a printed document, the sheet deflector gate **24** will deflect the cut document to the path determined by the sheet exit rolls **26** and **28**. If, however, the paper to be cut is scrap paper, which would occur during various conditions which will hereinafter be more fully discussed, the sheet deflector gate **24** operates to deflect the cut paper from knife **22** into the scrap box **32** by means of path **30**. Thus, only actual documents will be emitted from the system while scrap paper from other conditions will be cut and deposited in a scrap box within the apparatus.

Controlling the operation of the mechanical apparatus of the present invention is the control electronics **34** deriving power from power supply **36**. Coupled to drive or tension roll **10**, is the paper flow counter **38**. This counter determines the length of paper which has been processed by the data system upon entrance into the area of the drive roller **10**. The amount of paper passing through the system is monitored by the control electronics **34** which will selectively operate the paper brake **16**, knife **22**, and sheet deflector gate **24** for proper cutting and feeding out of the documents and scrap sheets from the system.

Seen in FIG. **1** is the paper loop **14** adjacent the drive roll **12**. When the control electronics **34** determine that the paper passing the knife station **22** should be cut, a signal is applied to the paper brake **16** which halts the movement of the paper through the system. Once the paper has come to a complete stop, the control electronics **34** selectively energizes the knife **22** which cuts the paper at the predetermined location. As above, if the paper is a document, it will be exited through the sheet exit rolls **26** and **28**. If, however, the paper is scrap, the sheet deflector gate **24** will deflect the scrap paper into scrap box **32**. During the time that the paper brake **16** is holding the paper stationary, the drive-tension roll **10** is still drawing the paper from the data system at a uniform rate. This is to allow the continuous operation of the data-printing system without interruption by the operation of the knife **22**. Once the knife has cut the paper and the paper brake **16** has been released, the loop cancellation rolls **18** and **20**, which operate at a faster rate than the drive rolls **10** and **12**, rapidly advance more paper to the cutting area and, most importantly, eliminate the paper loop **14** formed around tension roll **12**. The sheet exit rolls **26** and **28** may operate at a speed equal to the input paper speed to tension roll **10**, but for faster exiting of the documents from the system, the sheet exit rolls move the paper away from the sheet deflector gate at a faster rate to leave more space between discrete documents for any sort of output unit such as a paper stacker, binding unit, or stapling machine, etc.

The apparatus of the present invention must be designed to operate under any one of various conditions. That is, scrap paper must be eliminated in a "start print" condition, as when the unit is energized; in a "stop print" as when printing has ceased and the last document has been exited from the system; when a paper jam, print or developing malfunction occurs; and other situations as will become more apparent.

In the start print mode, as when one or more documents is to be printed, the paper from the printing station, not shown, to the output of the system, must be eliminated so as not to mix at the output printed documents and scrap paper. As shown in FIG. **1**, taken in conjunction with FIG. **2**, all the paper shown in the FIG. **1** must be scrapped prior to the exiting from the system of the first printed document. FIG. **2** shows that the distance from the registration line, that is, the leading edge of the next document to be exposed, to the knife edge would be, for example, the length of six documents. Since the scrap box **32** in FIG. **1** must contain the 66 inches or thereabouts of scrap, the system must cut the paper into lengths say no shorter than three inches and no longer than 11 inches. Thus, after a document is printed, as seen in FIG. **2**, the length of paper preceding the area on which the document is printed is cut into the 3 to 11 inch segments upon operation of the paper brake **16**, the knife **22**, with the sheet deflector gate **24** deflecting the scrap pieces to the scrap box **32**, all under control of the control electronics **34**. When the leading edge of the document reaches the knife **22**, the paper is now cut with the paper preceding the leading edge of the document already cut and directed to the scrap box **32**. Now, however, the paper flow counter **38** has indicated to the control electronics **34** that the leading edge of the document now appears at the knife station **22**. The control electronics **34** operates the sheet deflector gate **24** to now direct the output of the document through the sheet exit rolls **26** and **28**. As long as documents continue to be printed by the data printer, the paper flow counter and other indications to the control electronics **34** will enable the knife **22** to cut the printed documents into the correct sheet lengths. These output documents will be stacked, bound or stapled or operated on in any of the known prior art manners.

After the control electronics **34** has been informed by the data printer by circuitry not shown that the last document has been printed and has been cut by the knife **22**, the sheet deflector gate **24** is deflected toward the scrap box **32**. That is, after the last printed document has been transferred out of the system through gates **26** and **28**, the sheet deflector gate is enabled to direct future paper to the scrap box until further documents are printed. When the last document is cut by knife **22**, it still must be moved through the sheet deflector gate area and out by the sheet exit rolls **26** and **28**. The blank paper that immediately followed the printed document continues to move right behind the last printed document and it is this lagging blank paper that is to be scrapped after the printed document has left the sheet exit roll area. When the last printed document has left the area the system is disabled and the remaining blank paper past knife edge **22** is scrapped in the scrap box **32**.

There is, therefore, a start up scrap cycle and a shut down scrap cycle so as to ensure that nothing but valid printed documents are exited from the system. A typical figure of the worst case start up print scrap cycle would be 91.5 inches from the beginning of the printing area to the paper cut at the knife edge **22**. A typical

figure for the total waste at the stop print or shut down procedure would be 28.8 inches of scrap at the shut down. Therefore, from a shut down to the next start up, the total waste would be, for example, 120.3 inches, which must be cut into lengths not shorter than 3 inches and not longer than 11 inches for deposit into scrap box 32. It is to be understood that these figures are exemplary only as different data print dimensions and cut and deflector system dimensions would alter these figures and require different time and paper flow cycles under control of the control electronics 34. Other cut and deflect cycles are initiated such as when an emergency occurs and power must be immediately withdrawn from the system; as when the source of data to the data printer indicates that the information printed was in error and must be disregarded, etc. The control electronics would be so designed as to compensate for these various and other conditions which require the cut and deflection of blank scrap paper.

In the scrap box 32 may be situated a photo detector 31 which in the start print cycle limits the scrap lengths to within 3 inches to 11 inches. That is, after a previous stopping of the system, there may be no control as to where the leading edge of the paper is beyond the knife edge and extending into the scrap box 32. In order to allow the scrap paper to lie flat in the scrap box 32, normalization is needed to insure that none of the cut sheets are less than 3 inches or more than 11 inches long. The photo detector 31, which may be, for example, 3 inches ahead of the knife edge 22 in the scrap path, detects the presence of paper and indicates to the control electronics 34 to initiate a cutting sequence by operation of paper brake 16 and knife 22.

Referring now to FIG. 3, there is shown the cut and deflector system in more detail which includes all the features of the present invention. The paper from the data printing system enters into the cut and deflect assembly by means of drive roller 10. The paper passes around drive roller 12 and enters into the brake and cut apparatus for cutting and deflection to the scrap box or the output from the system. The system seen in FIG. 3 will be described with the same designation numerals as with similar components seen and described in conjunction with FIG. 1. Brake solenoid 16 is shown partly in section to note the operation thereof. Within housing 160 is the coil and other apparatus for the operation of shaft 166 to stop the paper 14 upon the proper control from control electronics 34. Shaft 166 passes through housing 161 and the various components therein. Sleeves 162 and 165 allow for accurate and smooth operation of the brake by means of the coil within housing 160. When the coil in the solenoid is activated, shaft 166 and foot 167 press the brake pad 168 against document 14 and subsequently against the back stop 51. As soon as the signal from control electronics 34 is received at the solenoid 16, the paper movement ceases by the action of the brake pad 168 against the back stop 51.

In actual operation there would be some slippage of the paper past the brake solenoid 16 until the full force thereof can halt the movement of the paper. The movement is insignificant, however, and, therefore, for purposes of discussion it will be assumed that no slippage occurs. After the cutter has cut the paper the brake solenoid is released by the control electronics 34 and by means of spring 164 the brake pad is released from the paper and shaft 166 withdraws to the rubber return stop 163 by means of the shoulder 169. During the time that the brake halts the action of the paper through the system, paper drive roller 10 is continuously moving the paper into the area. Accordingly, a paper loop 14 forms about drive roller 12 until the brake solenoid is released. Guide plate 50 guides the paper through the area of the brake solenoid for correct paper position, etc.

Loop pull out rollers 18 and 20 in the meantime have been slipping against the halted paper 14 while the brake solenoid has been activated. Once the brake solenoid 16 is released, the pull out rollers which are rotating at a speed greater than the speed of the drive roller 10 begin moving the paper through the system again at said higher rate of speed, thereby cancelling the paper loop 14. The paper then comes into the area of the knife solenoid 22. Knife solenoid 22 similarly comprises housing 220 which would contain the coils and other apparatus for the necessary operation of the solenoid. Within housing 221 is the shaft 228 which moves against sleeves 222 and 227 for accurate positioning of the knife shaft. Unlike the brake solenoid 16, the knife solenoid would have no bottom-most stopping point so there is an upper and lower rubber stop limits 223 and 226, respectively. Upon operation of the solenoid, the shaft would be moved vertically downward until shoulder 224 contacts the rubber down stop 226 for the bottom-most point of movement. Upon releasing of the solenoid by the control electronics 34, spring 225 would force the shaft 228 vertically upward until the shoulder 224 would contact rubber return stop 223.

The knife solenoid further comprises the paper guides 52 and 56. The paper 14 would be advanced past the slant edge 54 of the paper guide 52 for proper paper registration at the cutting edge 58. As the shaft 228 is driven downward by the knife solenoid coil, the knife edge of the knife blade 231 would meet the paper at the edge 58 of the stationary cutting blade 56 to thereby cut the paper thereat. For accurate cutting of the paper, a bias spring 230 is utilized against backing angle 229 to force the cutting blade 231 against cutting edge 58 for smooth cutting and non-damage to the document formed.

After the cut paper leaves the area of the cutting solenoid, the paper has one of two paths of movement thereafter. If the sheet deflector gate 24 is in the position of the solid line shown, output roller 62 will move the document along the area of paper guide 60 to contact the sheet exit rolls 26 and 28 to exit the document from the system. For accurate movement of the document, sheet exit rolls 26 and 28 are shown to drive webs 72 and 74 for exiting the document out to one of the stacking, binding, etc., units as hereinabove set forth. If, however, the paper cut was scrap, the control electronics 34 would move the sheet deflector gate 24 to the position shown by the dashed lines in FIG. 3. Thus, the paper would be forced to follow the path of the sheet deflector gate and web 64 driven by scrap rollers 62 and 66. The paper would continue to move down the path defined by webs 64 and 69 which is driven by rollers 68 and 70 to the excess paper or scrap box. As long as the sheet deflector gate 24 is in the dashed line position, all cut paper would be deflected to the scrap box.

FIG. 4 shows the end view from the direction of the sheet exit from the system of the knife assembly 22 as seen in FIG. 3. Solenoid 22 and the upper housing 220 and the lower housing 221 are shown connected to a support structure 233. Shaft 228 can be seen to be extending vertically downward from the solenoid 22 in back of the backing angle 229. Lightening holes 232 are formed in the backing angle 229 to decrease the weight of the backing angle itself. The document or scrap paper would be passing through the system and out of the paper when viewing FIG. 4 between pinch roll 28 and the sheet exit roll 26. The moving cutter blade 231 is shown attached by various bolts to the backing angle 229. The cutting blade 231 would cut the paper as the cutting blade passes the stationary cutting blade 56. As seen in FIG. 4, the moving cutting blade 231 is in the shape of an inverted V or is known as a "roof top" cutting blade. The roof top cutting blade is superior to other types of cutting blades in this particular application in that the blade acts as dual guillotines and is further advantageous in that the outer edges of the document are cut first allowing for superior registration of the cutting blade with the stationary blade 56 and makes for a smooth and accurate cut of the document. The shape of the blade, however, as well as the other features seen in FIGS. 3, 4 and 5, are exemplary only as other configurations thereof could be utilized while still maintaining the principles of the present invention.

FIG. 5 is an end view as seen from the sheet exit side of the apparatus of the brake solenoid 16 as seen in FIG. 3. Brake solenoid 16 in the upper housing 160 and the lower housing 161 are shown attached to a support structure 159. Upon actuation of the brake solenoid the shaft 166 would move in a vertical direction to contact the document which is moving in a direction out of the paper between pinch roller 18 and loop cancellation roller 20. The paper is pinched between the brake pad 168 and the support member 51 to halt the movement of the paper through the system. After the brake solenoid is released by the control electronics 34, the loop cancellation roll quickly moves the paper to the knife area thereby cancelling the paper loop as seen in FIG. 3. The paper is guided through the area of the brake solenoid by means of the backing plate 51 and the paper guide 50 as seen to be attached to the backing plate 51 by the various bolts as shown.

In the foregoing there has been disclosed apparatus for effectively eliminating from the output of a continuous web document printing system of scrap paper upon which no information has been printed. The system has been described in a start print and a stop print mode, but it is apparent that scrap paper can be formed during other operations of the system such as misprint of information on the document, a splice detected in the continuous paper web, a form projection misapplication, an "abort" command from the data processor, or a "hard stop" condition when an emergency stop must be effected. Further, specific embodiments have been disclosed and described as to the physical placement of the brake solenoid, paper solenoid, etc. Other configurations could be utilized, such as placing the brake and knife assemblies under the path of the paper movement and having the solenoids operate in a vertically upward direction rather than the vertically downward direction as disclosed. Moreover, a specific cutting blade has been shown and described but it is apparent that any shaped cutting blade which provides a smooth and accurate cut may be utilized while still conforming to the principles of the present invention. A paper flow counter has been included in the description of the present invention which notes the amount of paper passing thereby. Other measures could be utilized, however, to note the amount of paper flow such as a line counter which would count the number of lines printed on the document, for example, while still retaining the principles of the present invention.

Thus, while the invention has been described with reference to specific embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the true spirit and scope of the invention. In addition, many modifications may be made to adapt to a particular situation without departing from the essential teachings of the invention.

What is claimed is:

1. A paper drive system comprising

first drive means including a pair of tension rolls for advancing said paper through said system, wherein said paper moves around one of said rolls to the point of contact of said rolls and then around the second of said rolls,

means for halting the movement of said paper, said first drive means continuing to drive said paper when said halting means is actuated, the paper thereby forming a loop around one of said tension rolls,

means for cutting said paper after the halting thereof,

second drive means between said halting means and said cutting means for advancing said paper to said cutting means, said second drive means operating at a substantially greater rate of speed than said first drive means to eliminate said loop formed around one of said tension rolls,

third drive means for advancing the cut paper away from said cutting means,

means for selectively deflecting said cut paper into one of two paths, said first path being the output path from said system and said second path leading to a scrap disposal area, and

control means for monitoring the paper flow through the system and the operation of said system for selectively actuating said halting means, cutting means and deflecting means, said control means operating to cut said paper into uniform lengths in an operating mode and to cut said paper into lengths of an upper and lower limit in a scrap mode for depositing thereof in said scrap disposal area upon selective actuation of said deflecting means.

2. In a continuous web document printing system, cut and deflect apparatus comprising

means for cutting said web into a first group of documents and a second group of scrap sheets,

brake means for interrupting the movement of said web prior to the cutting thereof,

means for deflecting said documents along an output path and for deflecting said scrap sheets along a second path to a scrap disposal area, and

control electronics means for selectively actuating said brake means, cutting means and said deflect-

ing means according to the presence or absence of printing on said web at the time of cutting.

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