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[54] **DEVICE FOR CONTROLLING THE FEEDING OF COPY SHEETS TO A SMALL OFFSET PRINTING MACHINE**

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[51] **Int. Cl.** **B41f 9/00**

[58] **Field of Search** 101/144, 233, 247, 101/132.5, 142

[56] **References Cited**

UNITED STATES PATENTS

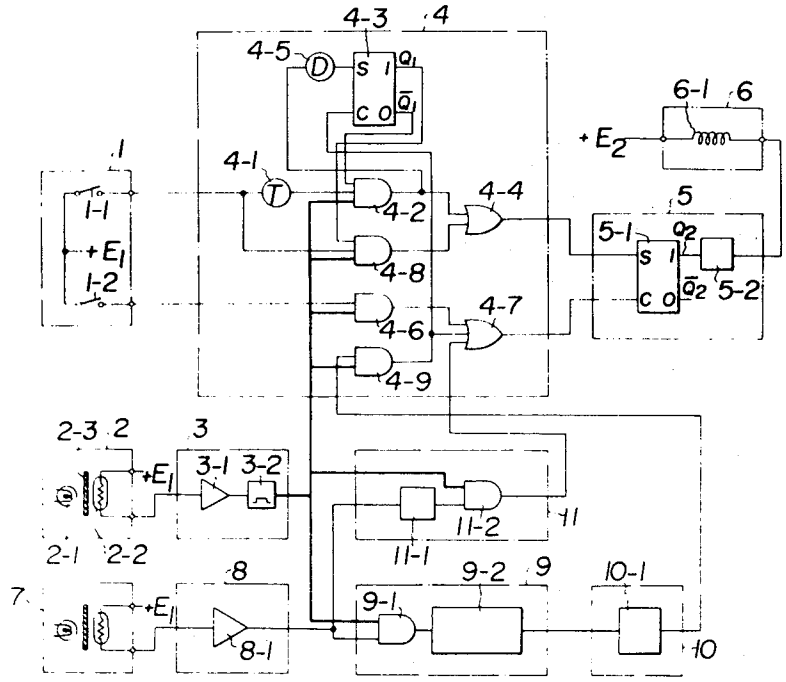
3,102,470	9/1963	Gragg et al.	101/233 X
3,169,476	2/1965	Fielding	101/247
2,965,019	12/1960	Hayes et al.	101/142 X
3,056,346	10/1962	Gammeter et al.	101/144
3,264,981	8/1966	Burger et al.	101/144
3,451,336	6/1969	Mignone	101/132.5
3,457,857	7/1969	Burger	101/144
3,603,253	9/1971	Tonkin	101/132.5 X
3,648,603	3/1972	Kaminstein	101/132.5
3,493,301	2/1970	Sable et al.	101/132.5 X

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[57] **ABSTRACT**

The device has means producing a synchronizing pulse in synchronism with rotation of a cylinder of the printing machine and responsive to completion of each revolution of the cylinder, timing means producing a time signal responsive to completion of the inking time of the printing machine, and a push button switch operable to initiate feeding of the sheets. A logic circuit is operable, responsive to simultaneous receipt of a time signal, operation of such push button and receipt of a synchronizing pulse, to effect operation of a lever for feeding copy sheets to the printing machine under the control of a feed cam on a cylinder of the machine. A "stop feeding" signal is produced responsive to printing of a preset number of sheets and conicident with a synchronizing pulse, or responsive to a lack of synchronism of the sheet feeding and the synchronizing pulse, or responsive to operation of a "stop" push button switch coincident with a synchronizing pulse. The synchronism is checked by a checking circuit including means producing a signal responsive to the termination of feeding of each individual sheet.

8 Claims, 2 Drawing Figures

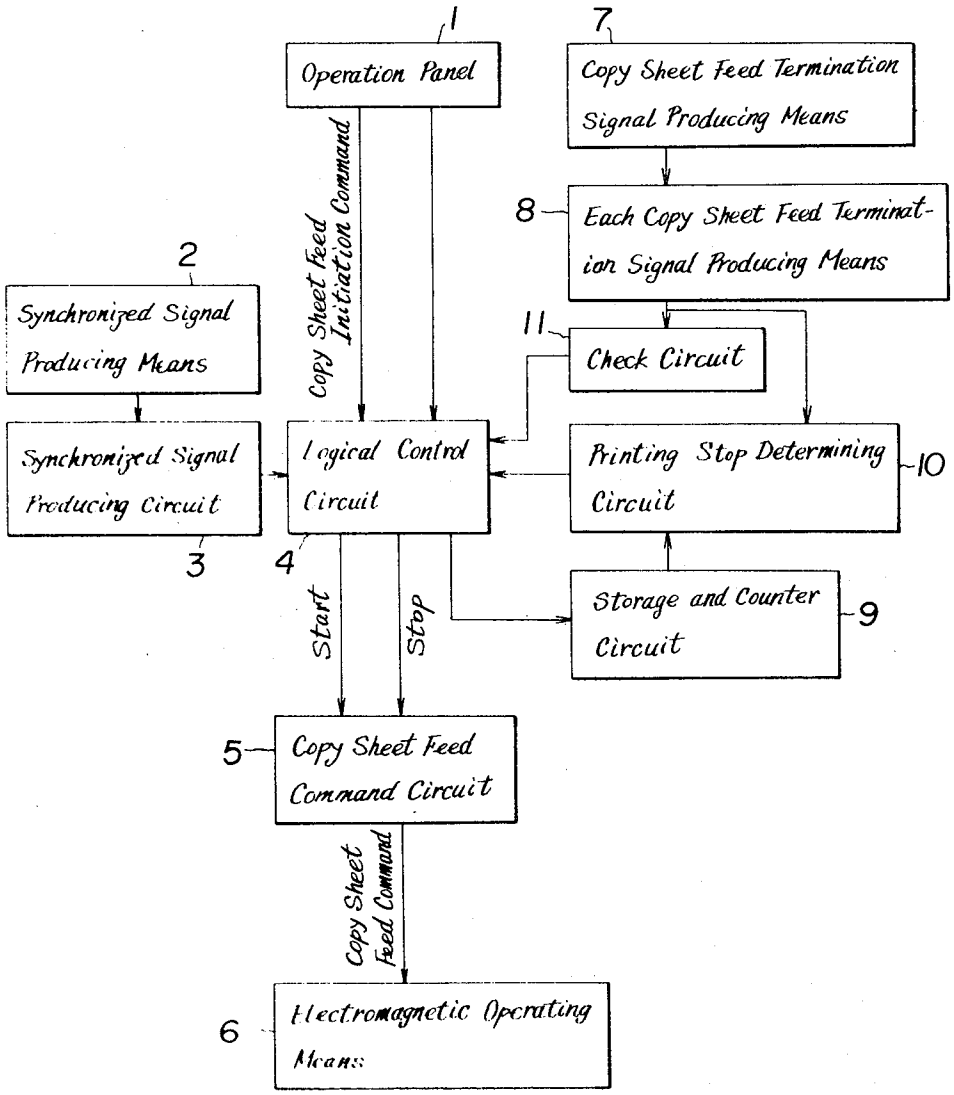


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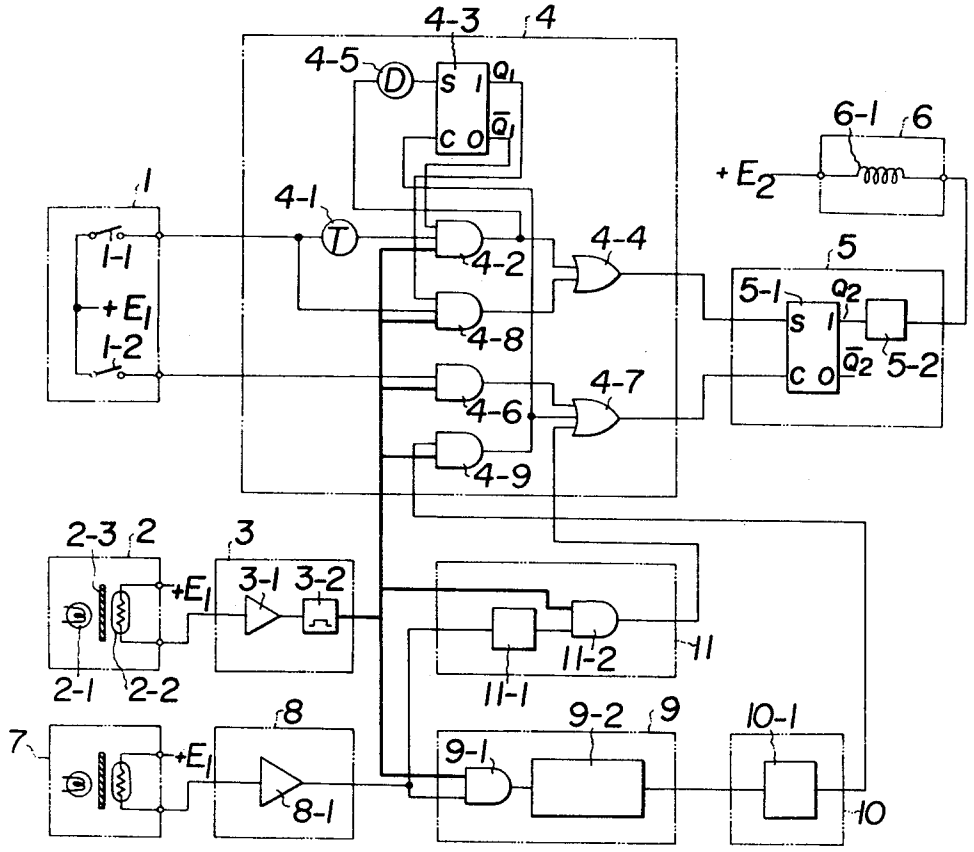
SHEET 1 OF 2

FIG. 1



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FIG. 2



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DEVICE FOR CONTROLLING THE FEEDING OF COPY SHEETS TO A SMALL OFFSET PRINTING MACHINE

BACKGROUND OF THE INVENTION

When a printing operation is performed, using a rotary offset printing machine, the present practice is first to apply an ink repellent etching solution to a master plate mounted on a master cylinder, then to apply ink to the master plate, and then to transfer an ink image from the master plate to a blanket cylinder. Copy sheets are fed successively, by a copy sheet feed device, between the blanket cylinder and an impression cylinder pressing against the blanket cylinder. Thereby, the ink image on the blanket cylinder is printed on the copy sheets by transfer printing.

Prior to the present invention, it has been customary to start and stop the feed of the copy sheets by operating the copy sheet feed device by manipulating a lever. In a high-speed offset printing machine, in which feeding of copy sheets is automated, it is necessary to effect control of the feed of copy sheets in chronological sequence, either mechanically or electrically, from outside the copy sheet feed device.

SUMMARY OF THE INVENTION

This invention relates to printing operations using rotary offset printing machines and, more particularly, to a novel device for controlling the feeding of copy sheets to an offset printing machine and in which the feeding of the copy sheets is automated.

In accordance with the invention, the feeding device electrically controls the feeding of copy sheets responsive to synchronizing signals which are synchronized with the angular rotation of a cylinder, and which synchronizing signals or pulses are produced in timed relation to the feeding of the copy sheets. The operation of counting the number of copy sheets printed, the checking of the starting and stopping of the printing operation, and the control of the feeding of each copy sheet can be performed in a positive manner.

Stated another way, the invention copy sheet feeding device involves a device for effecting control of the timing of the feeding of copy sheets, the counting of printed copy sheets and the checking of the condition of feeding of the copy sheets by means of synchronizing pulses which are synchronous with the angle of rotation of a cylinder of the printing machine, and by means of a logic circuit. The advantages of the invention include that of being able to perform, positively and readily, a copy sheet feed operation in an automated offset printing machine, and to effect control of the feeding of the copy sheets in synchronism with the rotation of a cylinder of the printing machine irrespective of variations in the rate of such rotation.

An object of the invention is to provide an improved automatic device for feeding copy sheets to an offset printing machine.

Another object of the invention is to provide such a feeding device in which the sheets are fed under the control of synchronizing pulses which are synchronized with the rotation of a cylinder of the printing machine and irrespective of variations in the rate of such rotation.

A further object of the invention is to provide such a feeding device including control and checking means

operatively interrelated through a logic circuit to control the operation of the feeding device.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the Drawing:

FIG. **1** is a schematic block diagram of an electric circuit for controlling the feeding of copy sheets in accordance with the invention; and

FIG. **2** is a schematic wiring diagram of one embodiment of the electric circuit shown in block form in FIG. **1**.

DESCRIPTION OF A PREFERRED EMBODIMENT

As mentioned above, the feeding of copy sheets to an offset printing machine is effected, by actuating a copy sheet feed lever for operating a feed roller of a copy sheet feed device, by means of a copy sheet feed cam secured to a blanket cylinder of the offset printing machine, so that the copy sheets can be fed, one after another, between the blanket cylinder and a cooperating impression or pressing cylinder or cylinders. In accordance with the invention, an electromagnetic operating means **6**, for example a solenoid **6–1**, as shown in FIG. **2**, is operated to start and stop a printing operation or to start and stop the copy sheet feed lever in slaved relation to the copy sheet feed cam of the offset printing machine.

In an automated offset printing machine, in which a copy sheet feed step is initiated automatically upon completion of the etching and inking steps of the printing machine, following depression of a printing"start" button **1—1** (FIG. **2**) on an operation panel **1** (FIG. **1**), a command to start the printing operation is supplied to the electromagnetic operating section **6** when the time set by a timer **4–1** for the etching step has run out. It is essential to control the timing of the actuation of the electromagnetic operating means **6** so that the leading edge portion of a first copy sheet is properly gripped by pawls provided on the impression cylinder. The copy sheet feed cam, previously mentioned, rotates with the blanket cylinder as a unit, so that the position of the feed cam is related to the angle of rotation of the blanket cylinder. Accordingly, it is possible to perform feeding of copy sheets positively and readily if the operation of the copy sheet feed device, started by the operation of the copy sheet feed cam, is controlled in a manner based on the angle of rotation of the blanket cylinder. This end, of effecting control of the timing of the feeding of copy sheets, can be attained by transmitting, to the electromagnetic operating means **6** for starting a copy sheet feed operation, signals which are synchronous with the angle of rotation of the blanket cylinder, in chronological sequence.

In FIG. **1**, synchronizing signal producing means **2** is adapted to produce one signal for each complete revolution of the blanket cylinder. The synchronizing signal producing means **2**, as best seen in FIG. **2**, may comprise a lamp **2–1** serving as a light source juxtaposed on a fixed member of the printing machine, a photoelectric transducer element **2—2**, and a sector blade **2–3** adapted to pass between lamp **2–1** and element **2—2** in sychronism with the rotation of the blanket cylinder. A variation in the output of photoelectric transducer ele-

ment 2—2, occurring when light from lamp 2–1 incident thereupon is intercepted by sector blade 2–3, may be used as a synchronizing signal.

Signal producing means 2 may be used also for reading the number of copy sheets, set to be printed for a master plate and marked on the master plate. Either the leading end or the trailing end of the output pulse or signal of photoelectric transducer element 2—2 may be used as a synchronizing signal in accordance with the present invention. Thus, in a printing machine in which the timing of initiation of copy sheet feed differs from the timing of termination of copy sheet feed, the leading end of the output pulse may be used as synchronizing signal for starting printing, and the trailing end of the pulse may be used as a synchronizing signal for stopping printing.

Alternatively, the synchronizing signal of the present invention may be produced by cooperation between a limit switch and an operating member, and it is to be understood that the synchronizing signal producing means of the invention is not limited to the specific embodiments shown and described herein, as any suitable means may be used as long as one synchronizing signal is produced for each complete revolution or rotation of the blanket cylinder. Furthermore, while the operating member for the synchronizing signal producing means has been described as mounted on the blanket cylinder in the particular embodiments illustrated by way of example, it should be understood that the operating member may be mounted on any other cylinder of the printing machine as long as all of the cylinders of the machine rotate in synchronism with each other.

The synchronizing signals produced by means 2 are converted into synchronizing pulses by a synchronizing signal producing circuit 3, and are transmitted to a logic control circuit 4. For this purpose, the output of photoelectric transducer element 2—2 is amplified by an amplifier 3–1 and converted into a one-shot pulse by a one-shot pulse producing circuit 3–2. As mentioned, timer 4–1 produces a signal after the time set for etching and inking has elapsed following the depression of printing starting button 1—1, shown in FIG. 2, and a command to initiate the feeding of copy sheets is transmitted to an AND circuit 4–2 of logic control circuit 4. At this time, a flip-flop circuit 4–3 is cleared so that $\overline{Q1}$ is set at 1. Thus, the gate is opened for the synchronizing pulse to supply a signal through an OR circuit 4—4 to a copy sheet feed command circuit 5. Upon receipt of this signal at set input S of a flip-flop circuit 5–1 of command circuit 5 Q2 is converted to 1, so that a command, to start the feeding of copy sheets, is given to electromagnetic operating means 6 through a driver circuit 5–2 of a solenoid 6–1. In this manner, the supply to copy sheets to the impression cylinder is initiated and, at this time, the output signal of AND circuit 4–2 is supplied, with a delay by a delay circuit 4–5, to set input S of flip-flop circuit 4–3 so as to set Q1 of flip-flop circuit 4–3 at 1.

A manual operation button 1–2 is provided on operation panel 1 for temporarily stopping the feeding of copy sheets and then restarting the feeding manually. If button 1–2 is depressed, then a signal, for stopping the feeding of copy sheets, is supplied to an AND circuit 4–6 of logic control circuit 4, where it is combined with the synchronizing pulse from the blanket cylinder. The output signal of AND circuit 4-6 is supplied to copy sheet feed command circuit 5 through an OR circuit 4–7. This clears flip-flop circuit 5–1, converting Q2 to 0, so that driver circuit 5–2 reverses its action to give a command to electromagnetic operating means 6 for stopping temporarily the feeding of copy sheets. If a command to restart the feeding of copy sheets is supplied to logic control circuit 4 by operation of button 1—1, an AND circuit 4–8 opens the gate for the synchronizing pulse from the blanket cylinder, because Q1 of flip-flop circuit 4–3 has already been converted to 1, so that the synchronizing pulse is passed through OR circuit 4—4 and transmitted to copy sheet feed command circuit 5 for restarting the feeding of copy sheets.

The copy sheet feed device of the invention also includes copy sheet feed termination signal producing means 7, which is adapted to detect the mechanical movement of the copy sheet feed device and produce a copy sheet feed termination signal each time a copy sheet is fed to the impression cylinder. This again may comprise a light source, a photelectric transducer, and a sector blade or the like moved in accordance with feeding of the copy sheets. The output signal of means 7 is amplified by an amplifier 8–1 of a copy sheet feed termination signal producing circuit 8, and is supplied to an AND circuit 9–1 of a memory and counter circuit 9 where it is combined with the synchronizing pulse from the blanket cylinder. The combined signal is transmitted to a subtraction counter 9–2.

Memory and counter circuit 9 is one in which the number of copy sheets set to be printed for a particular master plate is stored in advance, and the number of copy sheets actually printed is subtracted from the stored number each time the copy sheet feed termination signal is produced. The information stored in memory and counter circuit 9 is constantly supplied to a printing termination determining circuit 10. When the number stored in the circuit 9 is reduced to zero, or when a predetermined number of copy sheets has been printed, a decoder circuit 10–1 of circuit 10 produces a signal which is transmitted to an AND circuit 4–9 of logic control circuit 4 to control electromagnetic operating means 6, through OR circuit 4–7, in the same manner as would be the case if a copy sheet feed termination signal were provided by operating feed termination button 1–2 on panel 1. At the same time, flip-flop circuit 4–3 is cleared, thereby terminating one cycle of the copy sheet feeding operation.

The copy sheet feed device also includes a check circuit 11 provided for the purpose of ascertaining whether the copy sheet feed termination signal, amplified by amplifier 8–1, is synchronous with the synchronizing pulse from the blanket cylinder, or whether the position and other conditions of the copy sheet fed to the cylinder are normal when the copy sheet feed termination signal is produced. When the copy sheet feed termination signal is not produced after each copy sheet is fed to the impression cylinder, the output of a NOT circuit 11–1 is converted to 1 and opens the gate for the sychronizing signal at an AND circuit 11–2, so that feeding of copy sheets is stopped through OR circuit 4–7. If the timing of the feeding of copy sheets is erroneous and the copy sheet fed to the impression cylinder is not in synchronism with the synchronizing pulse from the cylinder, so that the copy sheet is not gripped by the pawls on the impression cylinder in a normal manner, then check circuit 11 is actuated so as temporarily to stop the printing operation.

Summarizing, a signal is transmitted to copy sheet feed command circuit 5 from storage and counter circuit 9 when a predetermined number of copy sheets has been printed. A signal is also transmitted to copy sheet feed command circuit 5 when copy sheet feed temporary stopping button 1-2 on panel 1 is operated. Similarly, a signal is transmitted to copy sheet feed command circuit 5 from check circuit 11 when the manner in which copy sheets are fed to the impression cylinder is not according to plan. Upon receipt of any one of the three signals mentioned above, the printing operation is stopped or the feeding of copy sheets is stopped.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. For use with an offset printing machine of the type including a rotatable cylinder making one complete revolution during each printing of a copy sheet, feeding means operable to feed copy sheets to be printed in synchronized relation with rotation of the cylinder, and means operable to etch and ink a master cylinder as an initial printing operation step; a device for controlling the feeding of copy sheets, comprising, in combination, operating means controlling activation and deactivation of said feeding means; start means connected to a source of electric potential and operable to supply a start print signal; timing means connected to said start means and activated by said start print signal, said timing means, when thus activated, being operable to supply a time signal at the completion of the etching and inking operation; pulse generating means operatively associated with said rotatable cylinder and providing a synchronizing pulse each time said rotatable cylinder completes one such revolution; a logic circuit connected to said start means, said timing means and said pulse generating means; said logic circuit including a first flip-flop having a set input and a clear input, a set output producing a 1 signal responsive to a "set" input signal, and a clear output producing a 1 signal responsive to a "clear" input signal, with each output producing a 0 signal when the other output produces a 1 signal, and a plurality of AND members each having first inputs connected in parallel to said pulse generating means to receive said synchronizing pulses, said AND members including a first AND member having a second input connected to said timing means, a third input connected to said clear output of said first flip-flop, and an output, and further including a second AND member having a second input connected directly to said start means in parallel with said timing means, a third input connected to said set output of said first flip-flop, and an output; said logic circuit further including a first OR member having respective inputs connected to the outputs of said first and second AND members and having an output; logic means connecting said first OR member output to said operating means to activate said feeding means responsive to an output signal from said first OR member; said logic circuit also including a delay circuit connecting the output of said first AND member to the set input of said first flip-flop; and temporary stop means connected to said source and to said logic means and operable to supply a stop print signal to said logic means to deactivate said feeding means following activation of said feeding means responsive to a start print signal; whereby, responsive to operation of said start means, said timing means supplies a time signal to said first AND member, said clear output provides a 1 signal to said first AND member, and, upon receipt of a synchronizing pulse at its first input, said first AND member applies an output signal to said first OR member to activate said feeding means, and supplies an output signal through said delay circuit to said set input of said first flip-flop to change the signal at said set output thereof to 1; said start means, when operated following operation of said temporary stop means, supplying an input signal directly to the second input of said second AND member with the third input of said second AND member being supplied with a 1 signal from said set output of said first flip-flop so that, upon receipt of a synchronizing pulse at its first input, said second AND member supplies an output signal to said first OR member to re-activate said feeding means.

2. A device for controlling the feeding of copy sheets, as claimed in claim 1, in which said AND members further include a third AND member having a second input connected to said temporary stop means and having an output; said logic circuit further including a second OR member having a first input connected to the output of said third AND member and having an output connected to said logic means to supply a stop print signal to said logic means responsive to simultaneous appearance of a synchronizing pulse at the first input of said third AND member and a temporary stop signal at the second input of said third AND member.

3. A device for controlling the feeding of copy sheets, as claimed in claim 2, in which said logic means includes a second flip-flop having a set input connected to the output of said first OR member and a clear input connected to the output of said second OR member and a driver circuit connecting a set output of said second flip-flop to said operating means; the set output of said second flip-flop producing a 1 signal responsive to a set input signal and producing a 0 signal responsive to a clear input signal.

4. A device for controlling the feeding of copy sheets, as claimed in claim 3, including signal generating means operatively associated with said feeding means and providing a copy sheet feed termination signal each time a copy sheet is fed to be printed; a counter operable to store a predetermined number of copy sheets to be printed; gate means connected to said signal generating means and to said pulse generating means and operable, responsive to coincidence between a synchronizing pulse and a copy sheet feed termination signal to supply the copy sheet feed termination signal to said counter; said AND members further including a fourth AND member having a second input and having an output connected to a second input of said second OR member and to the clear input of said first flip-flop; and means connected to said counter and to said second input of said fourth AND member and operable, responsive to coincidence between said predetermined number and the number of copy sheet feed termination signals supplied to said counter, to supply a stop print signal to said second input of said fourth AND member; said fourth AND member, responsive to the simultaneous presence at its inputs of a stop print signal and a synchronizing pulse, supplying the stop print signal to the second input of said second OR member for supply of the stop print signal to said operating means, and supplying a clear signal to said first flip-flop.

5. A device for controlling the feeding of copy sheets, as claimed in claim 4, in which said means connected to the output of said counter and to the second input of said fourth AND member is a decoder.

6. A device for controlling the feeding of copy sheets, as claimed in claim 4, in which said gate means comprises a fifth AND member having a first input connected to said pulse generating means, a second input connected to said feed termination generating means, and an output connected to said counter.

7. A device for controlling the feeding of copy sheets, as claimed in claim 6, including a checking circuit having respective inputs connected to said synchronizing pulse generating means and to said feed termination signal generating means, and having an output connected to a third input of said second OR member; said checking circuit, responsive to a lack of synchronization between a copy sheet feed termination signal and a synchronizing pulse, supplying a stop print signal to said third input of said second OR member to supply the stop print signal to said operating means.

8. A device for controlling the feeding of copy sheets, as claimed in claim 7, in which said checking circuit includes a NOT member having an input connected to said feed termination signal generating means and having an output; and a sixth AND member having a first input connected to said synchronizing pulse generating means, a second input connected to the output of said NOT member, and an output connected to said third input of said second OR member.

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