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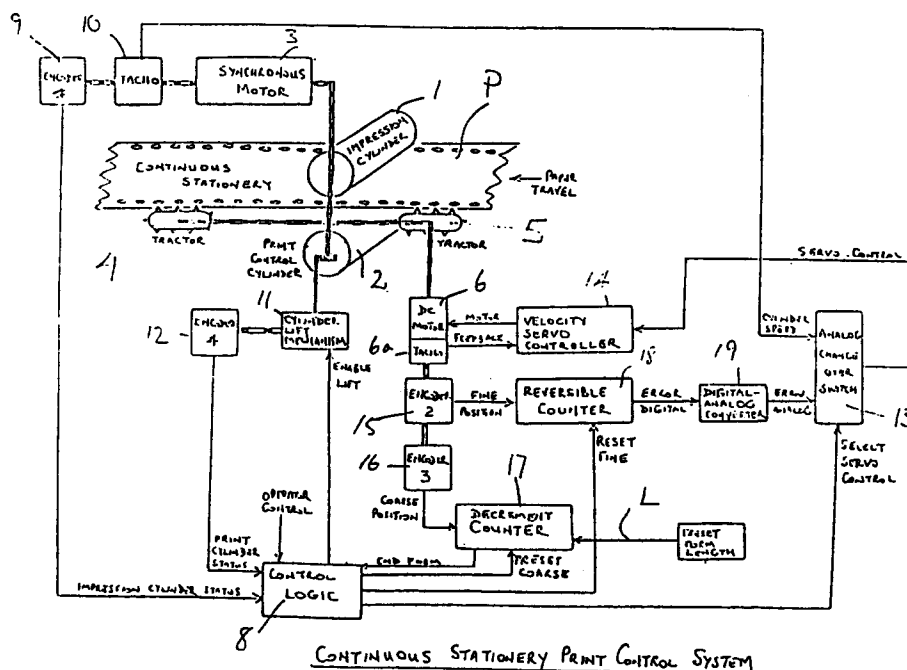
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54 A continuous stationery print control system.

57 A continuous sheet of stationery is fed between an impression cylinder (1) and a print control cylinder (2) by pin feed tractors (4 and 5) and of a printing machine. Printing is continuous and cyclic and, at the end of each cycle, control circuitry including control logic (8) and fine and course positional encoders (15) and is employed to determine any sheet overrun and to reposition the sheet in the correct position through the tractors (4 and 5) ready for the next cycle.

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A CONTINUOUS STATIONERY PRINT CONTROL SYSTEM

The present invention relates to apparatus for and a method of controlling repetitive registering a continuous feed of sheet material in a cyclic process. The invention is particularly, but not exclusively concerned with the printing of continuous stationery.

The applicants are already aware of printing machines in which individual separate sheets of paper are sequentially fed to the machine to be printed. A problem with converting such a machine to handle continuous stationery is that it is difficult to maintain the printing rollers of the machine and the form being printed in the correct relative position after each print cycle ready for the next print cycle.

According to one aspect of the present invention there is provided apparatus for controlling repetitive registering of a continuous feed of a sheet material means for moving the continuous sheet relative to a rotatable processing member, means for determining the position of the sheet material relative to the member, and control means for controlling the means for moving to reposition the sheet of material at the end of each processing cycle ready for the next processing cycle.

According to another aspect of the present invention

there is provided a method of controlling repetitive registering of a continuous feed of sheet material in a cyclic process including the steps of moving the sheet of material to be processed relative to a rotatable

5 . processing member, measuring the position of the sheet of material relative to the processing member and controlling the position of sheet at the end of each processing cycle ready for the next processing cycle.

10 In one embodiment of the invention as applied to a printing machine, a continuous sheet of stationery is fed between an impression cylinder and a print control cylinder, which forms the rotatable processing member. The means for moving the continuous sheet
15 comprises pin feed tractor units which cooperate with perforations provided in the sheet. The means for determining the position of the sheet comprises coarse and fine encoders. Advantageously, these optically detect the position and produce a corresponding
20 electrical signal. Preferably, a preset value representing the length of sheet or form to be printed per cycle is fed into a counter which is decremented by the coarse encoders as the cycle progresses. When the end of the form or sheet is detected the fine encoder
25 feeds the fine position into a reversible counter and that counter then accumulates the movement of the

tractor units past the end form position. The end form position can then be precisely returned to by reversing the tractor units a distance equal to the accumulated measurement.

5 The counter and encoders form part of a control system which also includes control logic for the control of the various functions of the system.

 In order that the invention may be more clearly understood, one embodiment thereof, will now be
0 described, by way of example, with reference to the single figure of the accompanying drawings. which shows a block circuit diagram of a continuous stationery print control system.

 A continuous sheet fed machine typically has
5 two cylinders driven by one synchronous motor, at a constant speed. The speed can be varied by the operator to give the desired quality of print.

 One cylinder carries the impression that is to be printed onto the paper. The other cylinder controls
0 the print. When a sheet arrives at the printing position, it is registered and when the impression is in the correct place, the print control cylinder allows the sheet of paper to move and to be printed. Normally on such machines the print control cylinder is manually
5 moved to the print position. One sheet is printed every revolution of the two cylinders.

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Referring to the drawing, the impression cylinder, print control cylinder and synchronous motor of the sheet fed machine are retained. These are respectively referenced 1, 2 and 3 in the drawing. An automatic control is provided for the print control system and two pairs of pin feed tractor units 4 and 5 are provided downstream and upstream of the cylinders 1 and 2 to drive the continuous stationery (referenced P) between those cylinders. These units 4 and 5 are driven by a D.C. servo motor 6 to which a tachometer 6a is attached. The automatic control and D.C. servo motor form part of the print control system, the other components of which will become apparent from the following description of the operation of the control system.

In operation the continuous stationery 7, is threaded between the two cylinders 1 and 2 on the two pairs of pin-feed tractors 4 and 5. Initially, the print control cylinder 2 is "down" and no printing takes place. The operator positions the paper such that the top of the form to be printed is in line with the centre line of the two cylinders. This point is known as "Top Form". The operator then commands printing to take place by an input to Control Logic 8.

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An encoder 9 is connected

to the synchronous motor 3 and provides a signal to the control logic 8 representative of the status of the impression cylinder 1. When the cylinder 1 is in the correct place the control logic produces an output signal enabling a cylinder lift mechanism 11 attached to the print control cylinder 2. When cylinder 2 has lifted in response to the enable signal, an encoder 12 indicates that printing is starting. A select servo control signal issues from the control logic 8, causing an analog change over switch 13 to select the impression cylinder speed signal. This signal is derived from the tachometer 10 which monitors the speed of the cylinders 1 and 2. The output from the analog change-over switch 13 is fed to a velocity servo controller 14 which causes the pin feed tractors 4 and 5 to be moved at the same speed as the peripheral speed of the cylinders 1 and 2. As the tractors 4 and 5 are moved, two positional encoders 15 and 16 record their movement. Encoder 15 is a fine position encoder (typically detecting four thousandth of an inch) and encoder 16 is a coarse position encoder (typically detecting one eighth of an inch). Both encoders are conveniently optical having a

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rotatable slotted or liner disc and associated detector.

A value L representing the length of form to be printed is initially fed into a decrementing counter 17. The output signal from the coarse position encoder 16 is fed into the decrementing counter 17. When the "End Form" is detected, the result is passed to the control logic 8. While the counter 17 is measuring form length a reversible counter 18 is held re-set. When "End Form" occurs, counter 18 accumulates the difference between the form length and the movement produced by the tractors 4 and 5. The difference in effect represents the overrun of the continuous stationery past the "End Form" position.

At the end of the print cycle, the print control cylinder 2 is mechanically tripped. The trip position is mechanically adjustable in increments of one inch and is normally set to correspond within one inch of the present-form length. As a result the counter 18 at the end of each print cycle contains a maximum value corresponding to one inch. Encoder 12 detects that the print cycle is complete from the position of the cylinder lift mechanism 11 and the select servo control signal switches over the analog change over switch 13. The error or overrun signal from the

reversible counter 18 is converted into a d.c.voltage, by a digital to analog converter 19 which is then applied by the switch 13 to the velocity servo controller 14.

5 The sense of this voltage is such that encoder 15 operates by a d.c.motor 6 as a positional error detector. As a result, the tractors 4 and 5 are reversed by d.c. motor 6 to position the paper at the "End Form" position. This point is also "Top Form" of the next form to be printed. They are then held in this position ready for the next cycle. This occurs when encoder 12 detects that the cylinder 2 has lifted.

By this means the continuous stationery is moved one form length every cycle to an accuracy determined by the fine position encoder. In addition, as each form is measured by the coarse encoder, the fine inaccuracies are non-cumulative. To stop printing, the enable lift signal from logic 8 is returned to normal. This can either be commanded by the operator or automatically set by the control logic 8 when a pre-determined number of forms have been printed.

It will be appreciated that the above embodiments has been described by way of example only and that many variations are possible without departing from the scope of the invention.

CLAIMS

1. Apparatus for controlling repetitive registering of a continuous feed of a sheet material(7) comprising means for moving(4,5) the continuous sheet relative to a rotatable processing member(2), characterised by means for
5 determining(15,16) the position of the sheet material(7) relative to the member(2), and control means for controlling(8,17,18) the means for moving(4,5) to reposition the sheet of material(7) at the end of each
10 processing cycle ready for the next processing cycle.
2. Apparatus as claimed in claim 1, in which the means for determining the position of the sheet material relative to the member comprises fine and course position encoders(15,16).
3. Apparatus as claimed in claim 2, in which the encoders
15 (15,16) optically detect sheet position and produce a representative electrical signal.
4. Apparatus as claimed in claim 2 or 3, in which the control means comprises a counter(17) into which a preset value representing a length(L) of sheet or form to be printed is fed
20 and which is decremented by the course encoder(16) as each

processing cycle progresses and by means of which the position of the end of the length of sheet or form may be detected.

5. Apparatus as claimed in claim 4, in which the control
5 means comprises a reversible counter(18) into which a signal from the fine position encoder(15) may be fed to record the movement of the means for moving(4,5) past the end of sheet or form position whereby by reversing the movement of the means for moving(4,5) a distance equal to this recorded movement
10 the sheet may be returned to the correct end position.

6. Apparatus as claimed in any preceding claim, in which the means for moving the continuous sheet comprises pin feed tractor units(4,5) which cooperate with perforations provided in the sheet.

15 7. Apparatus as claimed in any preceding claim, in which the rotatable processing member is the print control cylinder(2) of a printing machine.

8. A method of controlling repetitive registering of a continuous feed of sheet material in a cyclic process
20 including the steps of moving the sheet of material to be processed relative to a rotatable processing member(2),

characterised by measuring the position of the sheet-material(7) relative to the processing member(2) and controlling the position of sheet at the end of each processing cycle ready for the next processing cycle.

- 5 9. A method as claimed in claim 8, in which the overrun of the sheet of material relative to the end of the sheet or form position at the end of each cycle is measured and the sheet is reversed a distance equal to the overrun to bring it back to the correct end position.
- 10 10. A method as claimed in claim 8, in which the correct end position is determined by a counter(17) into which a value equal to the length(L) of a sheet or form is fed which value is progressively decremented as each cycle processes, and the overrun is determined by a reversible counter(18) which
15 begins counting at the correct end position.

