Europäisches Patentamt

(19) European Patent Office

Office européen des brevets

(11) Publication number: **0 009 528**
A1

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: 78300518.4

(22) Date of filing: 18.10.78

(51) Int. Cl.³: **B 65 H 43/00**
B 65 H 31/24, B 07 C 3/00
G 03 G 15/00, G 06 K 13/06

(54) Jam detection system for a continuous paper sorting machine.

(57) Jam detection system for a continuous paper sorting machine in which the receiver (16) is comprised of stacks of paper storage trays (36) with entrances for receiving paper sheets from a feeder (14). The receiver (16) moves relative to the feeder mechanism (14), such that the bin entrances move past sheet feeder deflectors and guides (34). The feeder (14) has an infeed conveyor (24) from a press or duplicator (12) which moves the sheets for directing the copies either into a proof tray (20) or on into the feeder (14). The sheets are then fed to an intermediate conveyor (26 or 28) and from there to a reversible generally vertically disposed feeder conveyor (32). Sensors (40, 42 and 44) are included in the sorting machine at predetermined locations as part of the control system and for jam detection. The jam detection system is designed to provide a visual read-out code for indicating the nature of and likely location of a paper jam.

EP 0 009 528 A1

./...

Fig. 3
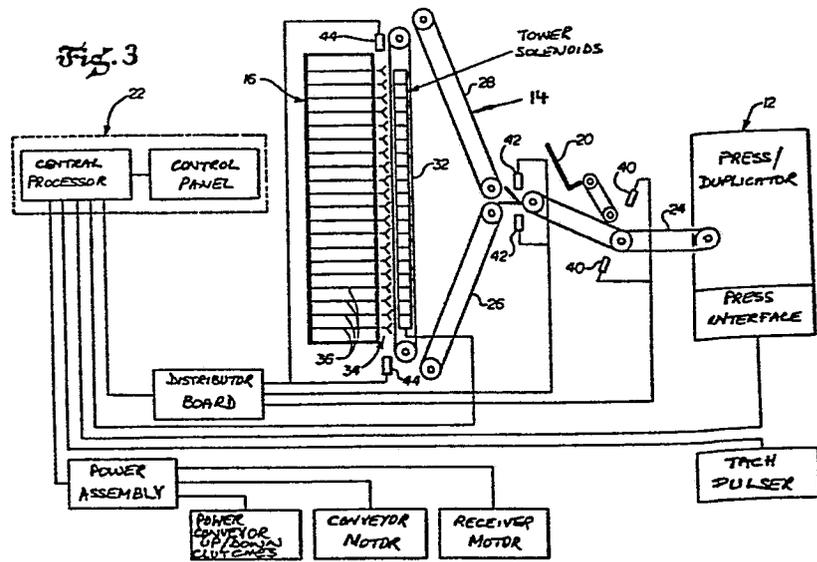
- 1 -

"Jam Detection System for a Continuous Paper Sorting

Machine"

This invention relates to sheet distributing or

sorting devices and more particularly to an apparatus

which sorts continuously large numbers of multi-page

documents and in which a novel and unique jam detect-

ion system is incorporated in the machine controls.

Reference is made to the following copending United

States Patent Applications which are incorporated

herein and which are directed to other features of

the instant machine in which the jam detection system

is incorporated. They are:

1. "Continuous Paper Sorting Machine"
   Serial No.: 897,272, filed April 17, 1978;

2. "Bin Receiver Mechanism for a Continuous
    Paper Sorting Machine"
   Serial No.: 897,273, filed April 17, 1978;

3. "Feeding Mechanism for a Continuous Sorting
   Machine"
   Serial No.: 897,274, filed April 17, 1978; and

- 2 -

4.   "Paper Sheet Deflecting System for Sorter
      Mechanism"
      Serial No.: 897,275, filed April 17, 1978

Prior art paper distributors, sorters and/or

collators have encountered many problems. One is

that the large increase in the cost of labor and

materials has made it more imperative that the

available press or duplicator capacity be utilized

to its fullest. In order for the maximum volume

capability of a printing, duplicating, or copy

making machine to be utilized, it is necessary

that the sorter have the capacity to receive the

printer or copy making machine output without un-

due loss of press or copy making machine time.

0009528
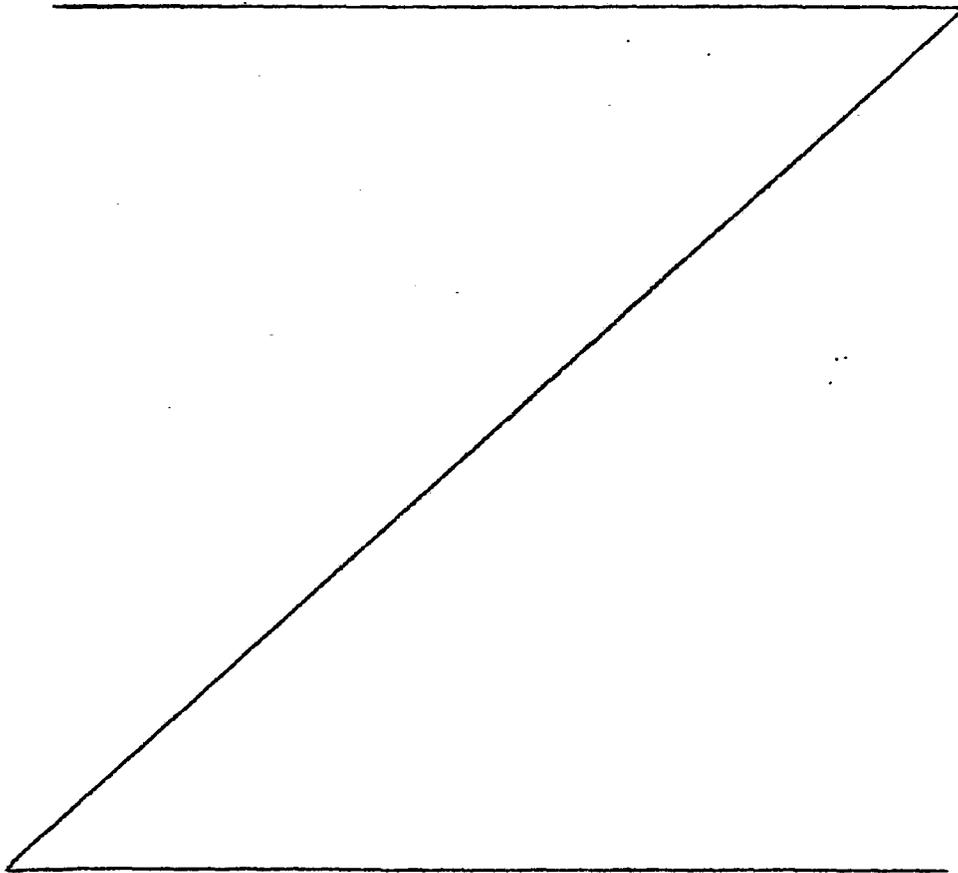
Areas of lost time would be those accounted for by
faulty or irregular transport of sheet copies and by
failure of the controls to detect nonprogrammed
occurrences such as sheets counted at entry to feeder

5   but not counted in tower. Others would be paper
sheets hanging up at deflector locations, stalling at
the entrances to trays and overlapping to name a few
of the irregularities.

Since there are different types of irregularities

10   which can occur, it is important that the operator
be able to locate the problem or irregularity area
for quick clearing of the machine. Those skilled in
the art will appreciate the savings in labor, time and
money if the output of a printing or copying center

15   is not impaired by long shutdowns to hunt for jams.

Among the prior art references which may be con-
sidered with respect to the features of this invention
are the following: United States Patent Nos. 3,988,018;
3,527,406; 3,905,594. The devices covered by the

20   above listed patents are considered to be nonanticipatory
of the teachings of this invention.

Summary

Jam detection system for a continuous paper sorting
machine, in which the receiver is comprised of at

25   least two columns of inclined side-by-side stacks of
paper storage trays with entrances for receiving paper
sheets from a feeder. The receiver is mounted
for lateral movement relative to the feeder mechanism,

such that the tray entrances move past the feeder in
a generally vertically plane. The feeder has an in-
feed conveyor from a press or duplicator which moves
the sheets of paper to a deflector which directs the
copies into a proof tray or on into the feeder. The
sheets are then fed upwardly or downwardly onto an
intermediate conveyor and from there to a reversible
generally vertically disposed feeder conveyor.
Sensors are included in the sorting machine at pre-
determined locations as part of the control system
and for jam detection. The jam detection system is
designed to provide a visual readout code on the con-
trol panel for indicating the nature of and likely
location of a paper jam.

Brief Description of Drawings

Figure 1 is a perspective outline view showing
the general arrangement and organization of the sorter
including both feeder and distributor sections;

Figure 2 is a detailed view of the control panel
for the machine, and

Figure 3 is a partial schematic and block diagram
showing major subcircuit or component sections of
the control system.

Description of the Preferred Embodiment

Referring now to the drawings and particularly to
Figures 1 and 3, it will be seen that the sorter
mechanism is generally designated by the number 10 and
5   receives paper copies from a duplicator or press
device generally designated by the number 12. A feeder
section of the sorter is identified by the number 14
and a paper receiver mechanism is identified by the
number 16 which moves laterally back and forth on a
10   track structure 18. The feeder 14 includes a proof
tray assembly 20 and a control panel box 22 as well as
infeed conveyor 24 which feeds papers either to a
downwardly inclined intermediate conveyor 26 or an
upwardly inclined intermediate conveyor 28. A tower
15   section generally designated by the number 30 supports
a vertically disposed reversible feeder conveyor 32
together with tray deflectors and guides 34 and trays
36 in the receiver section 16. As can be seen, the
tower section 30 is supported on a base section 38.

20   As can be seen by reference to Figure 3, three
sets of photoelectric sensors are provided, one being
the light emitting diode and photo receiver sensor 40
at the entrance to the proof tray conveyor. A second
light emitting diode and photo receiver 42 are
25   previous to the junction of the up/down intermediate
conveyors 26 and 28 with the inner end of infeed con-
veyor 24. Light emitting diode 44 and photo receiver
44 are disposed generally parallel to the face of the

0009528

vertical up/down conveyor 32 and the deflector and
guides 34. The control panel as seen in Figure 3 is
provided with a vertical row of number or digit buttons
50 and a vertical row of selector buttons 52 corresponding

5   to indicator lights 54 and the parameter indicia 56
also seen in vertically arranged rows on the face
of the control console. Four sets of digital or
numeric three place readout displays 58 are provided
to correspond with the first four control parameter

10   indices seen in respect of number 56. To the left
of the control panel can be seen thumb switch 64 for
a "count adjust" which anticipates the number of
sheets which are in transit from the press or dup-
licator to the feeder after the press has been shut off.

15   Thumb switch 62 allows the operator to select the
number of copies for each master which will be directed
into the proof tray 20. Finally the third thumb
switch 64 allows the operator to tell the control
system the number of bins, that is modules of 100

20   trays, being used. A toggle switch 66 tells the con-
trol system which size trays are being used in the bin
modules.

For the purpose of providing a better understanding
of the jam detection system a brief description of the

25   operation will now be set forth.

The sorter has the ability to store the parameters
set forth as indicia by number 56. These parameters
will define specifics for sorting from one to nine
different jobs in sequence. Entry of the job parameters

0009528

is accomplished by a series of depressions of the various function and digit keys 52 and 59 on the panel. The operator receives direction and readout information from the different numeric parameter displays and condition indicators on the panel.

The first parameter associated with each sorting job is the "job" parameter which defines the job's position in the sequence of up to nine jobs which may be entered and stored in the machine's control memory. Jobs are executed in the same order in which they are entered.

The next parameter is the "first tray" parameter. This defines the position number or address of the tray which will receive the first sheet during sorting of a given job. Tray addresses may range from 0 to 600, with 0 denoting proof tray 20 shown in Figure 1.

The third parameter is "sets" and this defines the number of sets which will result from the sorting job. Sets values range from 1 to 600.

The fourth parameter is "pages" and this defines the number of pages (masters) in each set to be sorted during the job. "Pages" values range from 1 to the total number of sheets which can be fit into a maximum of two trays.

In order to enter parameters defining the jobs to be sorted, the operator must be sure that the system is in "enter" mode, signified by the fact that the "enter" indicator light 54 is lit. Once in the "enter" mode, the parameters for the various jobs must be entered

in order of increasing job number. The four parameters
for a given job must be sequentially entered in the
order seen as the first four indicia, that is "job",
"first tray", "sets," and "pages". A job will not be
accepted for sorting unless the operator has success-
fully entered each of the four parameters for that
job. After nine complete sets of job parameters have
been entered, the system will automatically go to the
"sort" mode. Next it will turn the "enter" indicator
54 off and the "sort" indicator 54 on, and wait for a
sort execution command from the operator. If the oper-
ator wishes to run fewer than nine jobs, he will press
"sort" following successful entry of the last parameter
of the last job to be sorted, whereupon the system
goes to "sort" mode.

The numeric values for "first tray", "sets" and
"pages" parameters can be entered one digit at a time
when their respective indicators are lit. When the
display 50 holds the value desired for that parameter,
the operator presses "enter" to record the parameter
for the current job being specified.

Depressing the sort key causes the receiver conveyor
to move into position for feeding paper into the first
tray address.

Jam Detection Action

In the "sort" mode the system is continuously
monitoring all events at the various sensors to see
if sheets are making their way through the sorter

without problem. Checks performed at the proof, up/ down. and tower sensors include counting each sheet that passes and measuring the amount of time each sheet is seen by each of the sensors. Whenever an irr-
5   egularity in the flow of sheets (i.e. jam) is detected, the system suspends current sorting operation and takes the following action:

1. Cause press feed interrupt to stop the flow of sheets into the sorter.

10   2. De-entergize proof deflectors to send any residual sheets due to press run out to the proof tray.

3. Deactivate both sorter clutches.

4. Turn off sorter conveyor belts.

5. Turn off receiver conveyor motor, terminating
15   any move in progress.

6. Turn on the "paper path" indicator lamp 54.

7. Display a number between 901 and 909 in the "first tray" display 58 which tells the operator by predetermined code the cause of the jam. Also, in
20   the "sets" numeric display 58 the operator is told the number of sets remaining which are to be completed at the time the jam occurred.

At this point, the operator must take corrective action, the nature of which depends upon the jam
25   condition being displayed in the first tray numeric display. It is then the operator's responsibility to remove all sheets from the conveyor and from the line of view of any of the sensors.

While in the jam mode, various panel keys may be

pressed, resulting in the following actions: **0009528**

(a) any key: pressing any key will cause the audio alarm to be turned off.

(b) stop/off: turn fans off.

(c) enter: returns the system to the job parameter entry mode causing any jobs previously held in memory to be not executed.

(d) paper path: first depression of this button 52 causes the receiver conveyor to move back to its home or zero switch to allow examination of the tower area. The second depression of this button causes the receiver conveyor to return to the position it was in when the jam occurred.

(e) continue: sorting may be resumed if all the sensors are found to be free of paper and when operator has removed all paper from sorter conveyor path. It must be noted that the receiver must be at its pre-jam position in order to resume sorting.

Upon successful jam recovery, the system resumes sorting by taking the following action:

(1) Turn off the "continue" and "paper path" indicator lamps 54.

(2) Re-display proper "first tray" for the job being sorted and redisplay the proper number of "sets" for that job.

(3) Turn on the conveyor belts and fans.

(4) After a one second delay, the controls activate the press feed.

(5) The system is returned to its pre-jam mode, either proof or sort.

The control panel will display automatically one
of the following nine jam conditions at the time a
jam occurs to indicate the location and nature of the
irregularity. The jam code number is displayed in the
"1st Tray" numeric display 58.

JAM NO.	CONDITION	ACTION
901	Sheet at proof sensor too long	Standard
902	Sheet at down/up sensor too long	Standard
903	Sheet at tower sensor too long	Standard
904	Sheet counts at tower and down/up sensors don't balance within alloted time after last sheet cleared down/up sensor	Find out where sheets are going after they leave down/up sensor region.
905	Sheet counts at tower and down/ up sensors differ by too many	Find out where sheets are going after they leave down/up sensor region.
906	Operator pressed STOP/OFF key	Standard
907	Sheet detected at tower sensor which was not counted at proof sensor	Standard. (But suggests possible more serious system malfunction)
908	Sheet detected at tower sensor which was not counted at proof sensor	Standard. (But suggests possible more serious system malfunction).
909	Zero or limit switch tripped by receiver conveyor at a time when it should not have been.	This condition causes the system to come to a complete half, since it denotes serious malfunctions, or too many bins. Restart is via machine reset only with all jobs parameters etc. lost.

Standard jam action requires that the operator do what is
necessary in order to remove all sheets from the sorter con-
veyor belts; then restart sorting process by pressing CONTINUE.

1. In a continuous paper sorting machine having
a feeder portion with an infeed conveyor leading from
a press/duplicator mechanism and a proof tray there-

5   above, and including upwardly and downwardly inclined
intermediate conveyors at the inner end of said infeed
conveyor and a generally vertical, reversible tower
conveyor with paper deflector and guide means, said
paper sorting machine also including a movable bin

10 receiver section with vertical stacks of paper trays
for receiving sheets of paper from said tower conveyor
feeder portion, the jam detection improvements com-
prising:

1)   first proof sensor means on said infeed

15 conveyor,

2)   second up/down sensor means near the inner
end of said infeed conveyor,

3)   third tower sensor means on said tower
conveyor,

20 4)   control means including a control panel
having visual read-out means thereon for indicating
by predetermined code the general nature and probable
location of a paper jam in said sorting machine when
such a jam occurs.

25 2. The jam detection improvements according to
Claim 1 and in which said control means, is able to
sense, and display on said visual readout means a

0009528

predetermined number of paper jam conditions in said sorting machine.

3. The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that a paper sheet was at said proof sensor for longer than a predetermined period.

4. The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that a paper sheet was at said down/ up sensor for longer than a predetermined period.

5. The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that a paper sheet was at said tower sensor for longer than a predetermined period.

6. The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that paper sheets counts at said tower and said down/up sensors did not balance within predetermined time after last sheet cleared down/up sensor.

7. The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that paper sheet counts at said tower and said down/up sensors differed by more than a predetermined number.

8.   The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that the machine was stopped by the operator depressing a stop/off switch.

9.   The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that a paper sheet was detected at said down/up sensor which was not counted at said proof sensor.

10.   The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that a paper sheet was detected at said tower sensor which was not counted at said proof sensor.

11.   The jam detection improvements according to Claim 2 and in which a jam detect and display code condition shows that a zero or limit switch was tripped by said movable receiver at a time when it should not have been.

12.   The jam detection improvements according to Claim 2 and in which while a jam condition is being displayed, said control means also displays the number of sets remaining to be completed at the time the jam condition occurred.
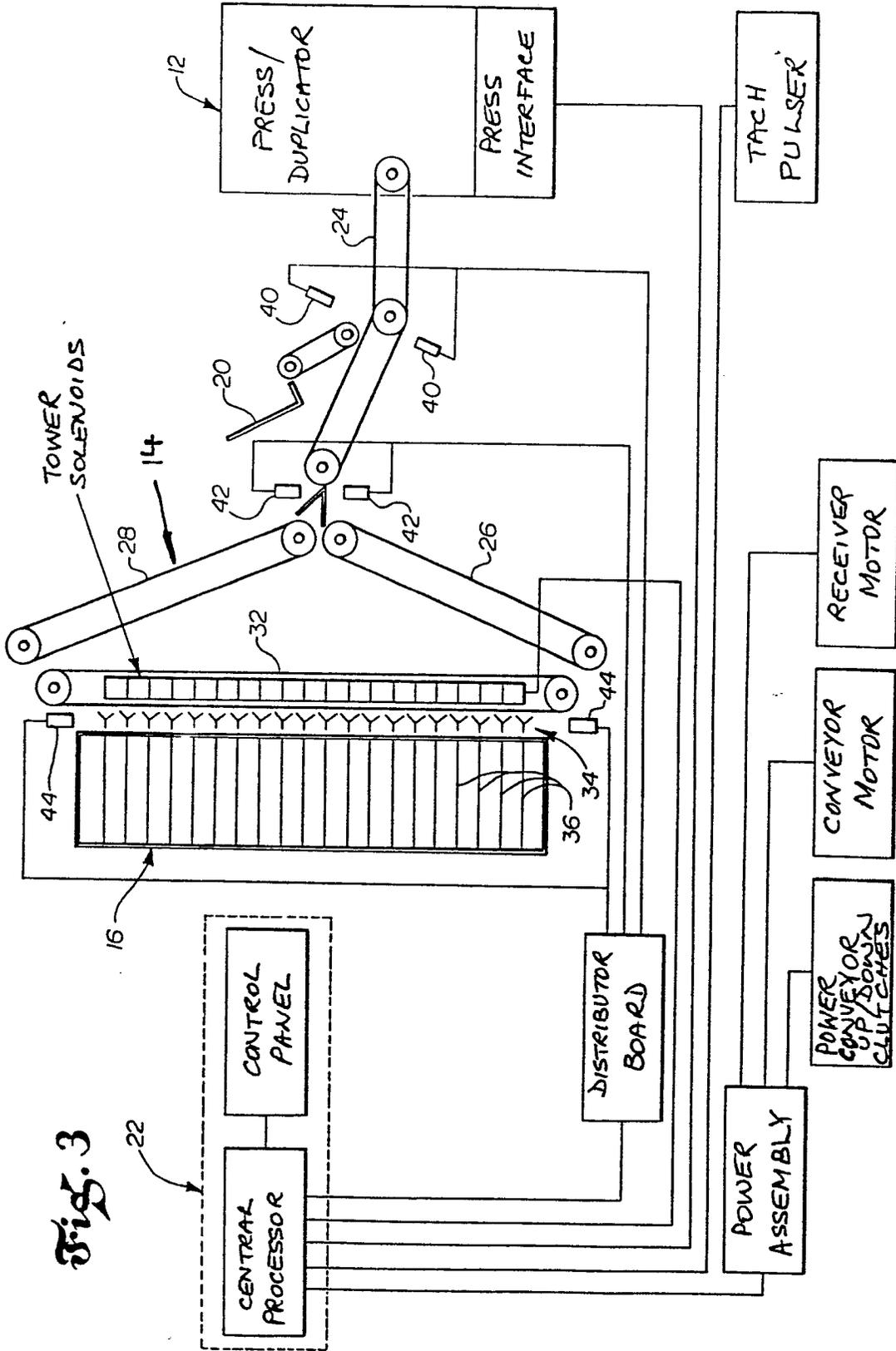
Fig.1

Fig.2

Fig. 3

European Patent
Office

EUROPEAN SEARCH REPORT

0009528
Application number

EP 78 300 518.4

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
D	US - A - 3 988 018 (R.J. TUSSO et al.) * abstract; fig 13 * --	1
D	US - A - 3 905 594 (E.D. DAVIS) * abstract; fig. 3 * --	1
	DE - B2 - 1 611 368 (RANK XEROX LTD.) * column 3, lines 41 to 63 * --	1,3
A	DE - B - 1 932 248 (XEROX CORP.) * claim 1 * ----	

DOCUMENTS CONSIDERED TO BE RELEVANT

CLASSIFICATION OF THE APPLICATION (Int. Cl.3)

B 65 H   43/00
B 65 H   31/24
B 07 C   3/00
G 03 G   15/00
G 06 K   13/06

TECHNICAL FIELDS SEARCHED (Int.Cl.3)

B 07 C   3/00
B 65 H   31/00
B 65 H   43/00
G 03 G   15/00
G 06 K   13/06

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search Berlin	Date of completion of the search 17-01-1980	Examiner BITTNER