US005983051A

United States Patent [19]

Mishima et al.

[11] Patent Number: 5,983,051

[45] Date of Patent: Nov. 9, 1999

[54] **IMAGE FORMATION APPARATUS EXECUTING PLURALITY REGISTERED JOBS IN ORDER**

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[73] Assignee: **Minolta Co., Ltd.**, Osaka, Japan

[21] Appl. No.: **09/127,894**

[22] Filed: **Aug. 3, 1998**

[51] **Int. Cl.**[6] **G03G 21/14**

[52] **U.S. Cl.** **399/83**; 399/81

[58] **Field of Search** 399/82, 83, 85, 399/87, 81

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,099,860	7/1978	Connin	355/14
5,669,040	9/1997	Hisatake	399/83
5,740,497	4/1998	Yamada et al.	399/87

Primary Examiner—Richard Moses

Attorney, Agent, or Firm—McDermott, Will & Emery

[57] **ABSTRACT**

A digital copy machine with a memory feature can have a plurality of jobs registered in a memory to execute the registered jobs in order. When the content of a job already registered in the memory is corrected, the time required for the job prior to correction and after correction is calculated. When the required time of the job is prolonged by the correction, execution of that job is deferred for a later execution. Thus, unexpected delay in processing another job can be prevented.

23 Claims, 33 Drawing Sheets

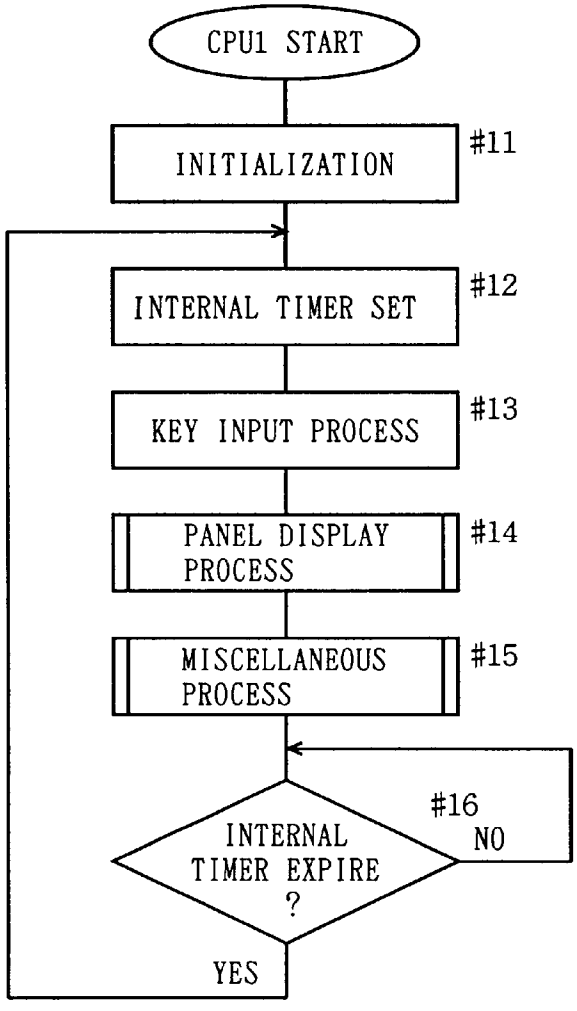
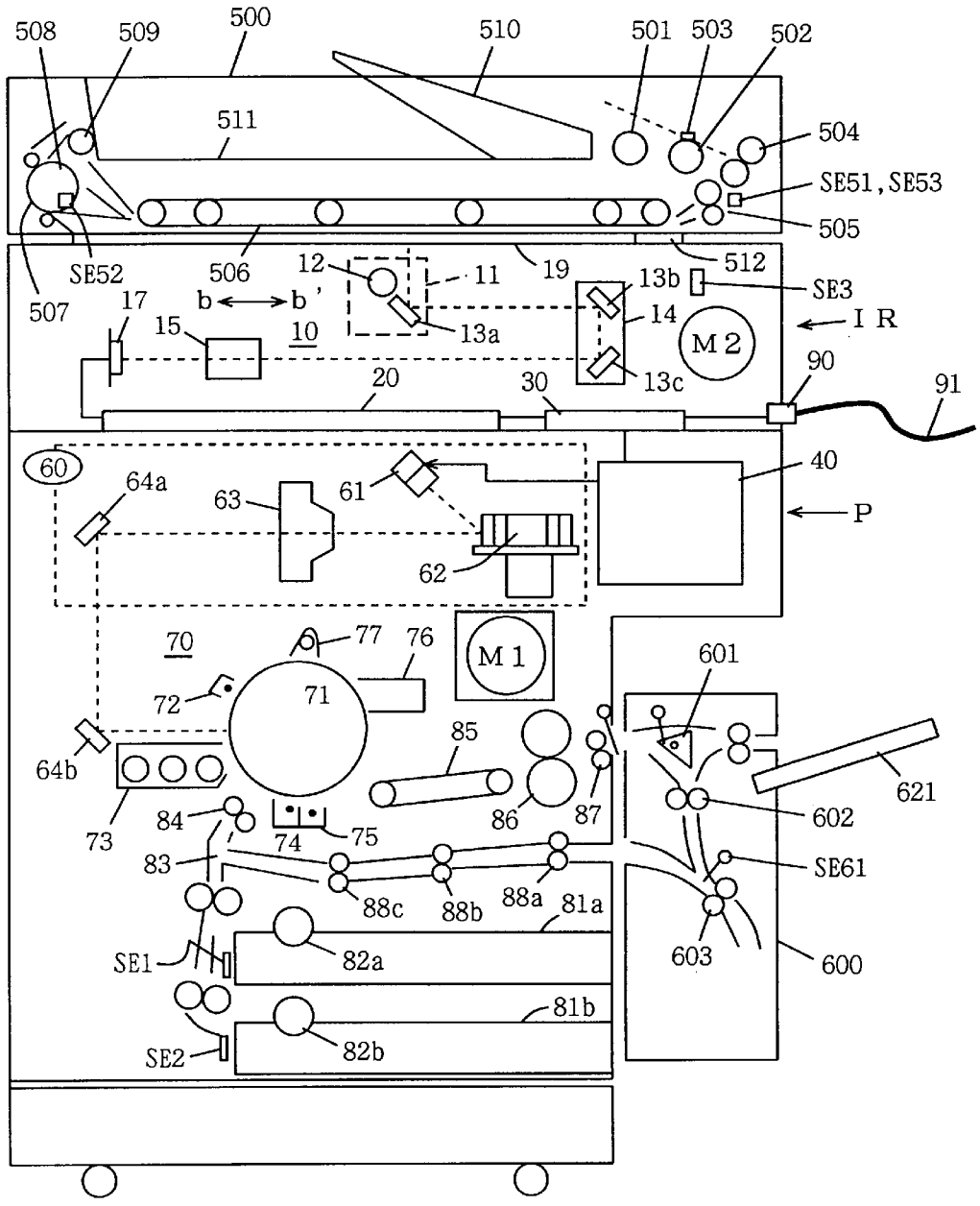


FIG. 1


508
509
500
510
501
503
502
511
504
SE51, SE53
505
512
SE52
506
12
11
19
13b
SE3
507
17
b ↔ b'
14
I R
15
10
13a
M 2
13c
90
91
20
30
60
64a
63
61
40
P
62
70
77
76
M 1
601
72
71
85
621
64b
602
73
84
74
75
86
87
83
SE61
88c
88b
88a
81a
SE1
82a
603
600
81b
SE2
82b

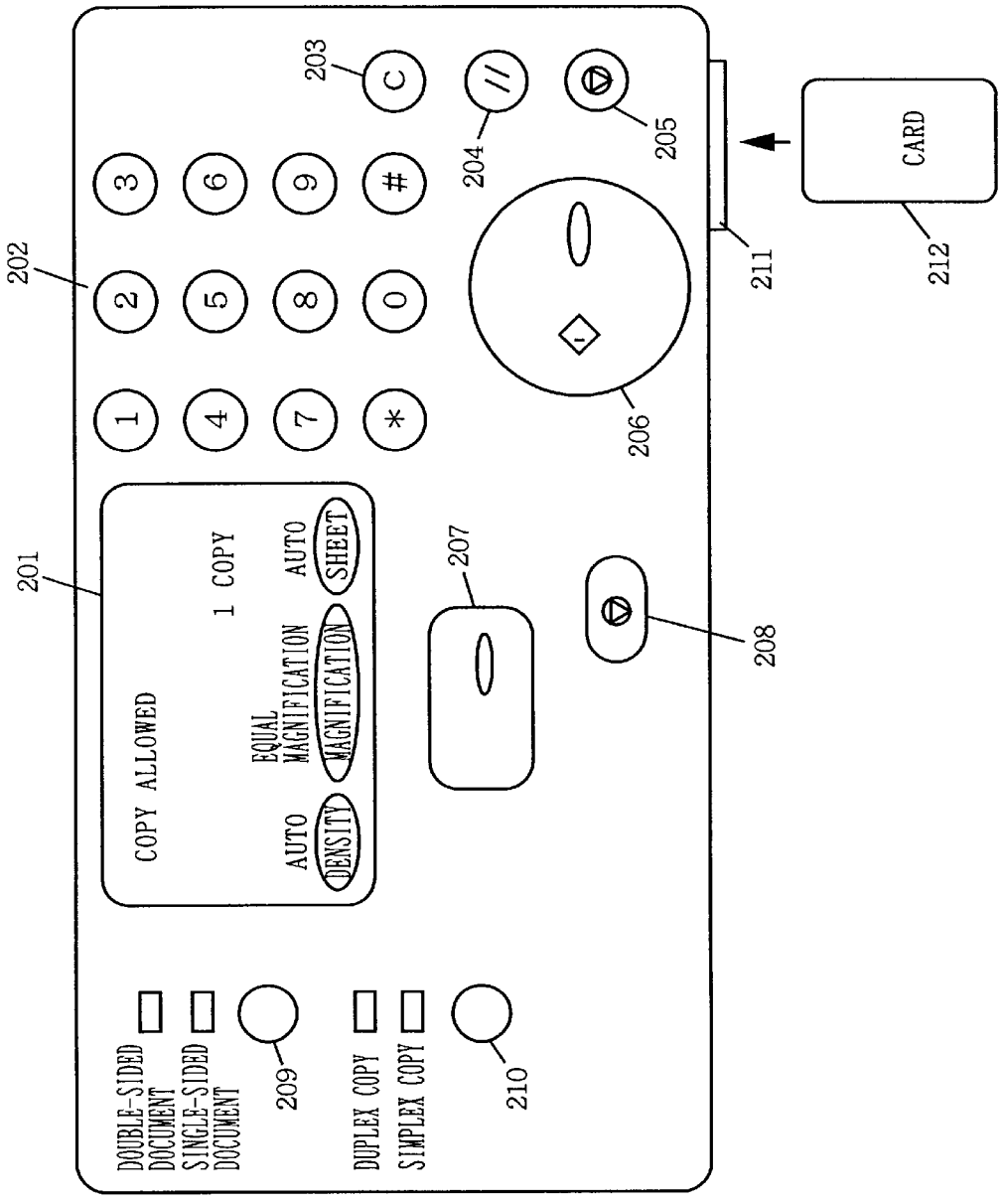

201
202
203
204
205
206
207
208
209
210
211
212
COPY ALLOWED
1 COPY
AUTO
DENSITY
EQUAL MAGNIFICATION
AUTO
SHEET
DOUBLE-SIDED DOCUMENT
SINGLE-SIDED DOCUMENT
DUPLEX COPY
SIMPLEX COPY
CARD

FIG. 2

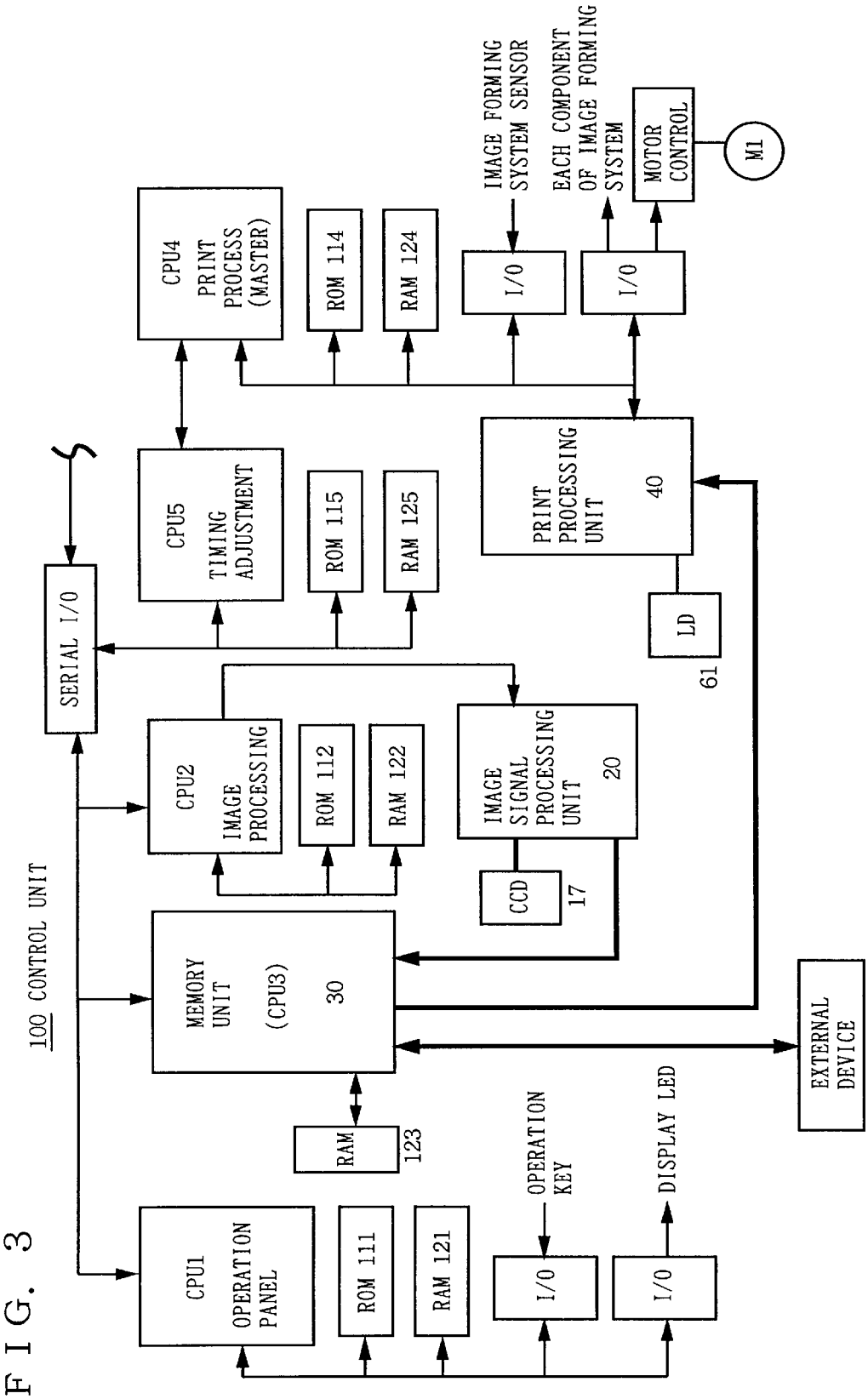

100 CONTROL UNIT
CPU1 OPERATION PANEL
ROM 111
RAM 121
I/O
OPERATION KEY
I/O
DISPLAY LED
RAM
123
MEMORY UNIT (CPU3) 30
EXTERNAL DEVICE
CPU2 IMAGE PROCESSING
ROM 112
RAM 122
IMAGE SIGNAL PROCESSING UNIT 20
CCD
17
SERIAL I/O
CPU5 TIMING ADJUSTMENT
ROM 115
RAM 125
PRINT PROCESSING UNIT 40
LD
61
CPU4 PRINT PROCESS (MASTER)
ROM 114
RAM 124
I/O
IMAGE FORMING SYSTEM SENSOR
I/O
EACH COMPONENT OF IMAGE FORMING SYSTEM
MOTOR CONTROL
M1

FIG. 3

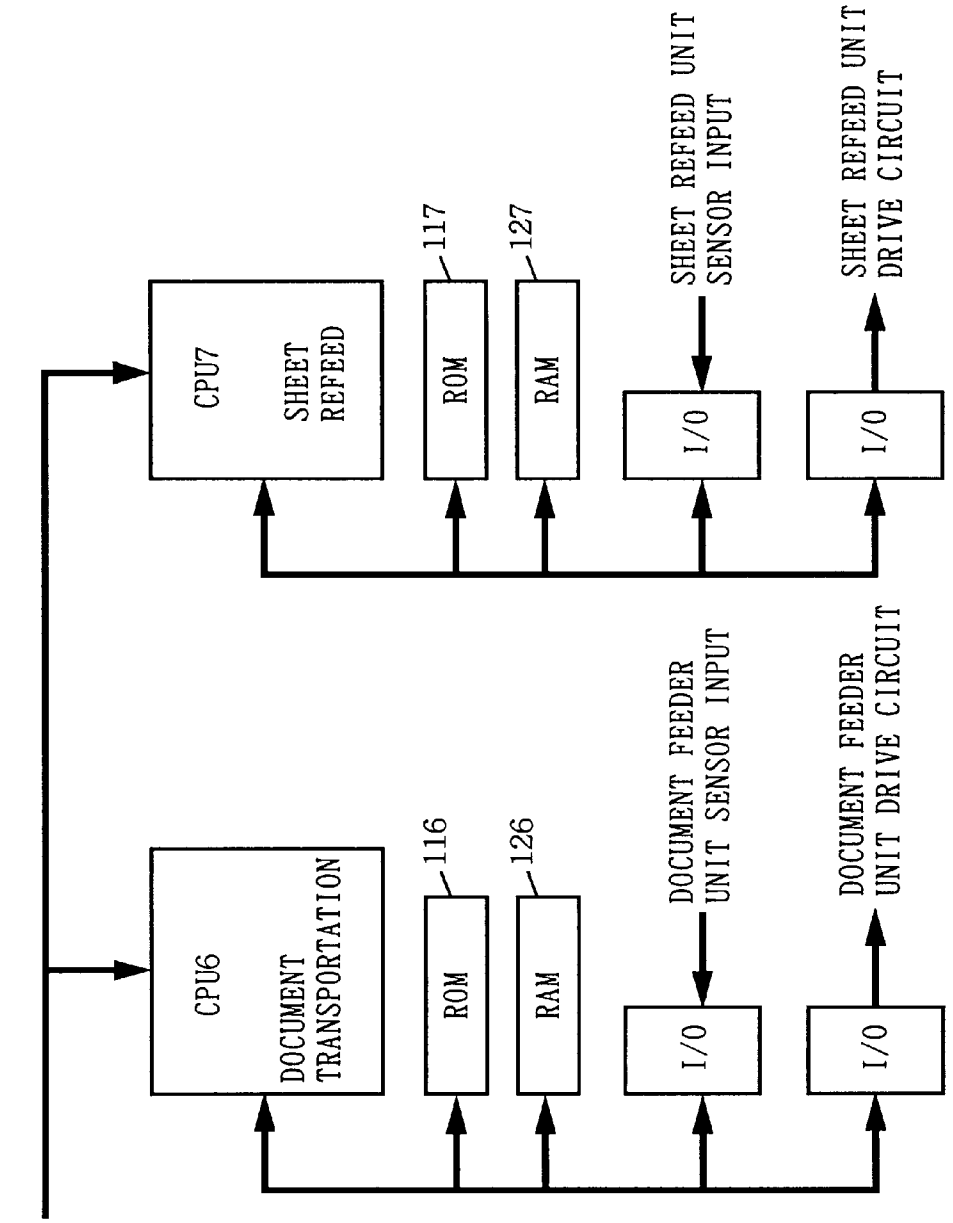

SERIAL I/O
CPU6
DOCUMENT TRANSPORTATION
ROM
116
RAM
126
I/O
DOCUMENT FEEDER UNIT SENSOR INPUT
I/O
DOCUMENT FEEDER UNIT DRIVE CIRCUIT
CPU7
SHEET REFEED
ROM
117
RAM
127
I/O
SHEET REFEED UNIT SENSOR INPUT
I/O
SHEET REFEED UNIT DRIVE CIRCUIT

FIG. 4

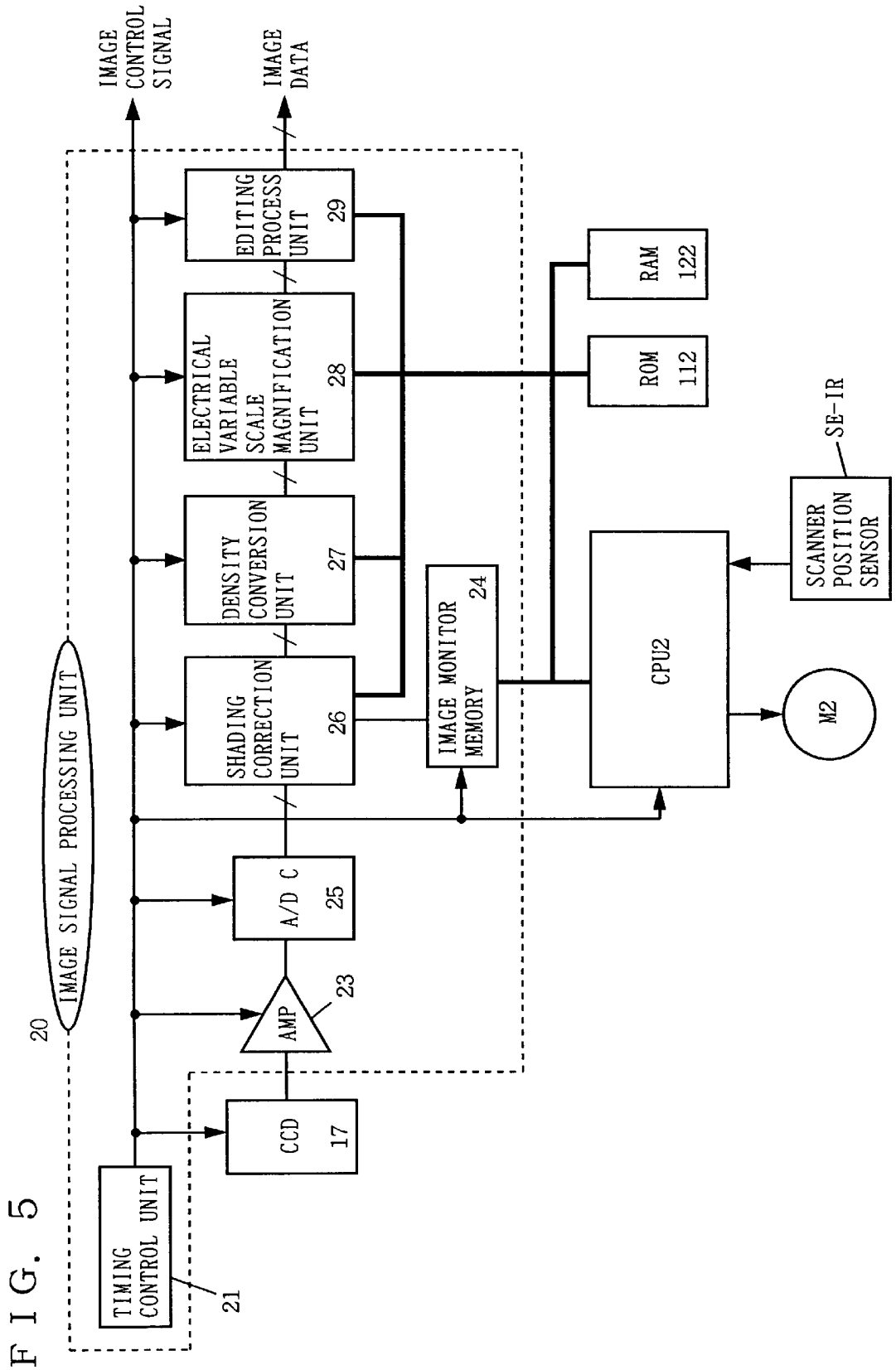


IMAGE CONTROL SIGNAL
IMAGE DATA
EDITING PROCESS UNIT 29
ELECTRICAL VARIABLE SCALE MAGNIFICATION UNIT 28
DENSITY CONVERSION UNIT 27
SHADING CORRECTION UNIT 26
A/D C 25
AMP 23
CCD 17
TIMING CONTROL UNIT
21
20
IMAGE SIGNAL PROCESSING UNIT
IMAGE MONITOR MEMORY 24
RAM 122
ROM 112
CPU2
SCANNER POSITION SENSOR
SE-IR
M2

FIG. 5

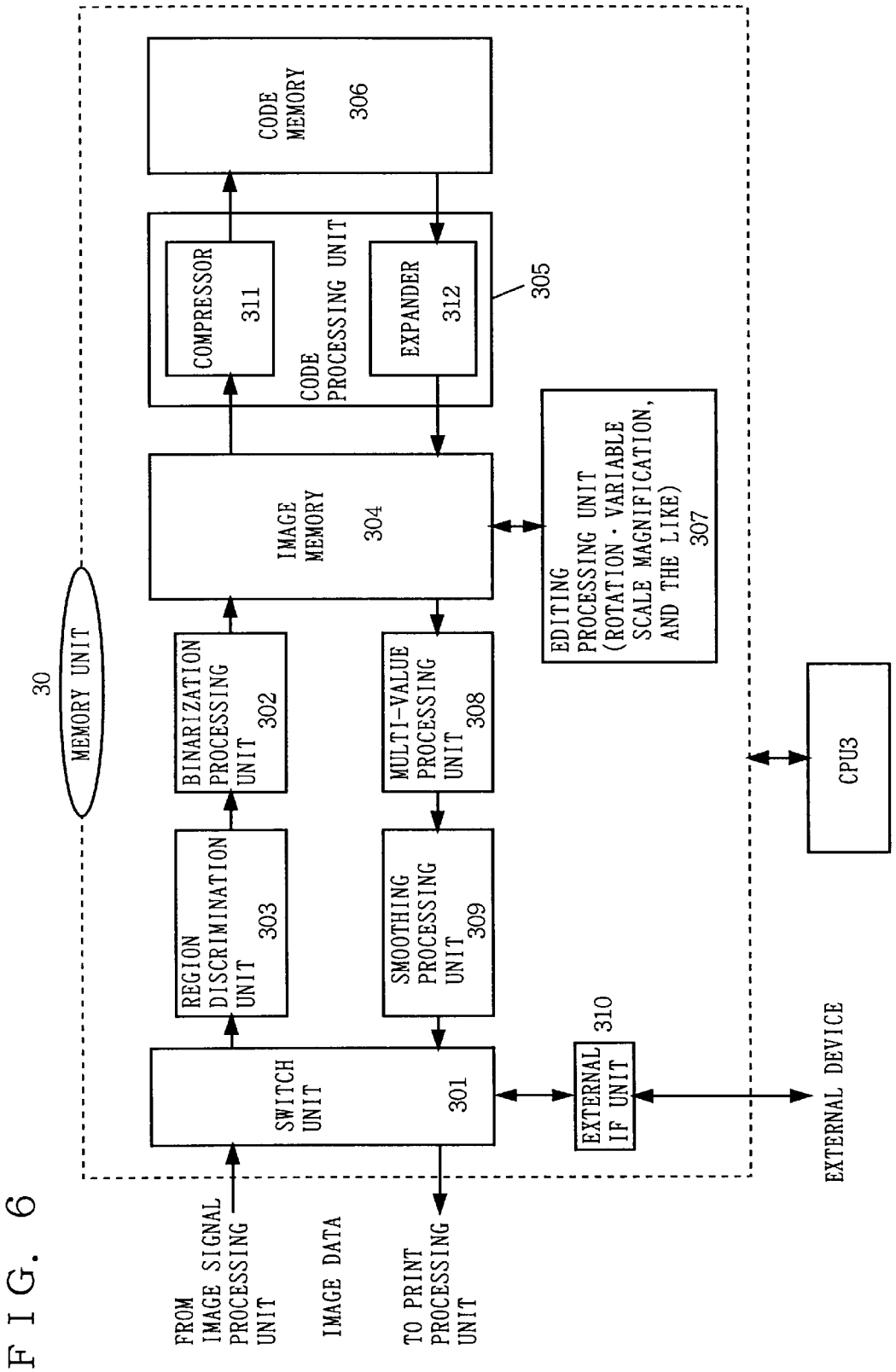

30
MEMORY UNIT
CODE MEMORY 306
COMPRESSOR 311
CODE PROCESSING UNIT
EXPANDER 312
305
IMAGE MEMORY 304
EDITING PROCESSING UNIT (ROTATION · VARIABLE SCALE MAGNIFICATION, AND THE LIKE) 307
BINARIZATION PROCESSING UNIT 302
MULTI-VALUE PROCESSING UNIT 308
REGION DISCRIMINATION UNIT 303
SMOOTHING PROCESSING UNIT 309
SWITCH UNIT 301
EXTERNAL IF UNIT 310
CPU3
EXTERNAL DEVICE
FROM IMAGE SIGNAL PROCESSING UNIT
IMAGE DATA
TO PRINT PROCESSING UNIT

FIG. 6

FIG. 7

MT1

REGION	PAGE NUMBER PN	PRECEDING-CONCATENATION	SUCCEEDING-CONCATENATION	ADDITIONAL INFORMATION
00	1	00	01	
01	1	01	FF	
02	2	00	03	
03	2	03	FF	
. . . .				

FIG. 8

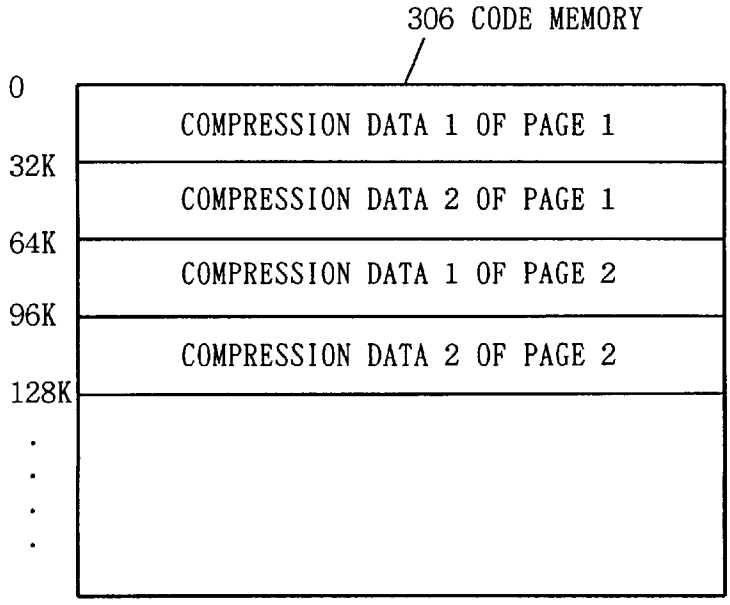


FIG. 9

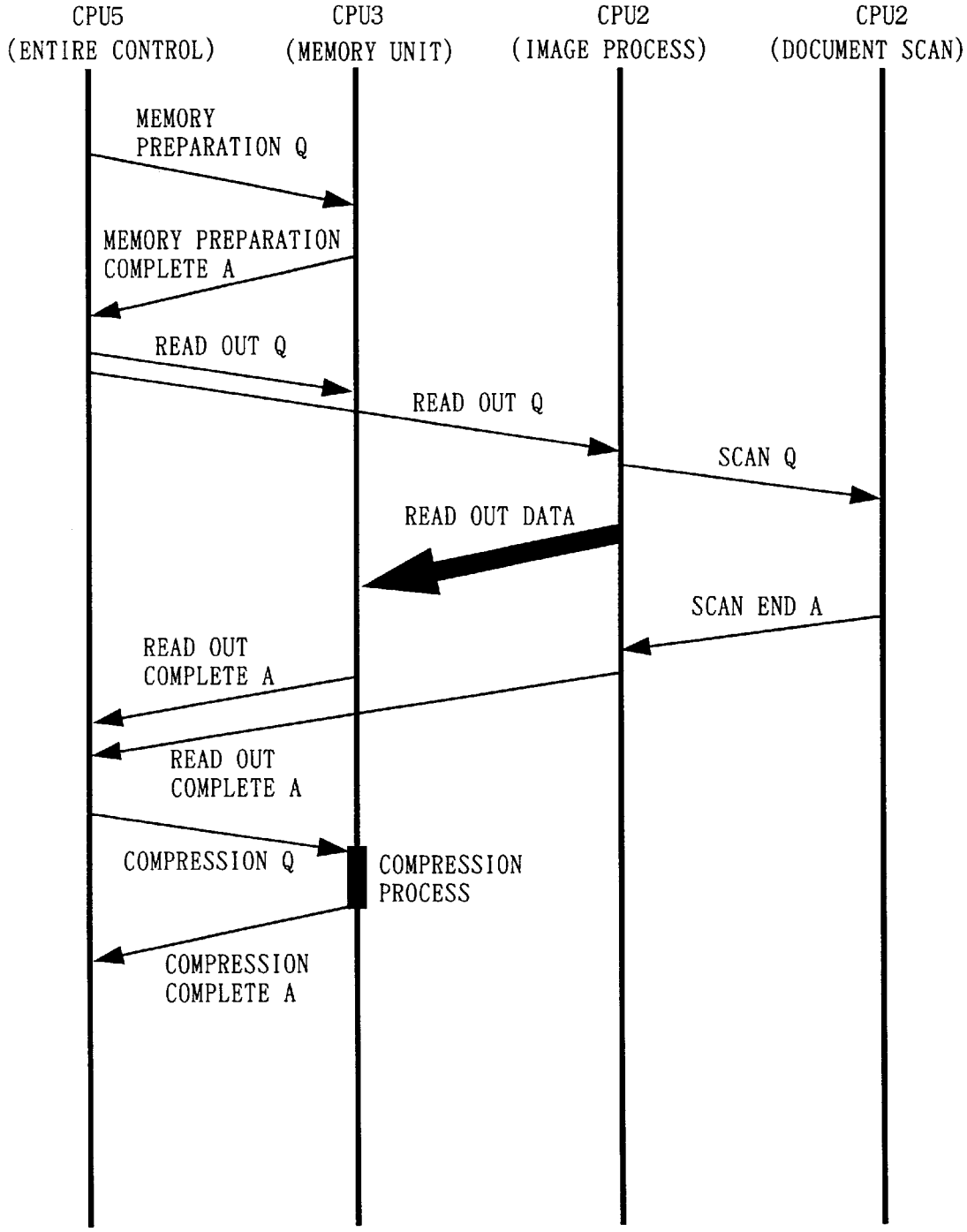

CPU5
(ENTIRE CONTROL)
CPU3
(MEMORY UNIT)
CPU2
(IMAGE PROCESS)
CPU2
(DOCUMENT SCAN)
MEMORY
PREPARATION Q
MEMORY PREPARATION
COMPLETE A
READ OUT Q
READ OUT Q
SCAN Q
READ OUT DATA
SCAN END A
READ OUT
COMPLETE A
READ OUT
COMPLETE A
COMPRESSION Q
COMPRESSION
PROCESS
COMPRESSION
COMPLETE A

FIG. 10

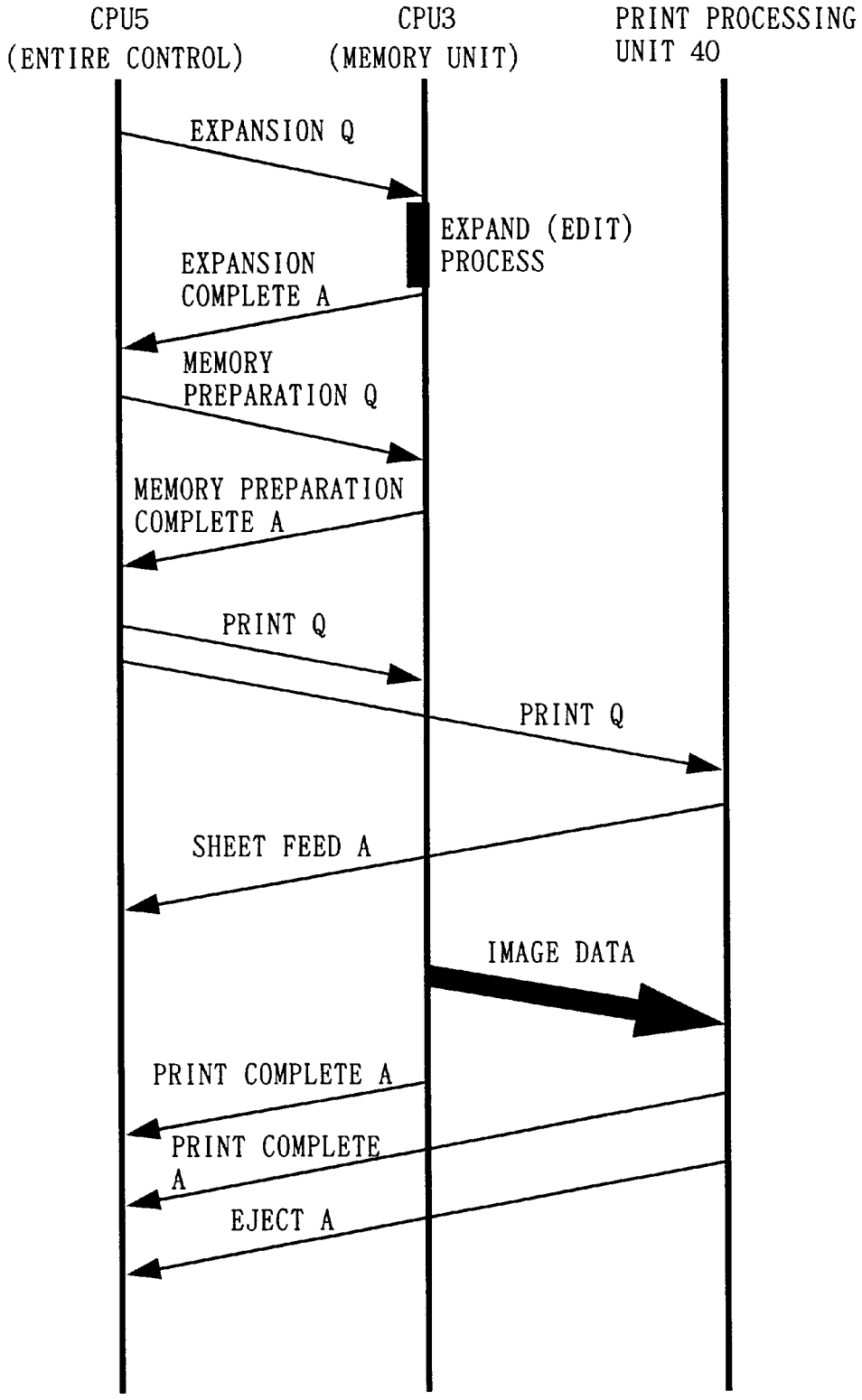

CPU5
(ENTIRE CONTROL)
CPU3
(MEMORY UNIT)
PRINT PROCESSING
UNIT 40
EXPANSION Q
EXPAND (EDIT)
PROCESS
EXPANSION
COMPLETE A
MEMORY
PREPARATION Q
MEMORY PREPARATION
COMPLETE A
PRINT Q
PRINT Q
SHEET FEED A
IMAGE DATA
PRINT COMPLETE A
PRINT COMPLETE
A
EJECT A

FIG. 11

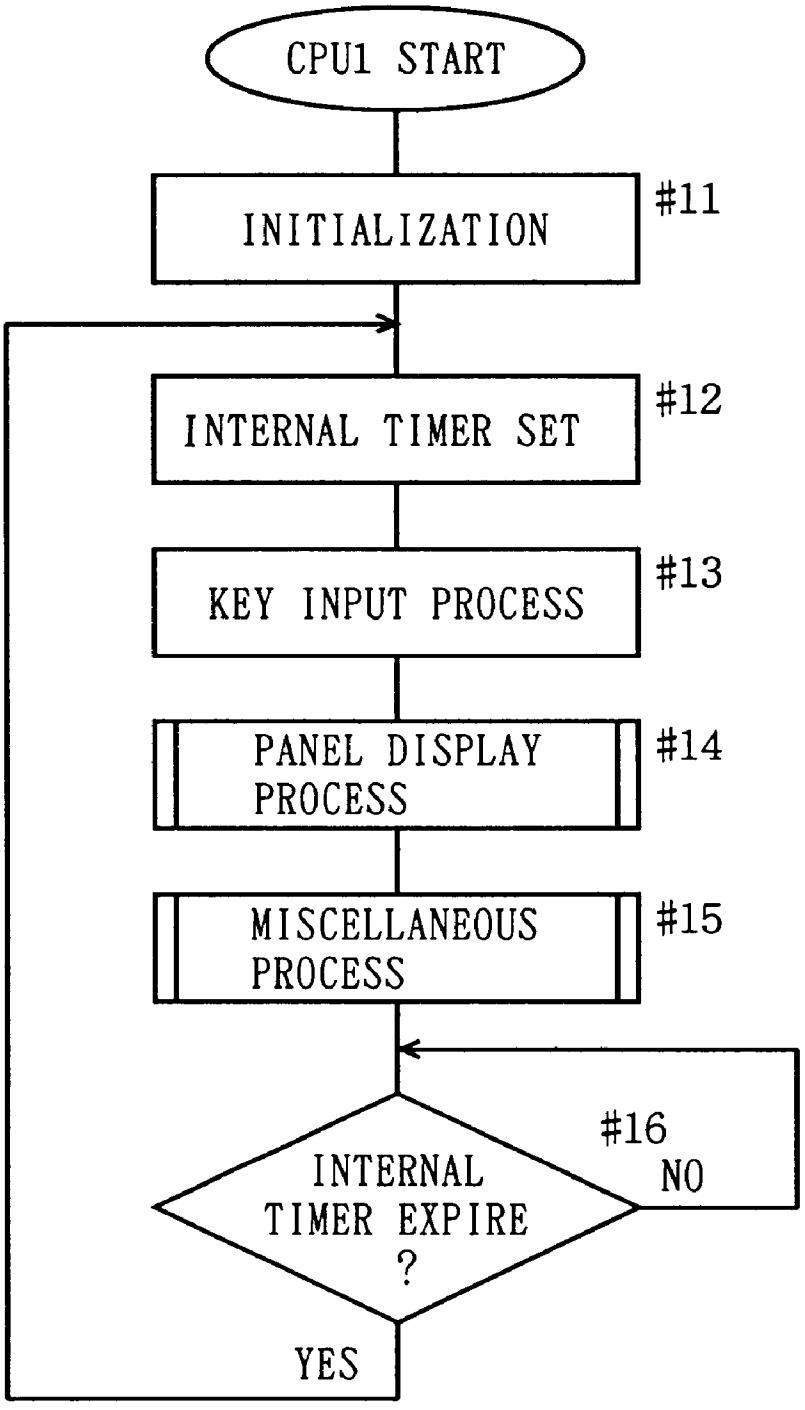

CPU1 START
INITIALIZATION
#11
INTERNAL TIMER SET
#12
KEY INPUT PROCESS
#13
PANEL DISPLAY PROCESS
#14
MISCELLANEOUS PROCESS
#15
INTERNAL TIMER EXPIRE ?
#16
NO
YES

FIG. 12

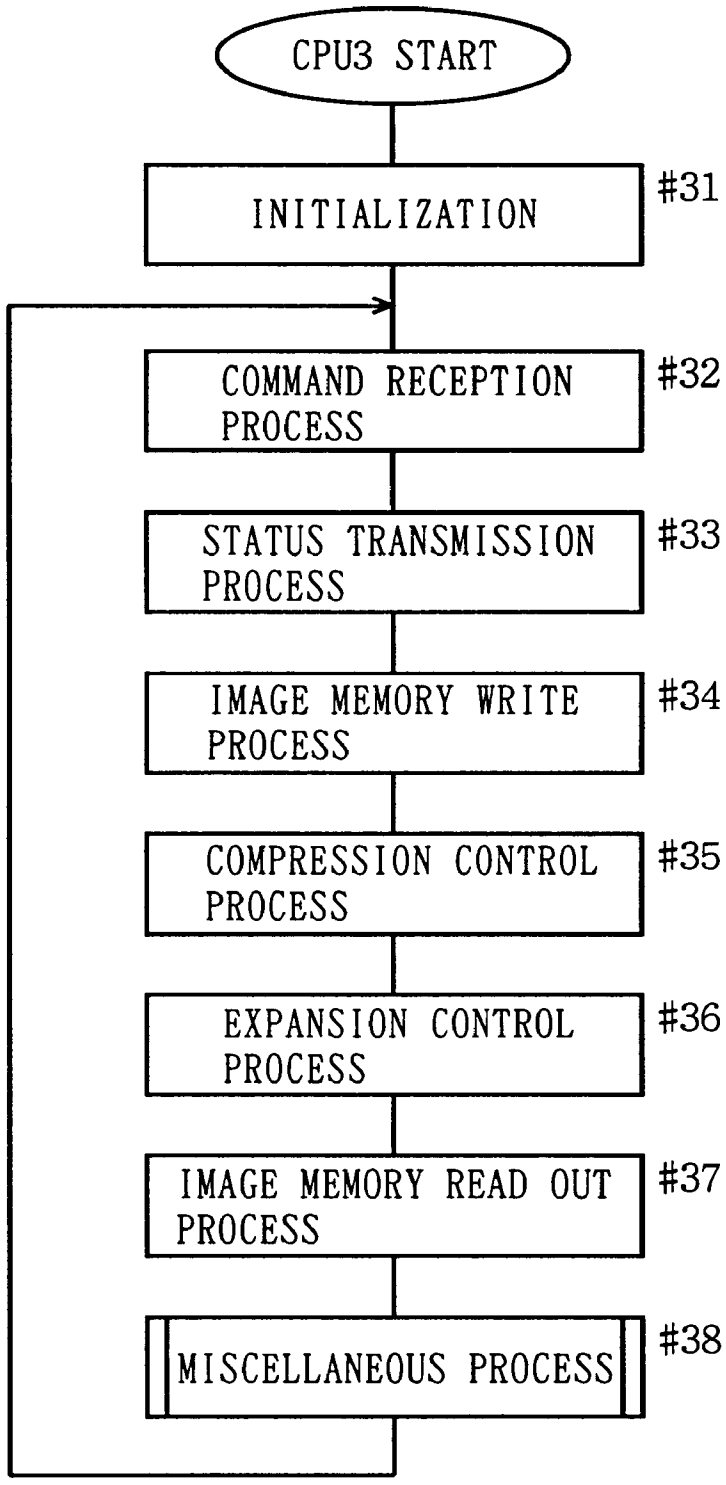

CPU3 START
INITIALIZATION
#31
COMMAND RECEPTION PROCESS
#32
STATUS TRANSMISSION PROCESS
#33
IMAGE MEMORY WRITE PROCESS
#34
COMPRESSION CONTROL PROCESS
#35
EXPANSION CONTROL PROCESS
#36
IMAGE MEMORY READ OUT PROCESS
#37
MISCELLANEOUS PROCESS
#38

FIG. 13

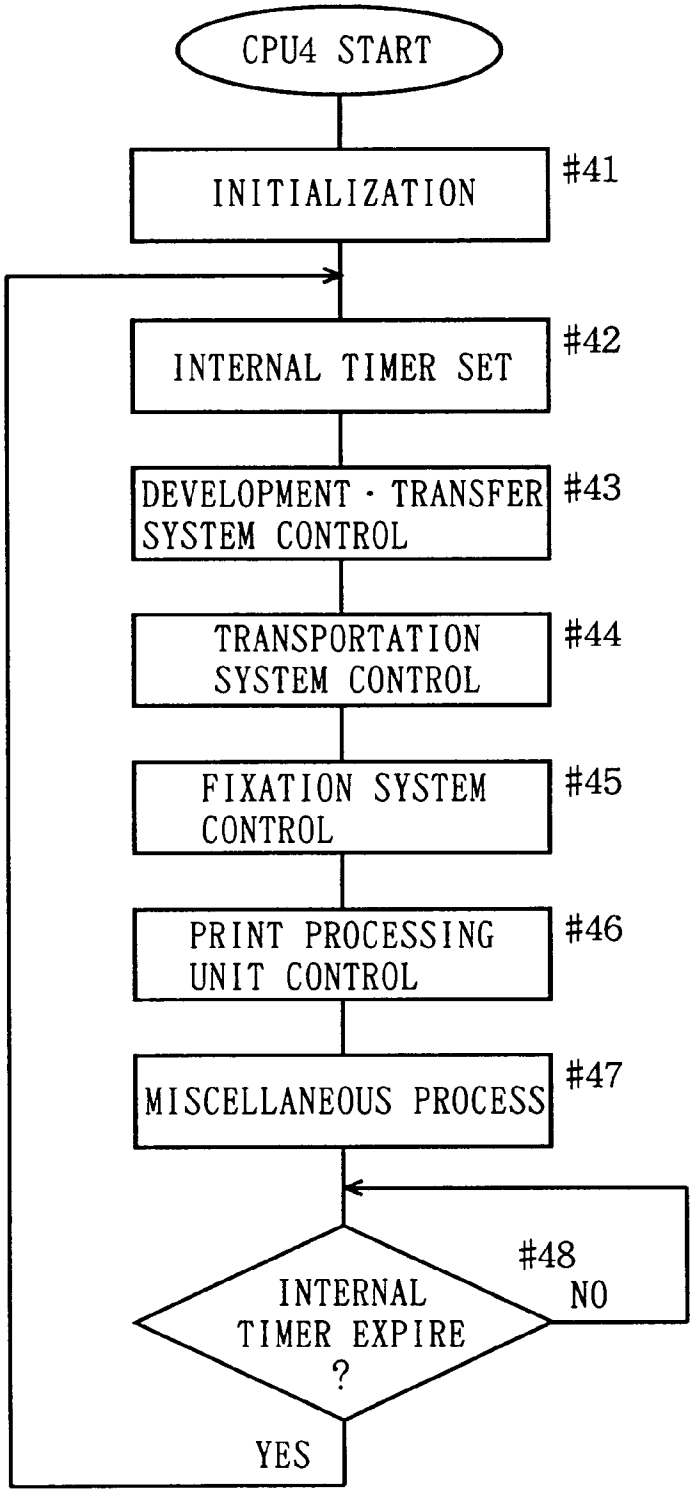

CPU4 START
INITIALIZATION
#41
INTERNAL TIMER SET
#42
DEVELOPMENT · TRANSFER SYSTEM CONTROL
#43
TRANSPORTATION SYSTEM CONTROL
#44
FIXATION SYSTEM CONTROL
#45
PRINT PROCESSING UNIT CONTROL
#46
MISCELLANEOUS PROCESS
#47
INTERNAL TIMER EXPIRE ?
#48
NO
YES

FIG. 14

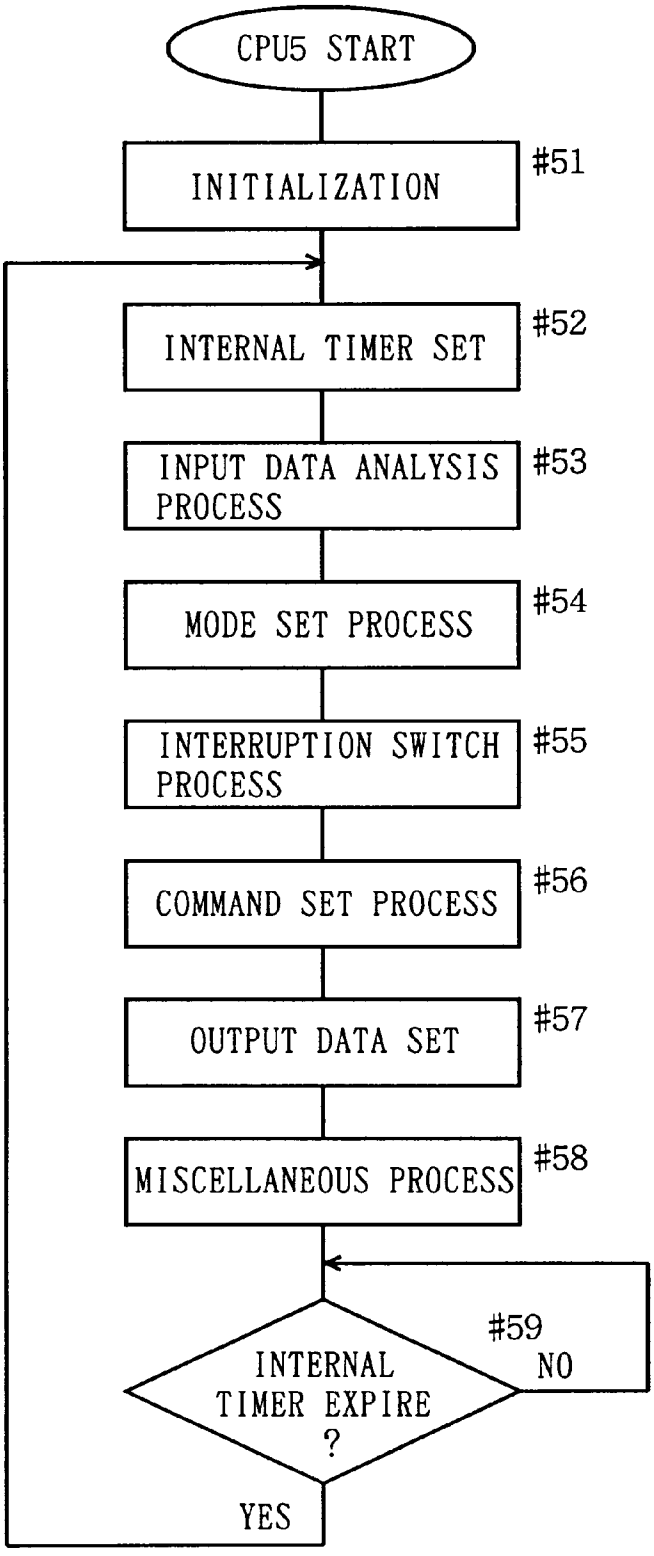

CPU5 START
INITIALIZATION
#51
INTERNAL TIMER SET
#52
INPUT DATA ANALYSIS PROCESS
#53
MODE SET PROCESS
#54
INTERRUPTION SWITCH PROCESS
#55
COMMAND SET PROCESS
#56
OUTPUT DATA SET
#57
MISCELLANEOUS PROCESS
#58
INTERNAL TIMER EXPIRE ?
#59
NO
YES

FIG. 15

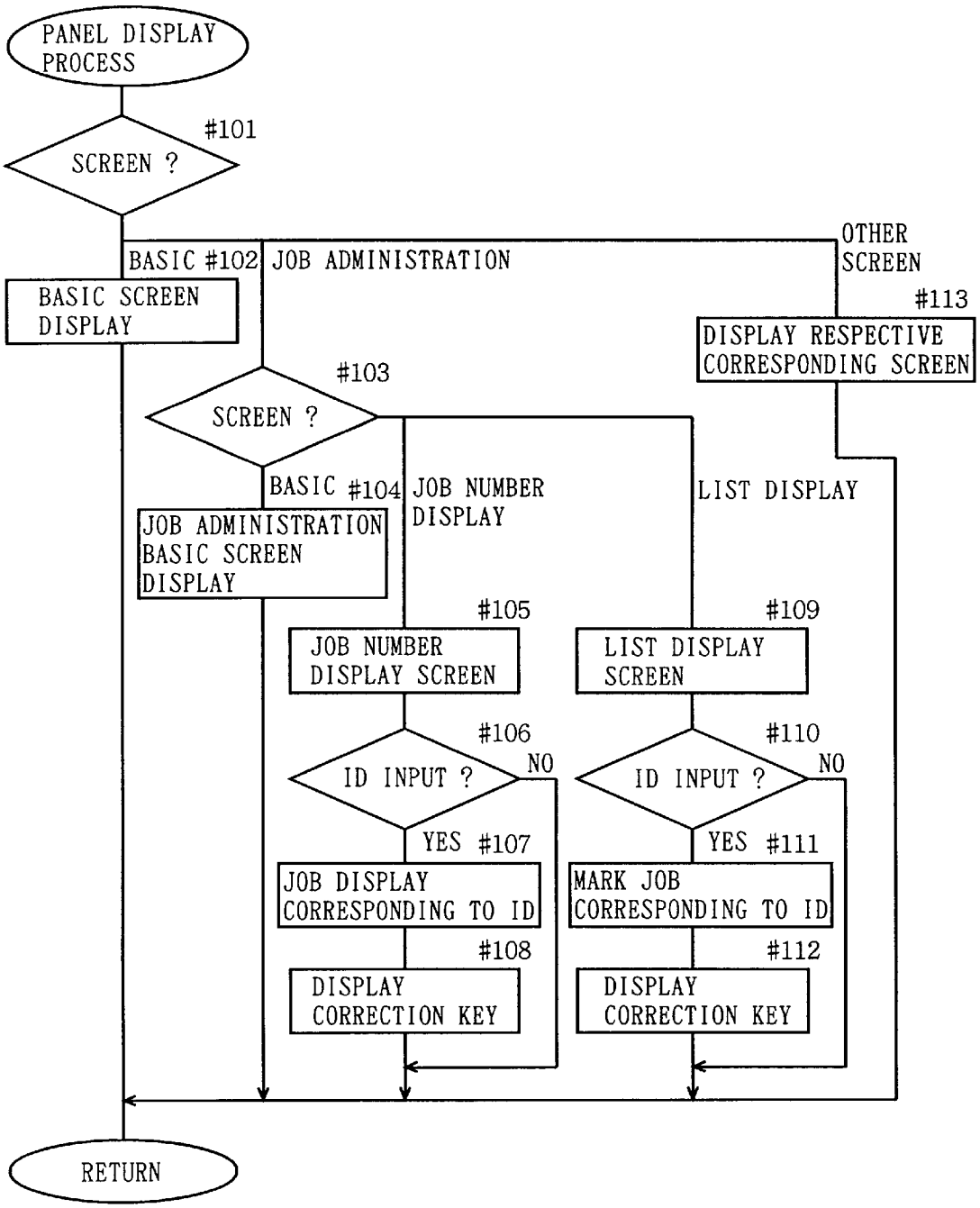

PANEL DISPLAY PROCESS
#101
SCREEN ?
BASIC #102
JOB ADMINISTRATION
OTHER SCREEN
#113
BASIC SCREEN DISPLAY
DISPLAY RESPECTIVE CORRESPONDING SCREEN
#103
SCREEN ?
BASIC #104
JOB NUMBER DISPLAY
LIST DISPLAY
JOB ADMINISTRATION BASIC SCREEN DISPLAY
#105
#109
JOB NUMBER DISPLAY SCREEN
LIST DISPLAY SCREEN
#106
#110
ID INPUT ?
NO
ID INPUT ?
NO
YES #107
YES #111
JOB DISPLAY CORRESPONDING TO ID
MARK JOB CORRESPONDING TO ID
#108
#112
DISPLAY CORRECTION KEY
DISPLAY CORRECTION KEY
RETURN

FIG. 16

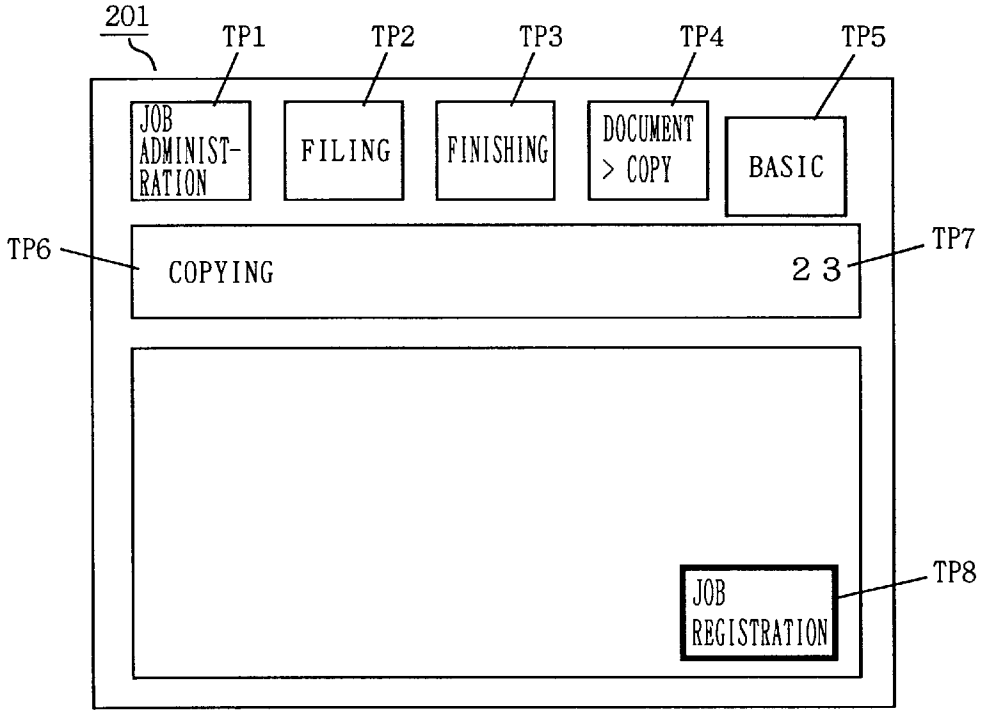

201
TP1
TP2
TP3
TP4
TP5
JOB ADMINIST-RATION
FILING
FINISHING
DOCUMENT > COPY
BASIC
TP6
COPYING
23
TP7
JOB REGISTRATION
TP8

FIG. 17

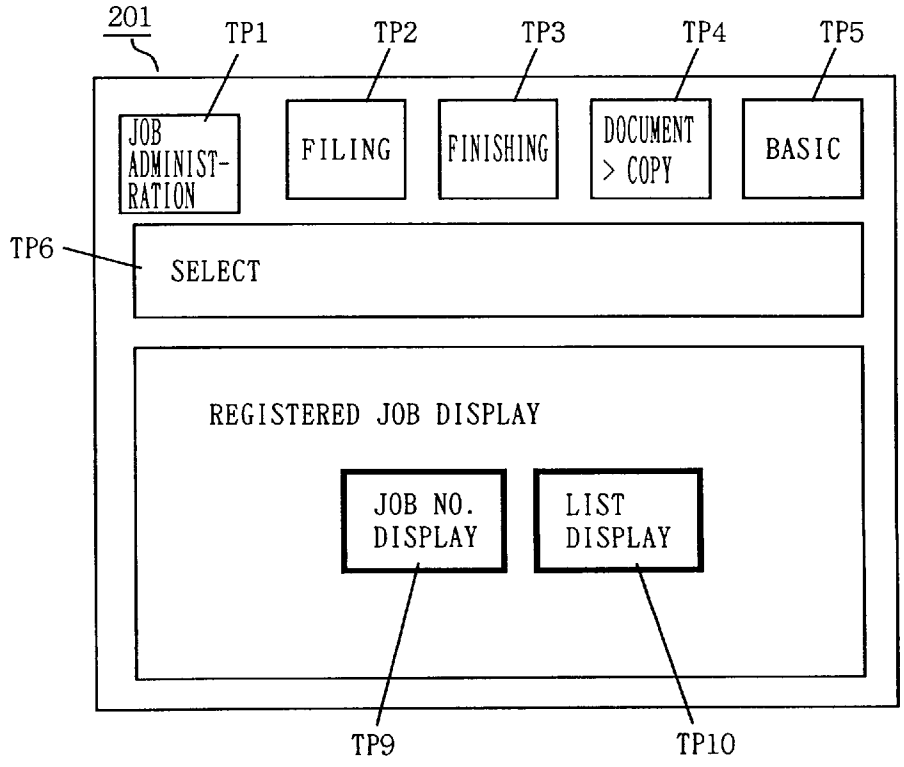

201
TP1
TP2
TP3
TP4
TP5
JOB ADMINIST-RATION
FILING
FINISHING
DOCUMENT > COPY
BASIC
TP6
SELECT
REGISTERED JOB DISPLAY
JOB NO. DISPLAY
LIST DISPLAY
TP9
TP10

FIG. 18

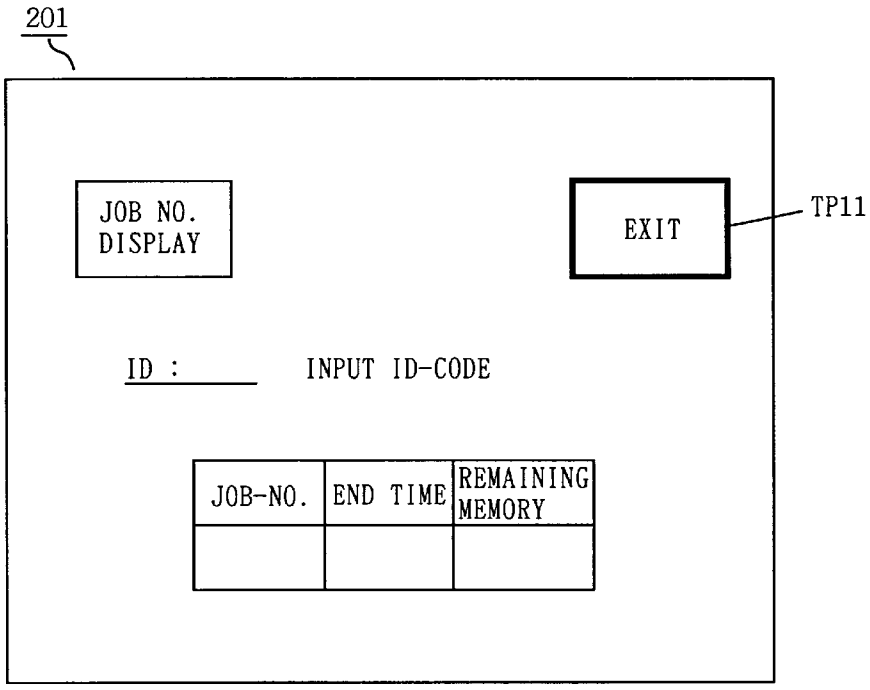

201
JOB NO. DISPLAY
EXIT
TP11
ID :
INPUT ID-CODE
JOB-NO.
END TIME
REMAINING MEMORY

FIG. 19

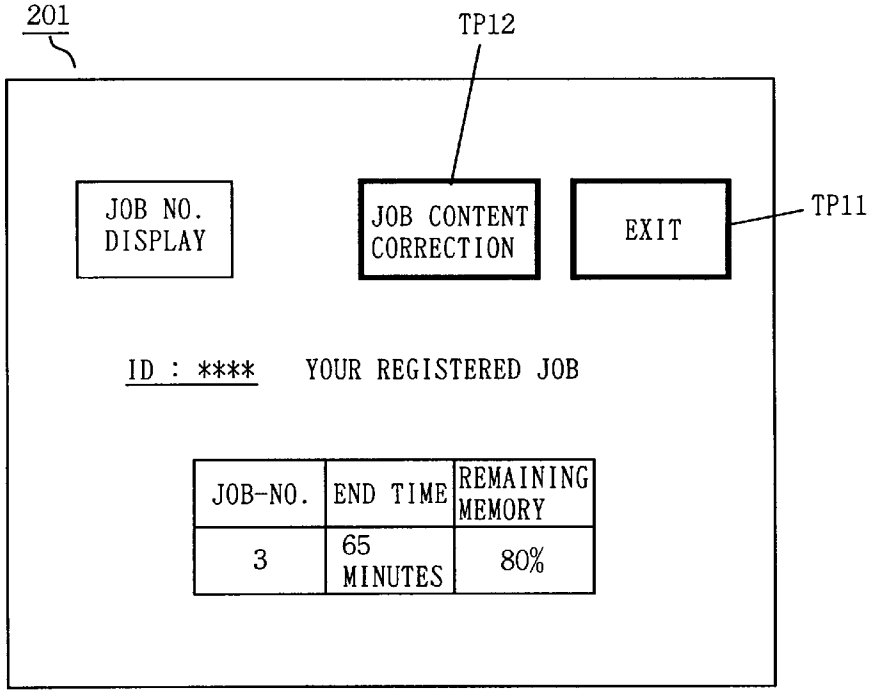

201
TP12
JOB NO. DISPLAY
JOB CONTENT CORRECTION
EXIT
TP11
ID : ****
YOUR REGISTERED JOB
JOB-NO.
END TIME
REMAINING MEMORY
3
65 MINUTES
80%

FIG. 20

	REGISTRATION NO.	CAPA(n)	TIME(n)	REST(n)	TSUM(n)	CSUM(n)	SPACE(n)	ID(n)
	1	250	5 MINUTES	0	0	—	—	1234
	2	300	6 MINUTES	0	0	—	—	7777
N=3	3	120	7 MINUTES	50 SECONDS	50 SECONDS	820	TOTAL AMOUNT −820	1234
	4	400	8 MINUTES	—	8 MINUTES 50 SECONDS	700	TOTAL AMOUNT −700	1111
n=5	5	300	6 MINUTES	—	14 MINUTES 50 SECONDS	300	TOTAL AMOUNT −300	4444
	6					0	TOTAL AMOUNT −0	

FIG. 21

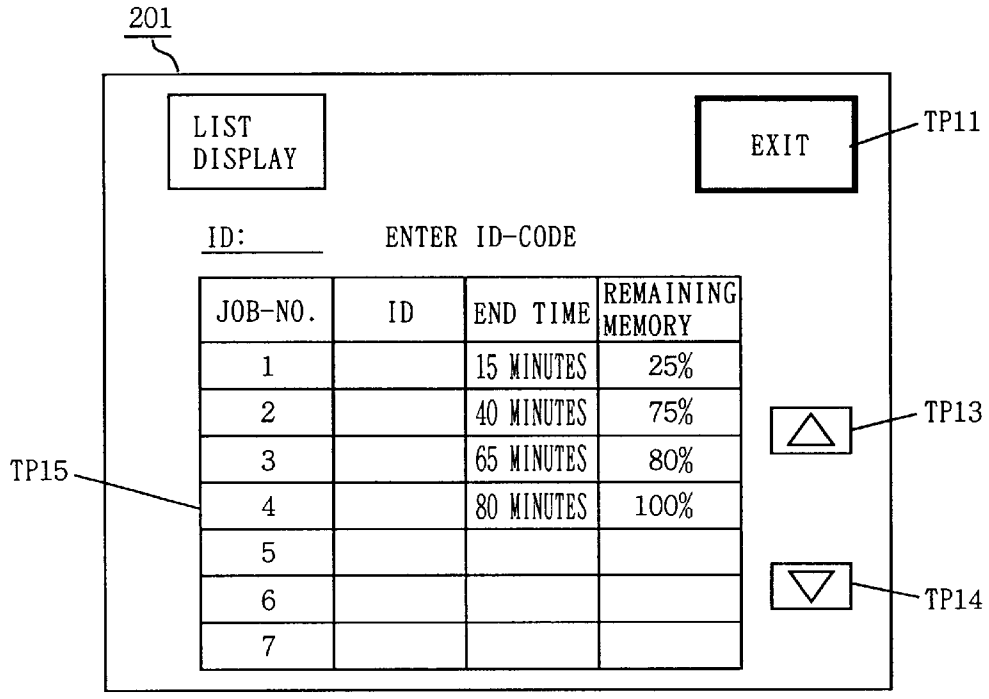

201
LIST DISPLAY
EXIT
TP11
ID: ENTER ID-CODE
JOB-NO. | ID | END TIME | REMAINING MEMORY
1 | | 15 MINUTES | 25%
2 | | 40 MINUTES | 75%
3 | | 65 MINUTES | 80%
4 | | 80 MINUTES | 100%
5 | | |
6 | | |
7 | | |
TP13
TP14
TP15

FIG. 22

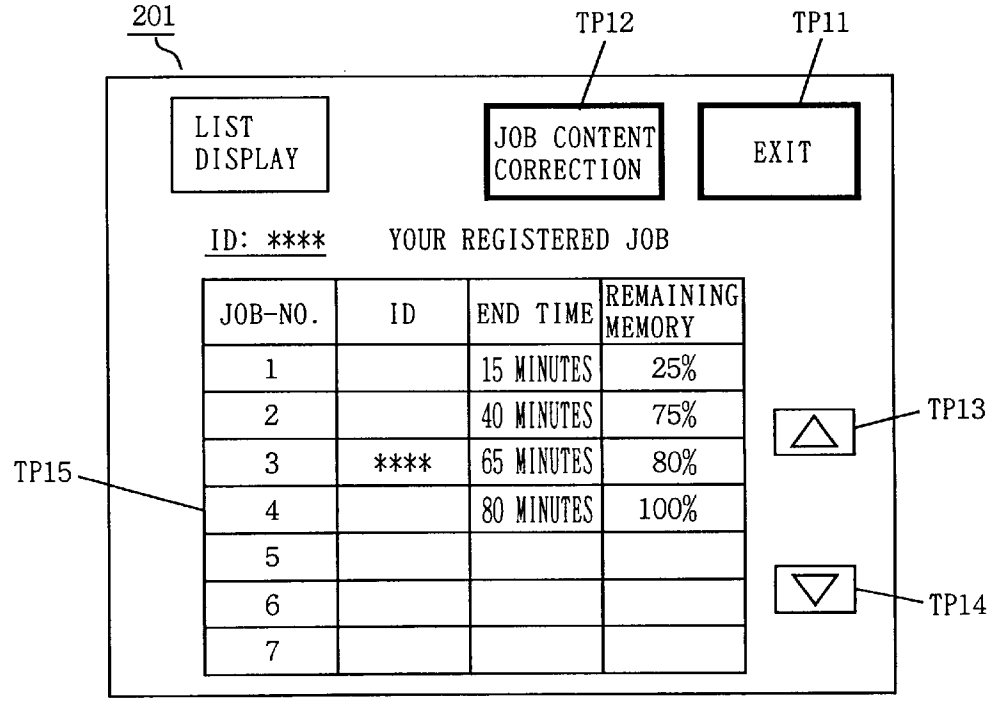

201
TP12
TP11
LIST DISPLAY
JOB CONTENT CORRECTION
EXIT
ID: **** YOUR REGISTERED JOB
JOB-NO. | ID | END TIME | REMAINING MEMORY
1 | | 15 MINUTES | 25%
2 | | 40 MINUTES | 75%
3 | **** | 65 MINUTES | 80%
4 | | 80 MINUTES | 100%
5 | | |
6 | | |
7 | | |
TP13
TP14
TP15

FIG. 23

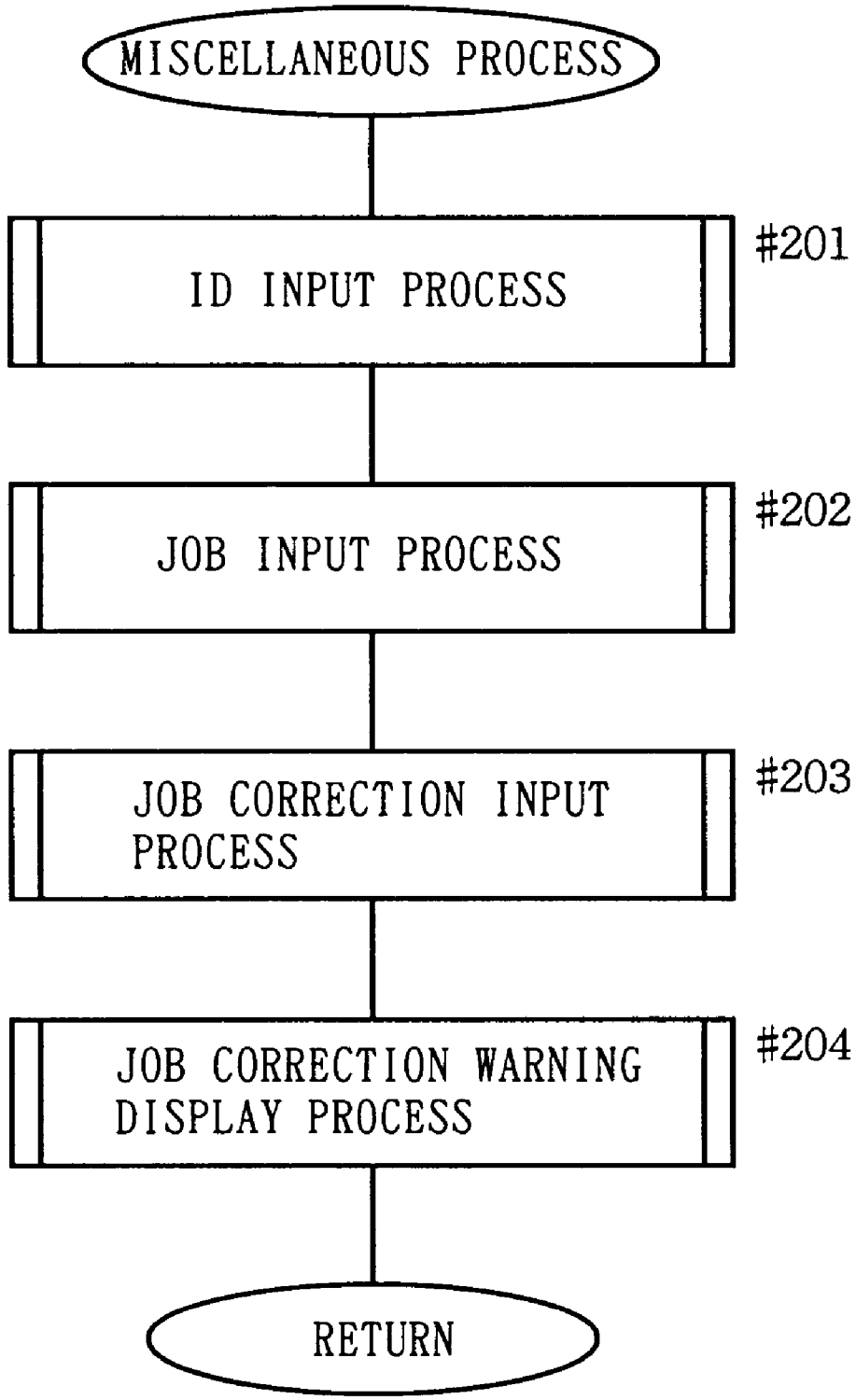

MISCELLANEOUS PROCESS
ID INPUT PROCESS
#201
JOB INPUT PROCESS
#202
JOB CORRECTION INPUT PROCESS
#203
JOB CORRECTION WARNING DISPLAY PROCESS
#204
RETURN

FIG. 24

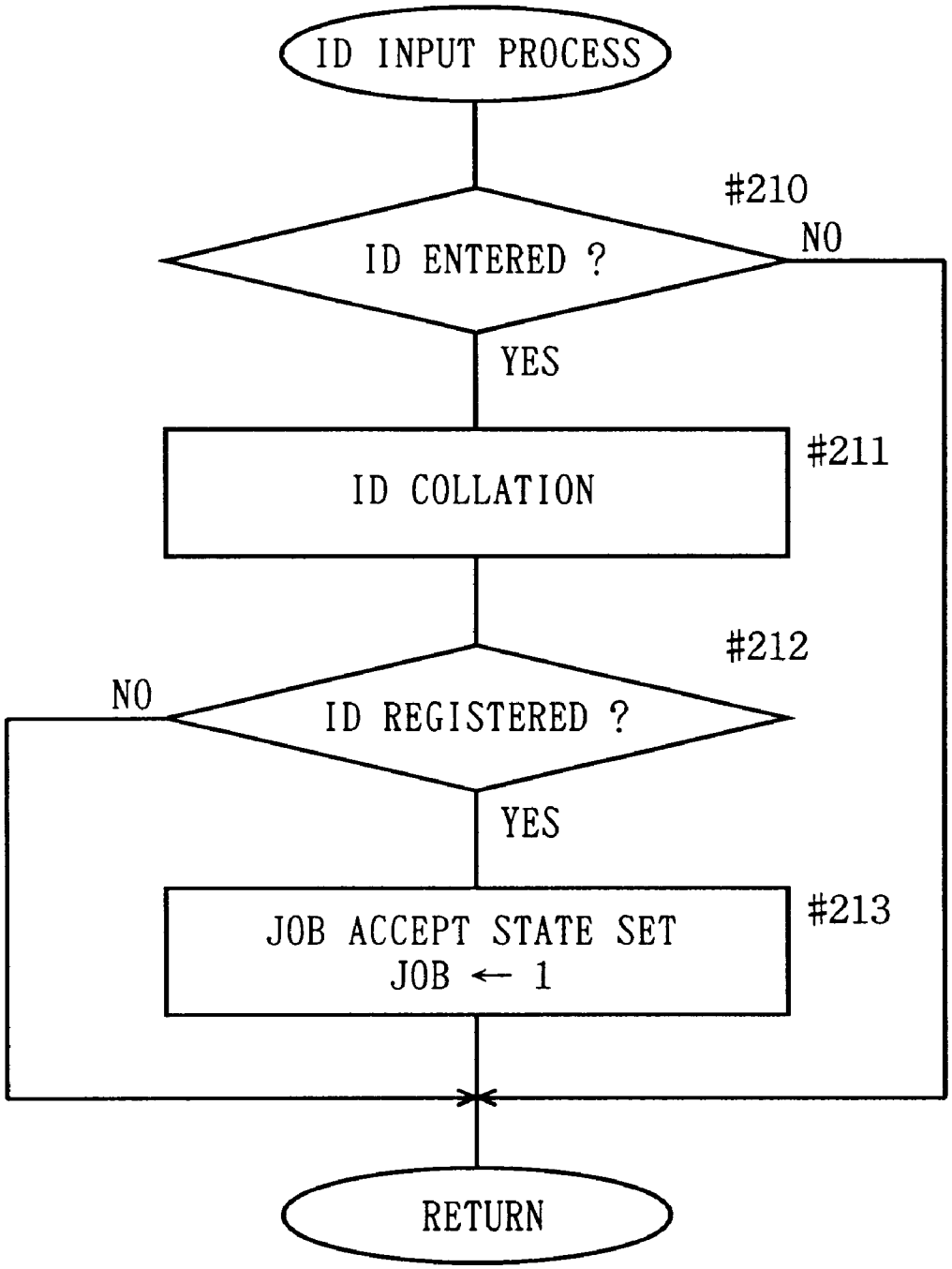

ID INPUT PROCESS
#210
ID ENTERED ?
NO
YES
#211
ID COLLATION
#212
NO
ID REGISTERED ?
YES
#213
JOB ACCEPT STATE SET
JOB ← 1
RETURN

FIG. 25

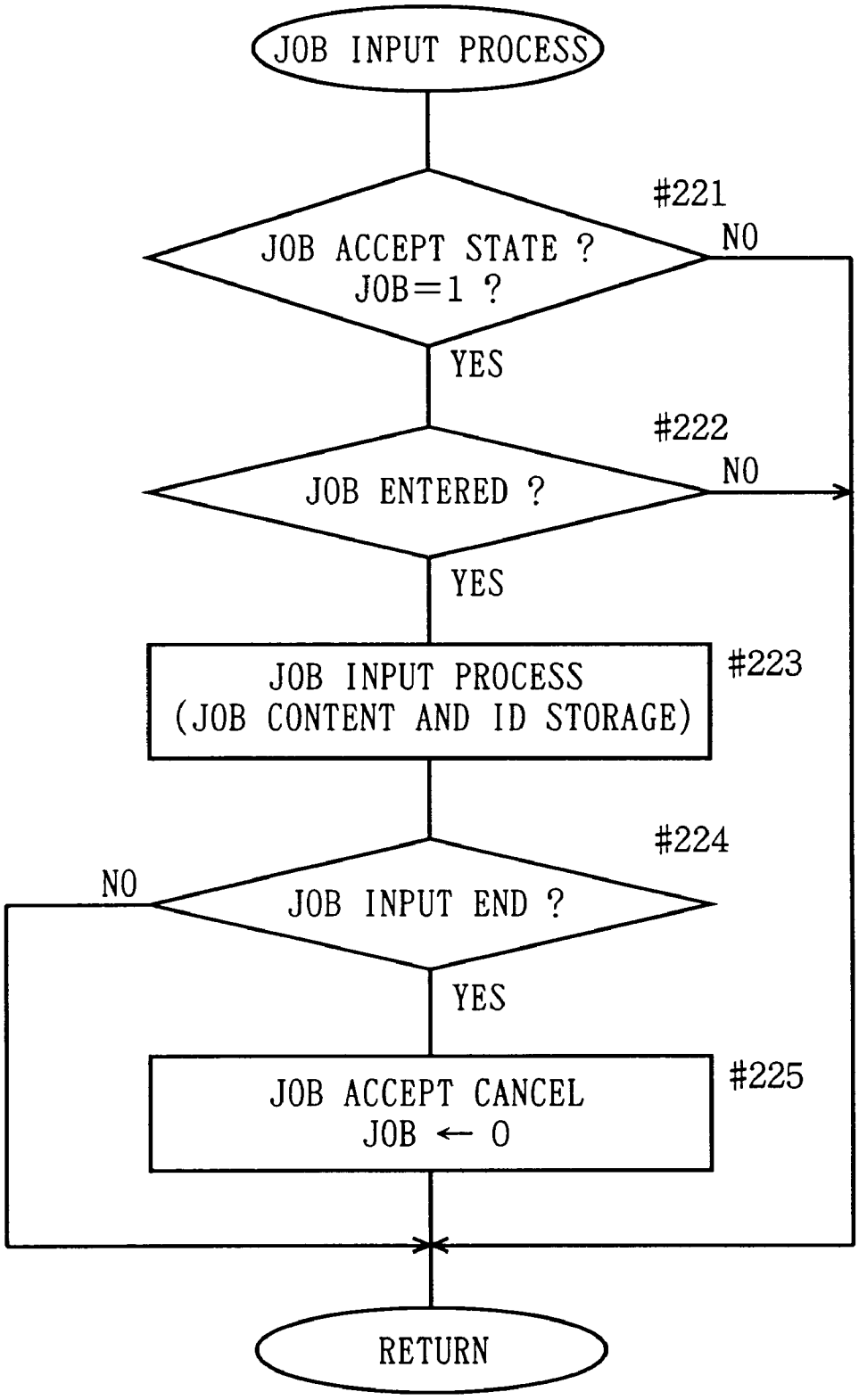

JOB INPUT PROCESS
#221
JOB ACCEPT STATE ?
JOB=1 ?
NO
YES
#222
JOB ENTERED ?
NO
YES
JOB INPUT PROCESS
(JOB CONTENT AND ID STORAGE)
#223
#224
NO
JOB INPUT END ?
YES
JOB ACCEPT CANCEL
JOB ← 0
#225
RETURN

FIG. 26

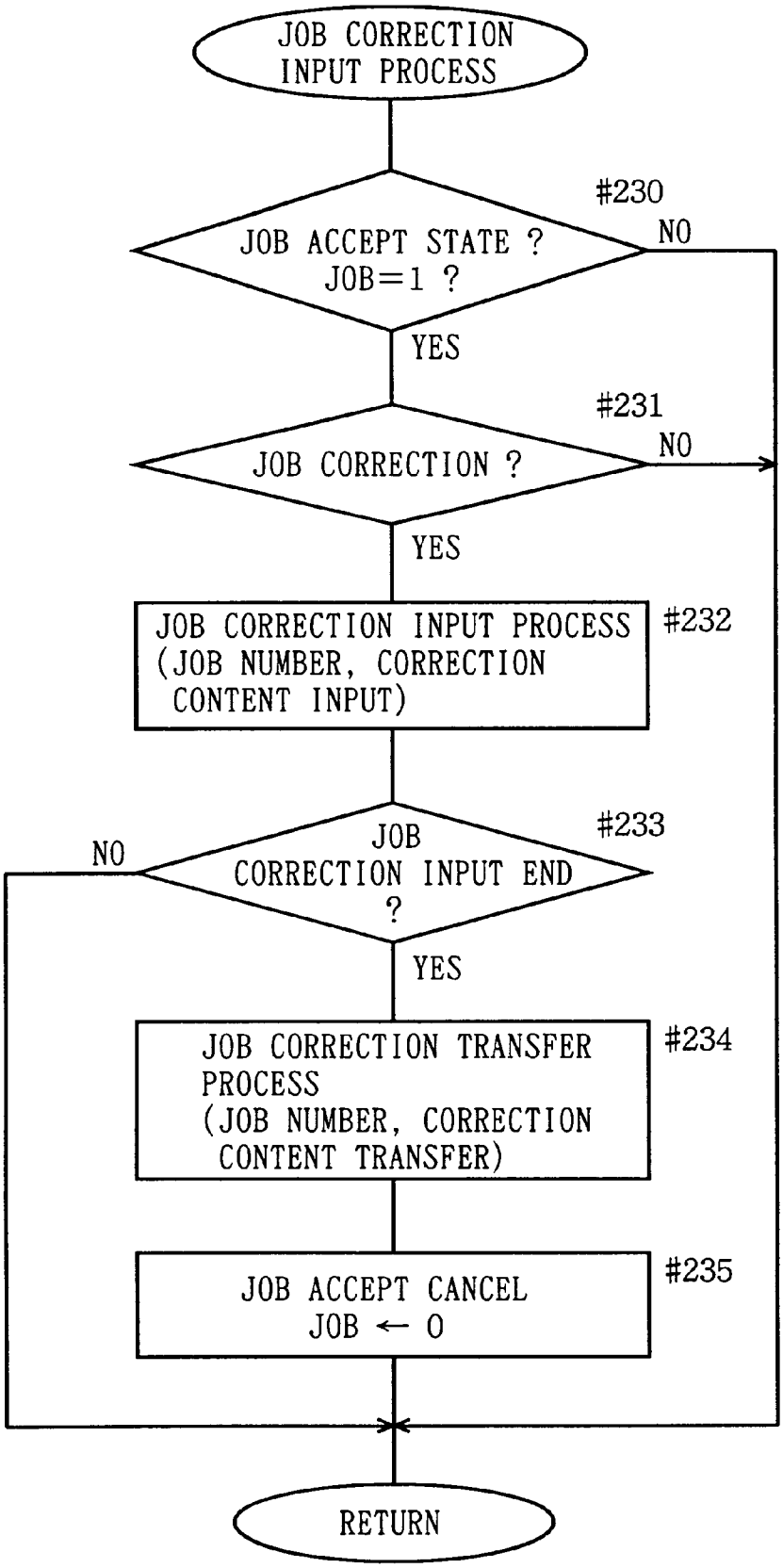

JOB CORRECTION INPUT PROCESS
#230
JOB ACCEPT STATE ? JOB=1 ?
NO
YES
#231
JOB CORRECTION ?
NO
YES
JOB CORRECTION INPUT PROCESS (JOB NUMBER, CORRECTION CONTENT INPUT)
#232
#233
JOB CORRECTION INPUT END ?
NO
YES
JOB CORRECTION TRANSFER PROCESS (JOB NUMBER, CORRECTION CONTENT TRANSFER)
#234
JOB ACCEPT CANCEL JOB ← 0
#235
RETURN

FIG. 27

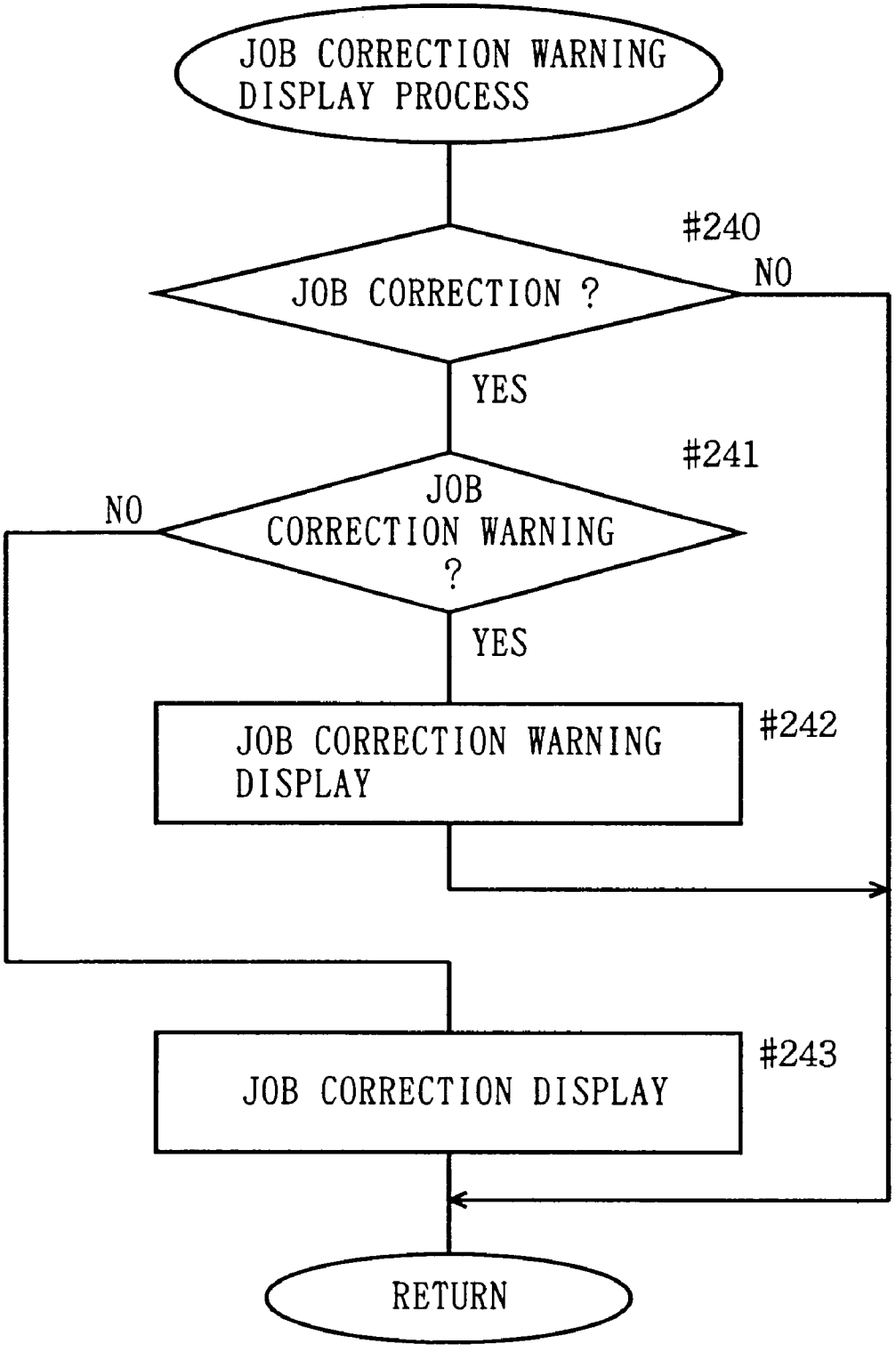

JOB CORRECTION WARNING DISPLAY PROCESS
#240
JOB CORRECTION ?
NO
YES
#241
JOB CORRECTION WARNING ?
NO
YES
JOB CORRECTION WARNING DISPLAY
#242
JOB CORRECTION DISPLAY
#243
RETURN

FIG. 28

201

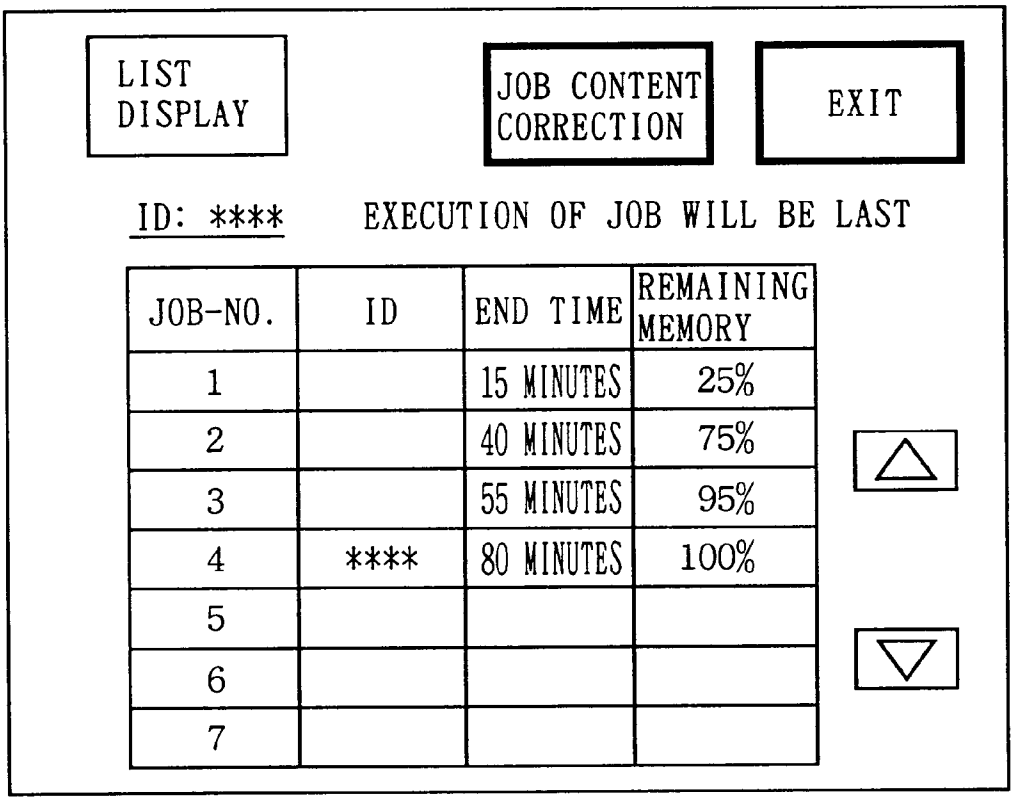

LIST DISPLAY
JOB CONTENT CORRECTION
EXIT
ID: ****
EXECUTION OF JOB WILL BE LAST
JOB-NO.
ID
END TIME
REMAINING MEMORY
1
15 MINUTES
25%
2
40 MINUTES
75%
3
55 MINUTES
95%
4
****
80 MINUTES
100%
5
6
7

FIG. 29

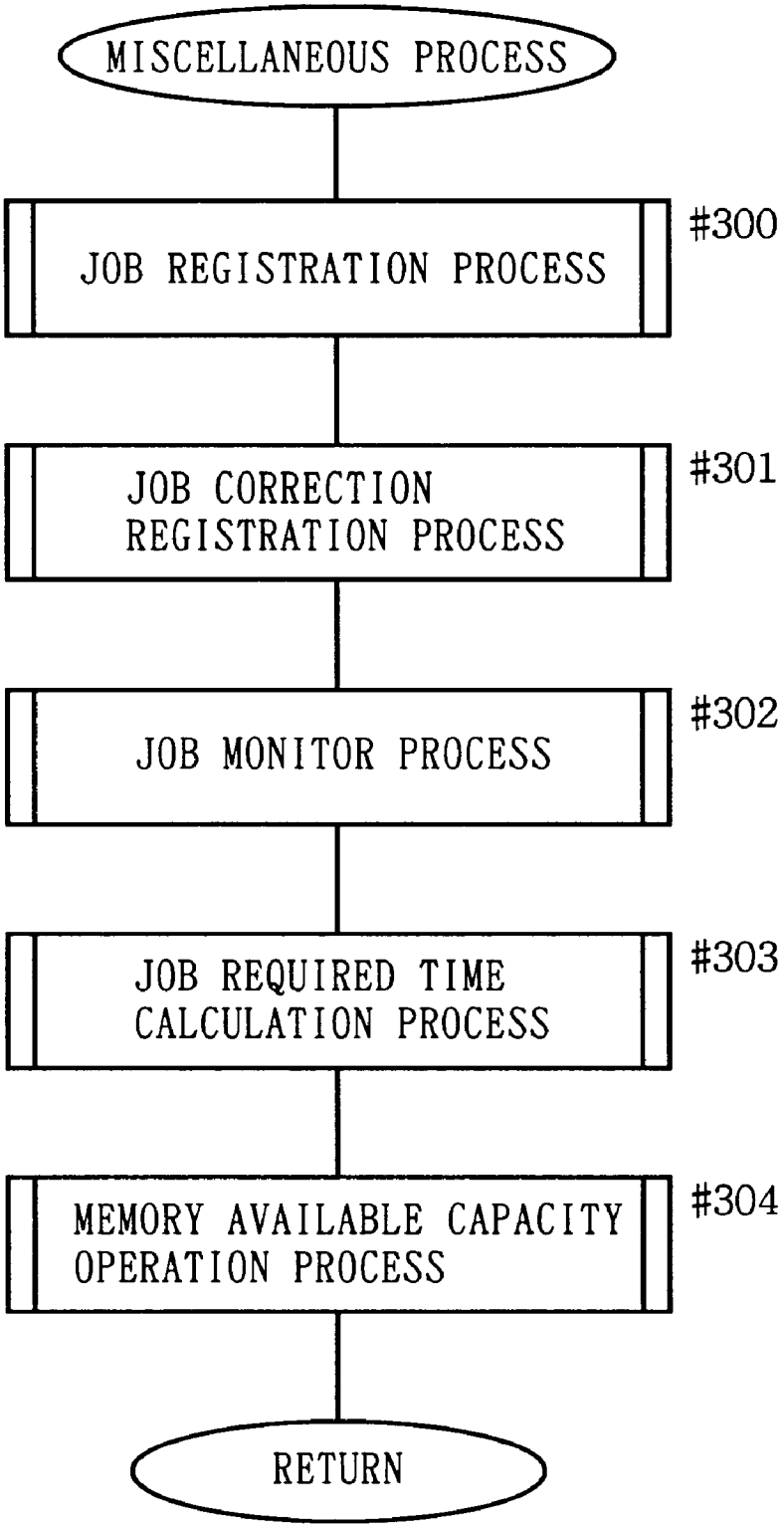

MISCELLANEOUS PROCESS
JOB REGISTRATION PROCESS
#300
JOB CORRECTION REGISTRATION PROCESS
#301
JOB MONITOR PROCESS
#302
JOB REQUIRED TIME CALCULATION PROCESS
#303
MEMORY AVAILABLE CAPACITY OPERATION PROCESS
#304
RETURN

FIG. 30

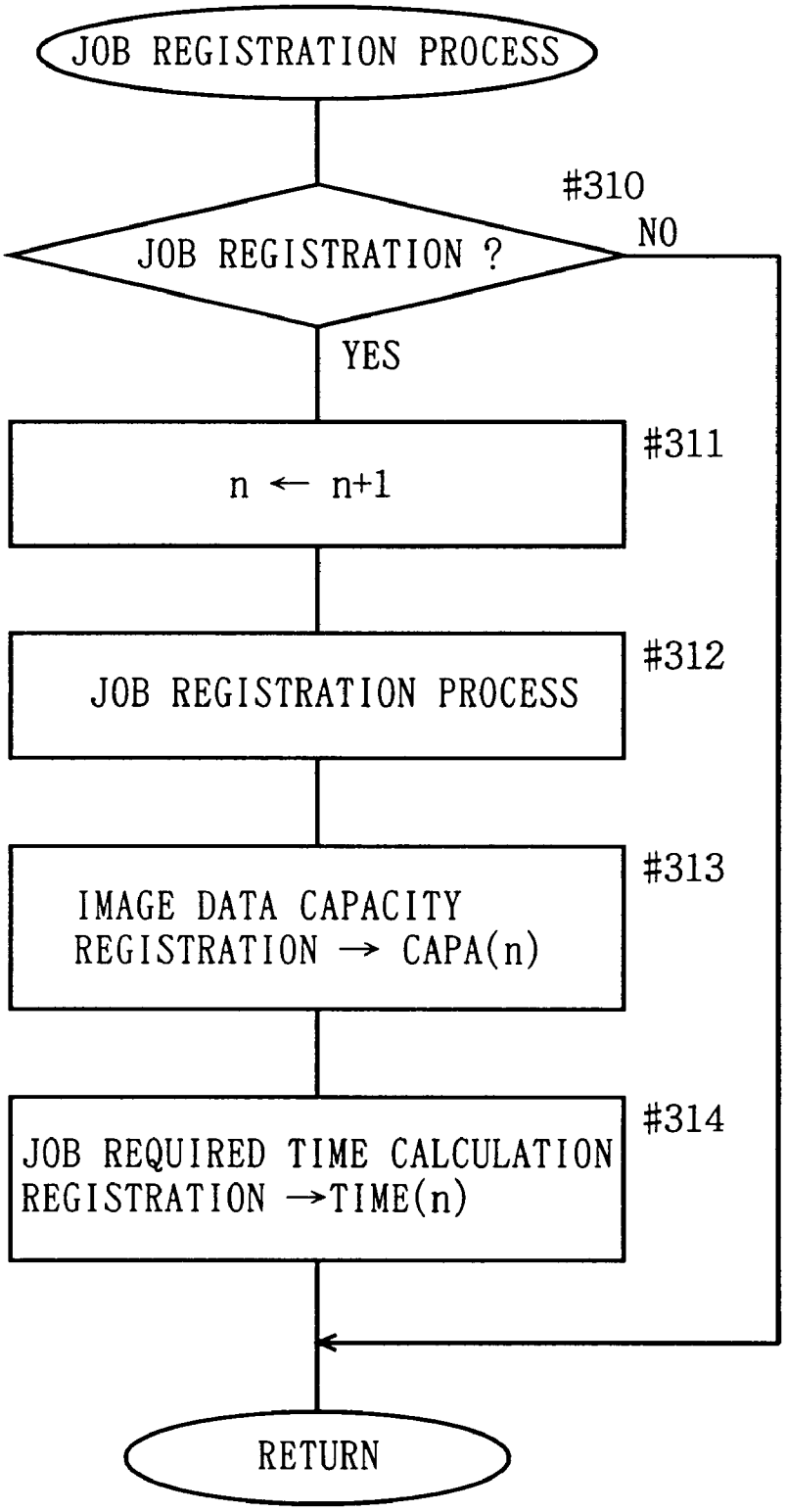

JOB REGISTRATION PROCESS
#310
JOB REGISTRATION ?
NO
YES
n ← n+1
#311
JOB REGISTRATION PROCESS
#312
IMAGE DATA CAPACITY REGISTRATION → CAPA(n)
#313
JOB REQUIRED TIME CALCULATION REGISTRATION →TIME(n)
#314
RETURN

FIG. 31

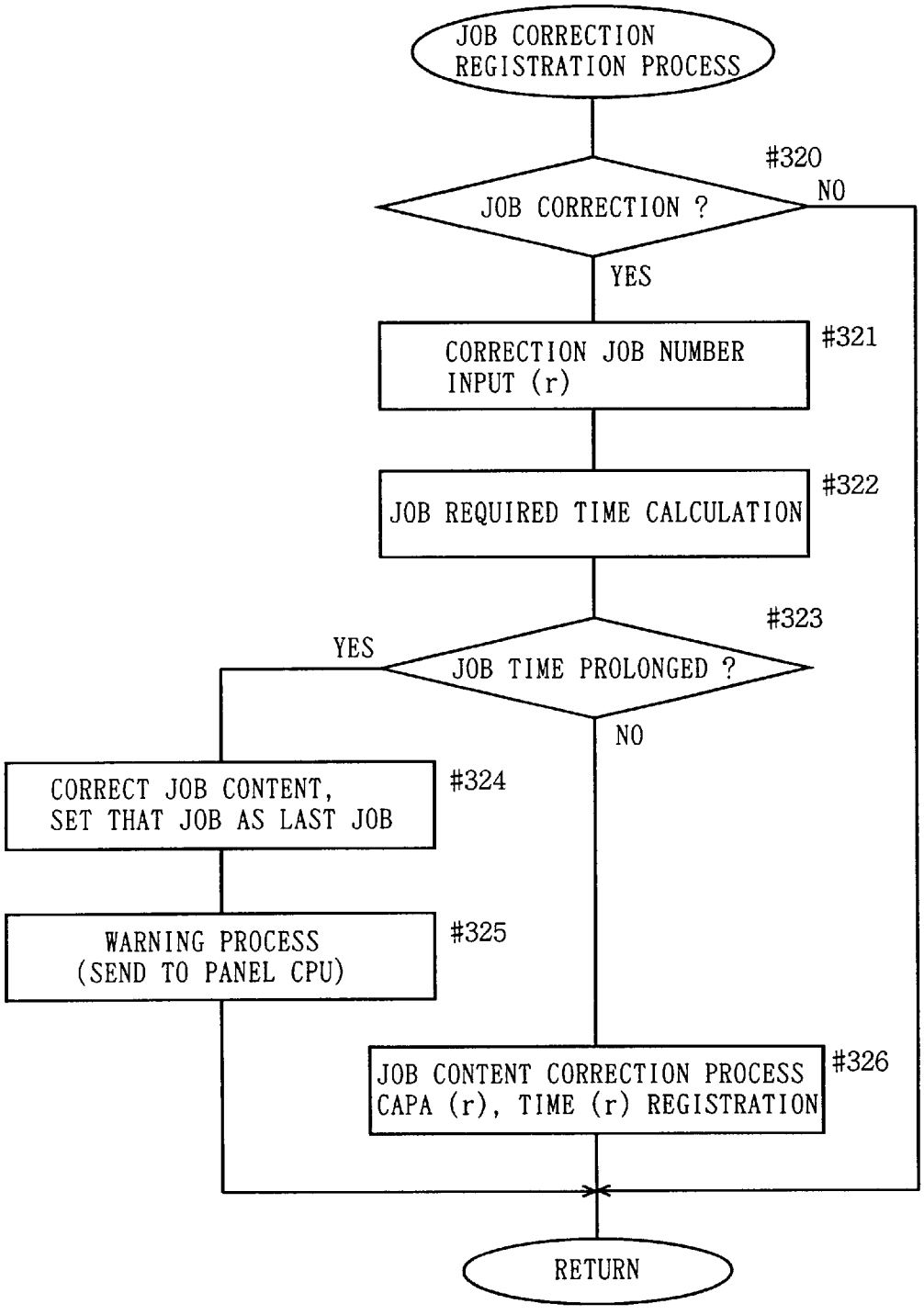

JOB CORRECTION REGISTRATION PROCESS
#320
JOB CORRECTION ?
NO
YES
CORRECTION JOB NUMBER INPUT (r)
#321
JOB REQUIRED TIME CALCULATION
#322
#323
YES
JOB TIME PROLONGED ?
NO
CORRECT JOB CONTENT, SET THAT JOB AS LAST JOB
#324
WARNING PROCESS (SEND TO PANEL CPU)
#325
JOB CONTENT CORRECTION PROCESS CAPA (r), TIME (r) REGISTRATION
#326
RETURN

FIG. 32

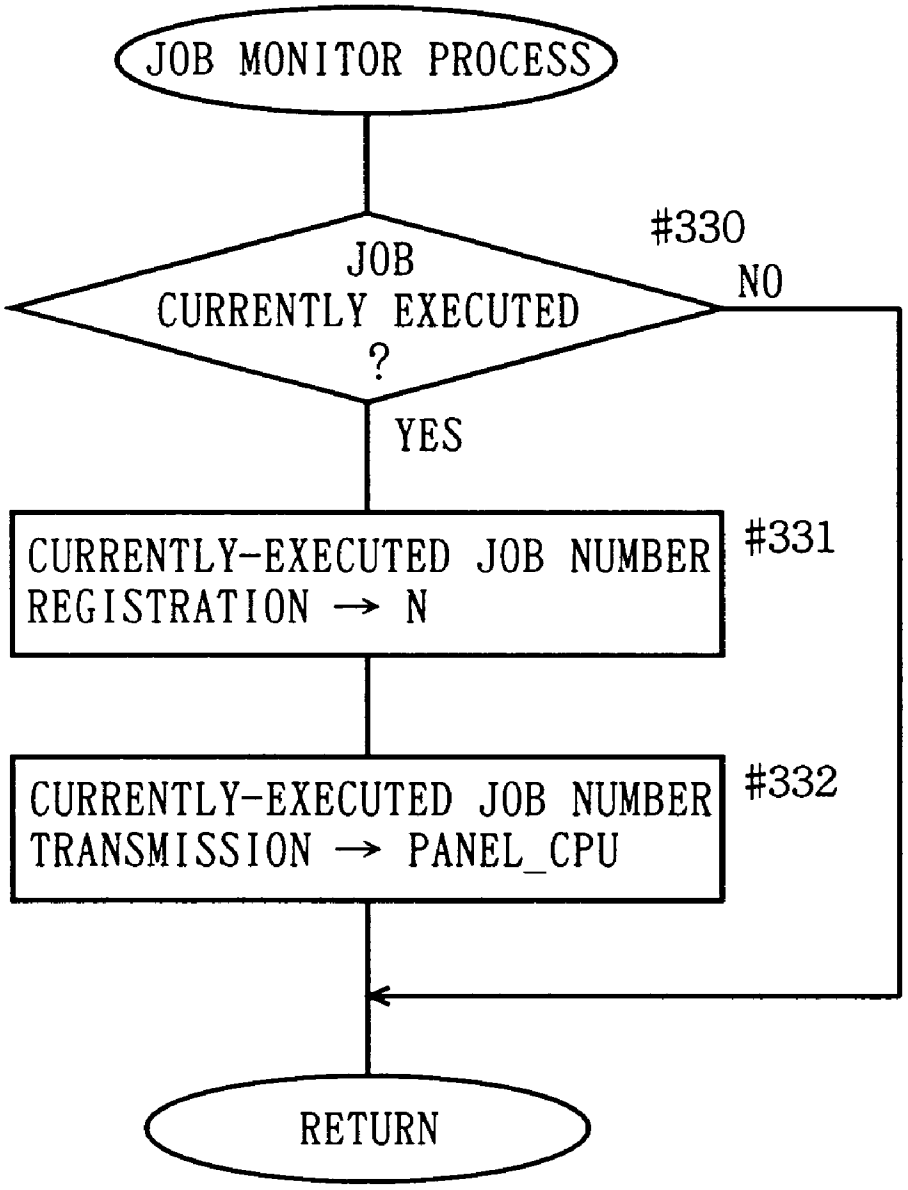

JOB MONITOR PROCESS
#330
JOB CURRENTLY EXECUTED ?
NO
YES
CURRENTLY-EXECUTED JOB NUMBER REGISTRATION → N
#331
CURRENTLY-EXECUTED JOB NUMBER TRANSMISSION → PANEL_CPU
#332
RETURN

FIG. 33

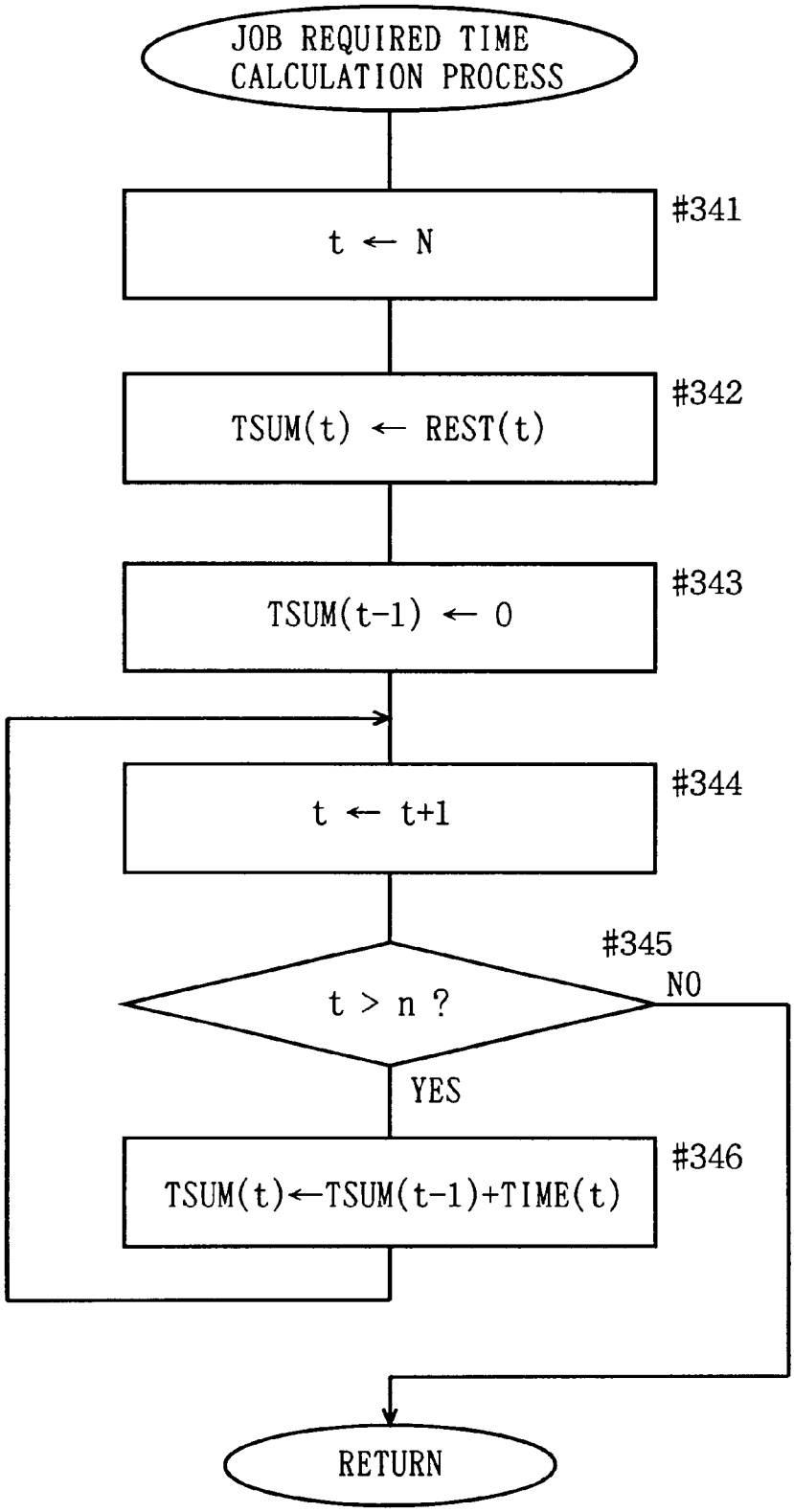

JOB REQUIRED TIME CALCULATION PROCESS
t ← N
#341
TSUM(t) ← REST(t)
#342
TSUM(t-1) ← 0
#343
t ← t+1
#344
t > n ?
#345
NO
YES
TSUM(t)←TSUM(t-1)+TIME(t)
#346
RETURN

FIG. 34

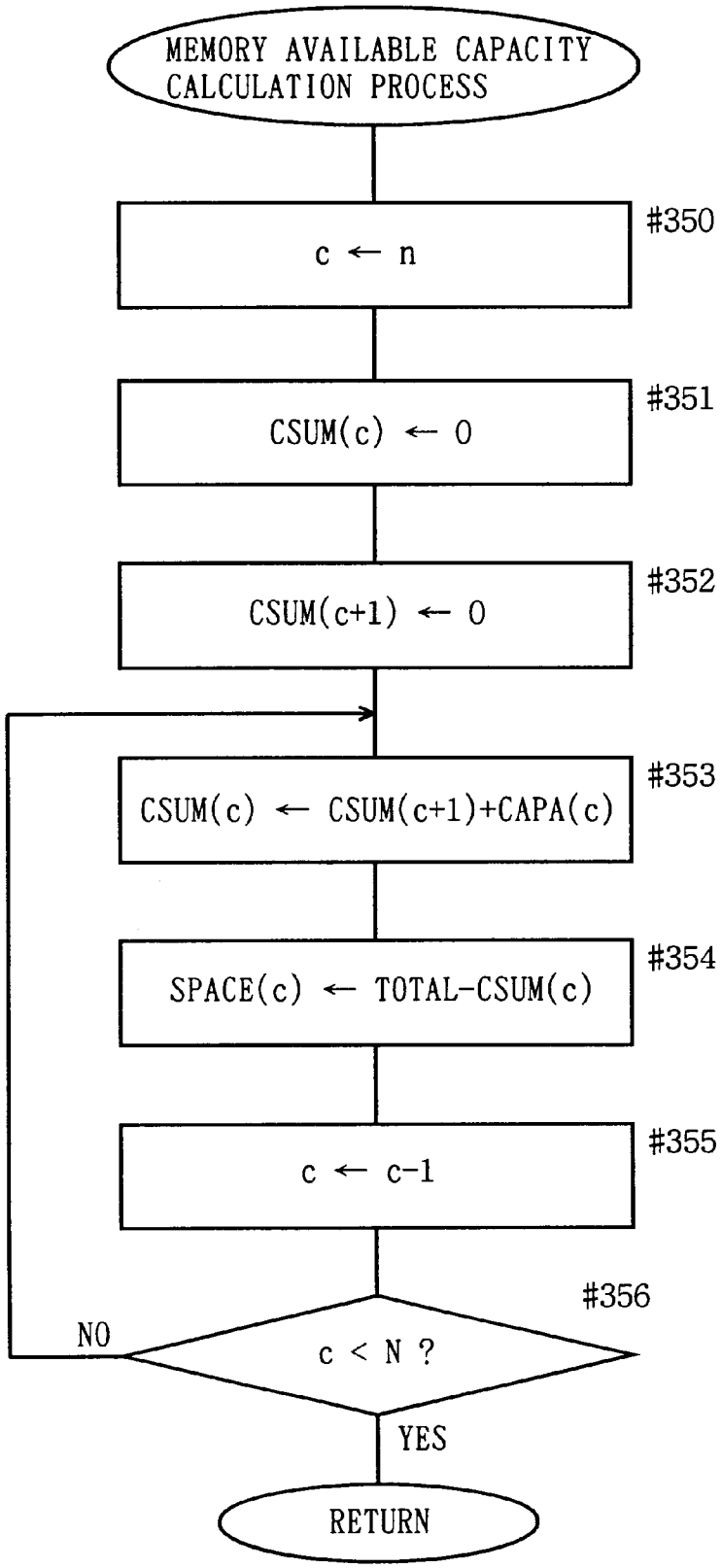

MEMORY AVAILABLE CAPACITY CALCULATION PROCESS
c ← n
#350
CSUM(c) ← 0
#351
CSUM(c+1) ← 0
#352
CSUM(c) ← CSUM(c+1)+CAPA(c)
#353
SPACE(c) ← TOTAL-CSUM(c)
#354
c ← c-1
#355
#356
NO
c < N ?
YES
RETURN

FIG. 35

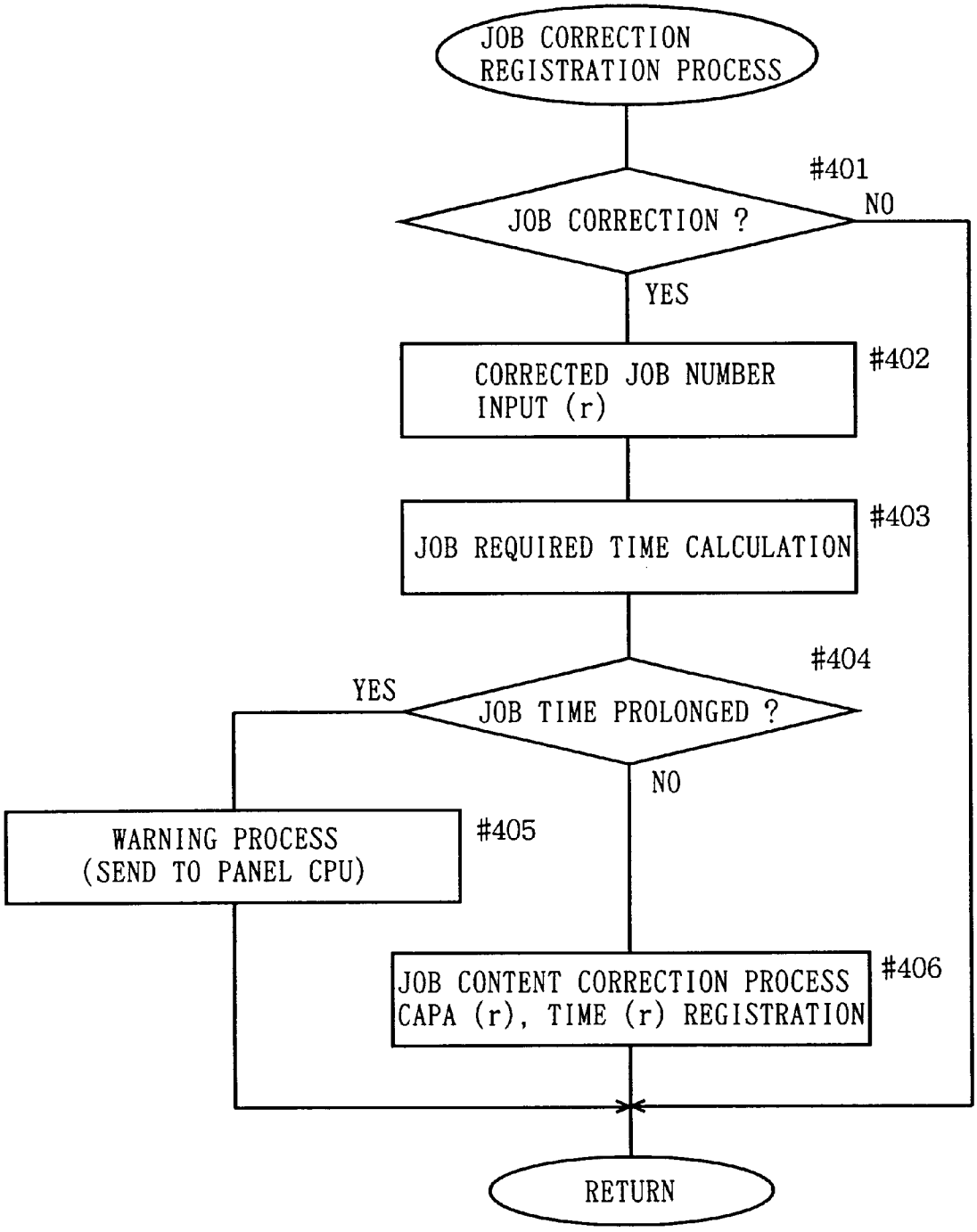

JOB CORRECTION REGISTRATION PROCESS
#401
JOB CORRECTION ?
NO
YES
CORRECTED JOB NUMBER INPUT (r)
#402
JOB REQUIRED TIME CALCULATION
#403
#404
YES
JOB TIME PROLONGED ?
NO
WARNING PROCESS (SEND TO PANEL CPU)
#405
JOB CONTENT CORRECTION PROCESS CAPA (r), TIME (r) REGISTRATION
#406
RETURN

FIG. 36

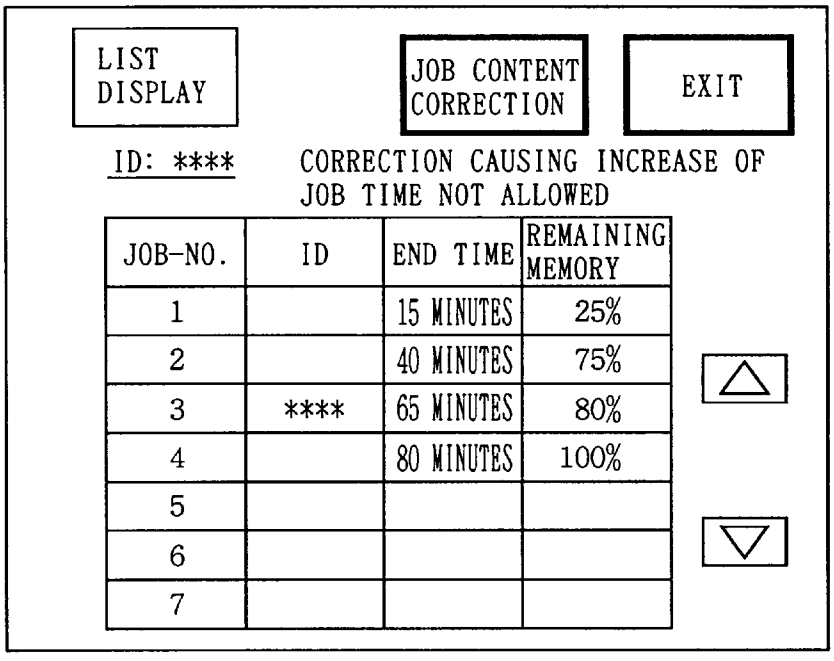

LIST DISPLAY
JOB CONTENT CORRECTION
EXIT
ID: ****
CORRECTION CAUSING INCREASE OF JOB TIME NOT ALLOWED
JOB-NO. | ID | END TIME | REMAINING MEMORY
1 | | 15 MINUTES | 25%
2 | | 40 MINUTES | 75%
3 | **** | 65 MINUTES | 80%
4 | | 80 MINUTES | 100%
5
6
7

FIG. 38

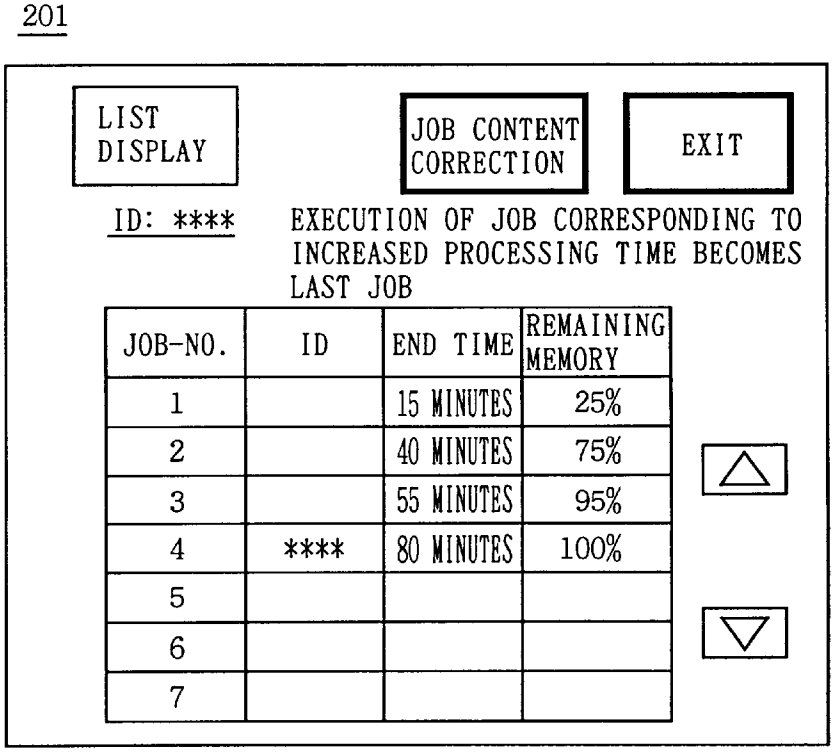

201
LIST DISPLAY
JOB CONTENT CORRECTION
EXIT
ID: ****
EXECUTION OF JOB CORRESPONDING TO INCREASED PROCESSING TIME BECOMES LAST JOB
JOB-NO. | ID | END TIME | REMAINING MEMORY
1 | | 15 MINUTES | 25%
2 | | 40 MINUTES | 75%
3 | | 55 MINUTES | 95%
4 | **** | 80 MINUTES | 100%
5
6
7

FIG. 37

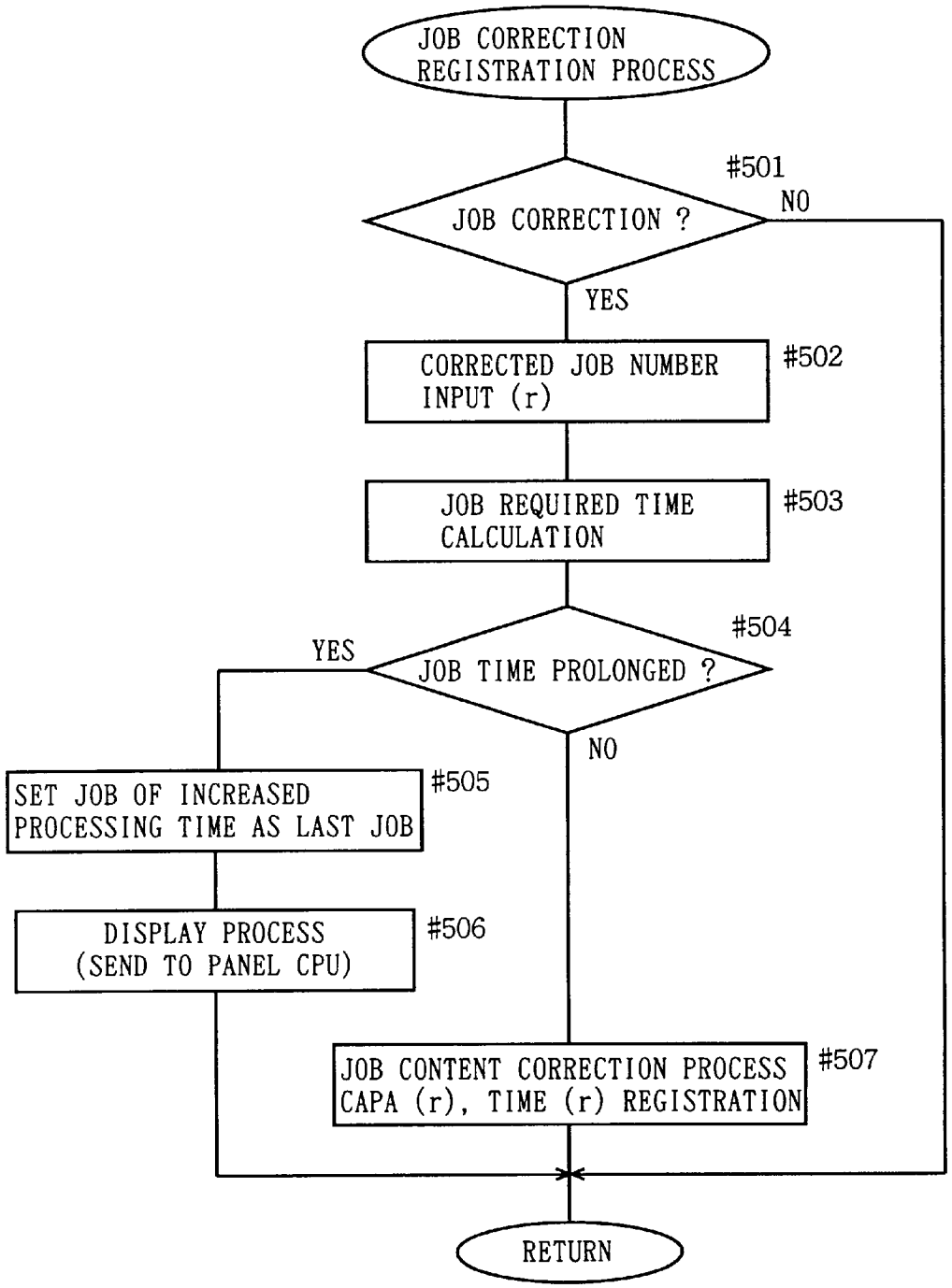

JOB CORRECTION REGISTRATION PROCESS
#501
JOB CORRECTION ?
NO
YES
CORRECTED JOB NUMBER INPUT (r)
#502
JOB REQUIRED TIME CALCULATION
#503
#504
YES
JOB TIME PROLONGED ?
NO
SET JOB OF INCREASED PROCESSING TIME AS LAST JOB
#505
DISPLAY PROCESS (SEND TO PANEL CPU)
#506
JOB CONTENT CORRECTION PROCESS CAPA (r), TIME (r) REGISTRATION
#507
RETURN

IMAGE FORMATION APPARATUS EXECUTING PLURALITY REGISTERED JOBS IN ORDER

This application is based on Japanese Patent Application Nos. 9-209284, 9-209285, 9-209286 and 10-206043 filed in Japan, the contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to image formation apparatuses, and more particularly, to an image formation apparatus employed as a copy machine, a facsimile apparatus, or a composite machine thereof

2. Description of the Related Art

Conventional digital copy machines with a memory function (one type of an image formation apparatus) is known. The memory function is provided to store read image data and task contents (number of copies, copy magnification rate and the like). By virtue of the memory function, input of image data and contents of a task and output of an image (copy output) can be carried out independently. One task is referred to as one job. A copy machine that has a plurality of jobs registered and executed in order is called a multi job copy machine.

In the case where a multi job copy machine is commonly used by a plurality of users, the person to register a new job can identify the time required until that newly registered job will be executed from the data amount of unprocessed job remaining in the memory.

In a multi job copy machine, the content (number of copies, magnification rate and the like) of a job registered in the memory and not yet processed may be corrected and modified. For example, when the number of copies to be taken is to be increased by correction, the time required for executing the job will be prolonged than the time prior to correction.

This means that the starting and ending time of a subsequent job will be delayed. Inconvenience will be caused to other users if the starting time and ending time of a job input by another user is delayed.

SUMMARY OF THE INVENTION

In view of the foregoing, an object of the present invention is to suppress inconvenience even when the content of a registered task is modified in a controller of an apparatus that registers and executes in order a plurality of jobs.

Another object of the present invention is to allow an operator to easily identify when his/her own job is to be executed in a controller of an apparatus that registers and executes in order a plurality of jobs.

A further object of the present invention is to suppress inconvenience even when the content of a registered task is modified in a controlling method of an apparatus that registers and executes in order a plurality of jobs.

Still another object of the present invention is to allow an operator to easily identify when his/her own job is to be executed in a controlling method of an apparatus that registers and executes in order a plurality of jobs.

The above objects of the present invention are achieved by a controller that controls jobs to be executed by an apparatus including the following elements.

According to an aspect of the present invention, a controller includes a memory for storing the order of execution

of a first job and a second job, and first data corresponding to the first job. The first job is to be executed before the execution of the second job according to the order. The first data relates to a period of time for executing the first job. The controller further includes a change unit for changing the content of the first data, and a prevention unit for preventing the second job from delaying the execution due to the change of the content of the first data.

Control is provided so that, even when the first data corresponding to the fist job is changed, the succeeding second job is not delayed. As a result, inconvenience will not occur even when the content of a registered task is altered in a controller of an apparatus that executes a plurality of jobs in order.

According to another aspect of the present invention, a controller includes a memory for storing the order of execution of a plurality of jobs including a specific job, and specific data relating to the specific job. The controller further includes an input unit for entering identity data for identifying an operator, and a notification unit for notifying an order of the specific job among the plurality of jobs to the operator in a case where the identity data applied from said input means is identical to the specific data of the specific job.

When the operator enters data identifying his/herself, the order of his/her own job out of the plurality of jobs is displayed. As a result, the operator can easily identify when his/her own job is to be executed in a controller of an apparatus that executes a plurality of jobs in order.

According to a further aspect of the present invention, a method for controlling jobs to be executed by an apparatus includes the steps of storing the order of execution of a first job and a second job, and first data corresponding to the first job. The first job is to be executed before the execution of the second job according to the order. The first data relates to a period of time for executing the first job. The method further includes the steps of changing the content of the first data, and preventing the second job from delaying the execution caused by a change in the content of the first data.

Control is provided so that, even when the first data corresponding to the first job is changed, the succeeding second job is not delayed by the change. As a result, inconvenience will not occur even when the content of a registered task is modified in a controller of an apparatus that executes a plurality of jobs in order.

According to still another aspect of the present invention, a method for controlling a job to be executed by an apparatus includes the steps of storing the order of execution of a plurality of jobs including a specific job, and also specific data relating to the specific job. The method further includes the steps of entering identity data for identifying an operator, and notifying an order of the specific job among the plurality of jobs to the operator in a case where the identity data applied from said input means is identical to the specific data of the specific job.

When the operator enters data identifying his/herself, the order of his/her job is displayed out from a plurality of jobs. As a result, the operator can easily identify when his/her job is to be executed in a controller of an apparatus that executes a plurality of jobs in order.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view showing an entire structure of a copy machine according to a first embodiment of the present invention.

FIG. **2** is a plan view of an operation panel of the copy machine of FIG. **1**.

FIG. **3** is a block diagram showing a structure of a control unit of the copy machine of FIG. **1**.

FIG. **4** is a block diagram subsequent to FIG. **3**.

FIG. **5** is a block diagram showing a structure of an image signal processing unit **20** of FIG. **1**.

FIG. **6** is a block diagram showing a structure of a memory unit **30** of FIG. **1**.

FIG. **7** shows an administration table of a code memory **306**.

FIG. **8** shows a structure of code memory **306**.

FIG. **9** shows an operation sequence in a memory write operation.

FIG. **10** shows an operation sequence in a memory read operation.

FIGS. **11**, **12**, **13**, and **14** are main flow charts of a CPU**1**, a CPU**3**, a CPU**4**, and a CPU**5**, respectively.

FIG. **15** is a flow chart of the panel display process (#**14**) of FIG. **11**.

FIG. **16** shows a basic screen.

FIG. **17** shows a job administration basic screen.

FIG. **18** shows a job number display screen.

FIG. **19** shows an input state of an ID code from the state of FIG. **18**.

FIG. **20** shows a specific example of a job administration table.

FIG. **21** shows a screen displaying a list of registered jobs.

FIG. **22** shows an input state of an ID code from the state of FIG. **21**.

FIG. **23** is a flow chart of the miscellaneous process (#**15**) of FIG. **11**.

FIG. **24** is a flow chart of the ID input process (#**201**) of FIG. **23**.

FIG. **25** is a flow chart of the job input process (#**202**) of FIG. **23**.

FIG. **26** is a flow chart of the job correction input process (#**203**) of FIG. **23**.

FIG. **27** is a flow chart of the job correction warning display process (#**204**) of FIG. **23**.

FIG. **28** shows a screen displaying a warning for job correction.

FIG. **29** is a flow chart of the miscellaneous process (#**38**) of FIG. **12**.

FIG. **30** is a flow chart of the job registration process (#**300**) of FIG. **29**.

FIG. **31** is a flow chart of the job correction registration process (#**30 1**) of FIG. **29**.

FIG. **32** is a flow chart of the job monitor process (#**302**) of FIG. **29**.

FIG. **33** is a flow chart of the job required time calculation process (#**303**) of FIG. **29**.

FIG. **34** is a flow chart of the memory available capacity calculation process (#**304**) of FIG. **29**.

FIG. **35** is a flow chart of the job correction registration process routine according to a second embodiment of the present invention.

FIG. **36** shows a warning display when the required time of a job is prolonged by correction according to the second embodiment.

FIG. **37** is a flow chart showing a job correction registration process routine according to a third embodiment of the present invention.

FIG. **38** shows display contents when the required time of a job is prolonged by correction according to the third embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

FIG. **1** is a sectional view showing an entire structure of a digital copy machine according to a first embodiment of the present invention. Referring to FIG. **1**, a digital copy machine includes a scanning system for reading an original document and converting the read information into image signals, an image signal processing unit **20** for processing image signals from scanning system **10**, a memory unit **30** for storing image data from image signal processing unit **20** and providing image data to a print processing unit **40**, print processing unit **40** for driving a semiconductor laser **61** according to image data output from memory unit **30**, a laser optical system **60** for directing a laser beam from semiconductor laser **61** to an exposure position on a photoconductor drum **71**, an image forming system **70** for developing a latent image by exposure to transfer the image on a recording sheet and fixing the same to form an image, an operation panel (not shown in FIG. **1**) provided at the top plane of the main body of the copy machine, and a document feeder unit **500** for conveying a document and reversing, if necessary, the sides of a document.

An image reader IR is formed of scanning system **10** and image signal processing unit **20**. A printer unit P is formed of print processing unit **40**, laser optical system **60**, and image forming unit **70**, and the like.

Image reader IR reads an image of a document placed on document glass **19** to generate image data corresponding to each pixel of the image of the document. A first scanner **11** includes an exposure lamp **12** and a first mirror **13***a*. A second scanner **14** includes a second mirror **13***b* and a third mirror **13***c*. First and second scanners **11** and **14** move in the direction (subscanning direction) of arrows b and b' by the drive of a scan motor M**2**.

The light from exposure lamp **12** is reflected by the original document on document glass **19** to be directed to a line sensor (CCD) **17** via mirrors **13***a*, **13***b*, **13***c* and a lens **15**. Line sensor **17** has a plurality of photoelectric conversion elements arranged in a direction (main scanning direction) perpendicular to the sheet plane of FIG. **1**. Line sensor **17** reads out an image at 400 DPI, for example, to output image data corresponding to each pixel.

Line sensor **17** subscans the document image by the travel of first scanner **11** in the direction of arrows b, b'. A sensor SE**3** serves to detect that first scanner **11** is at its home position.

Image data output from line sensor **17** is processed by image signal processing unit **20** to be sent to memory unit **30**. Memory unit **30** compresses the image data from image signal processing unit **20** to store the compressed image data. The data is expanded to be sent to printer unit P. At this stage, a rotation editing process and the like is applied if necessary.

Memory unit **30** includes an interface unit that will be described afterwards with respect to an external device. Memory unit **30** is connected to an external device through an external cable **91** by means of an external device connector **90**. The details of image signal processing unit **20** and memory unit **30** will be described afterwards.

Printer unit P will be described hereinafter. Print processing unit **40** provides control of laser optical system **60**

according to the image data from memory unit **30**. Laser optical system **60** includes semiconductor laser **61** emitting a laser beam that is modulation-controlled (on/off) by print processing unit **40**, and a polygon mirror **62**, a fθ lens **63** and mirrors **64***a* and **64***b* for directing the laser beam from semiconductor laser **61** onto photoconductor drum **71** for scanning.

A corona charger **72**, a development device **73**, a transfer charger **74**, a separation charger **75**, a cleaner **76**, and an erasure lamp **77** are arranged in the direction of rotation around photoconductor drum **71** that is rotated. A toner image is formed by the well known electrophotographic process on photoconductor drum **71** to be transferred onto a sheet. A sheet is fed out from sheet feed cassettes **81***a* and **81***b* by sheet feed rollers **82***a* and **82***b* to be sent to a position of transfer charger **74** through a sheet feed path **83** and by a timing roller **84**. The sheet on which a toner image is transferred at the site of transfer charger **74** is discharged to a sheet refeed unit **600** via a transportation belt **85**, a fix device **86**, and a discharge roller **87**.

Each roller of image forming unit **70** and photoconductor drum **71** are driven by a main motor M1. Sheet size detection sensors SE1 and SE2 for detecting the size of the sheet stored in each cassette are provided in the proximity of sheet feed cassettes **81***a* and **81***b*.

Document feeder unit **500** functions to automatically feed a document set on document feed tray **510** onto document glass **19**, and also discharge a document read out by scanning system **10** to document discharge unit **511**.

In a normal mode, the user sets one or a plurality of documents on document feed tray **510** with the side to be read out upwards. The user also adjusts the side regulation board to the width of the document. Upon initiation of an operation, the set document is fed out from the bottom sheet one by one in order by sheet feed roller **501** to be separated from each other by an unloosen roller **502** and an unloosen pad **503**. The fed document passes through an intermediate roller **504** to have the size and the like detected by a regist sensor SE**51** and a width size sensor SE**53**. Any slanting arrangement is corrected by a regist roller **505**. When the trailing end of the document passes the left end of a document scale **512**, document transport belt **506** is slightly inverted in rotation and stops.

As a result, the right end of the document abuts against the edge of document scale **512**. The original is set at a proper position on document glass **19**. At the current stage, the leading end of the next document arrives at the position of resist roller **505** to reduce the time required for transferring the next document.

When the document is set at a proper reading position on document glass **19**, the document is scanned to be read out by scanning system **10**. When the reading operation of the document ends, the document is conveyed leftwards by document transport belt **506** to have its direction of transportation altered by an inversion roller **507**. The sheet passes above a switching claw **508** to be discharged onto discharge tray **511**.

When the readout of the first side face ends for a double-sided document, the document is conveyed leftwards by document transport belt **506** to have its direction of transportation altered by an inversion roller **507**. Then, the document is sent back onto document glass **19** by switching claw **508**. As a result, the second side face of the original is set at the reading position.

Following the read out of the second side face, the document is conveyed leftwards by document transport belt **506** to be discharged to discharge tray **511** via inversion roller **507**, switching claw **508**, and discharge roller **509**.

Sheet refeed unit **600** is attached at the side face of the plinter as an additional device to effect duplex copy automatically. Sheet refeed unit **600** functions to temporarily store a sheet fed out from the main unit by discharge roller **87** and effect switch back transportation to send the sheet back again to the printer.

In a simplex copy mode, the sheet passes through sheet refeed unit **600** to be discharged to discharge tray **621**. In a duplex copy mode, the left end portion of switching claw **601** moves upwards by a solenoid not shown. The sheet discharged from discharge roller **87** arrives at a forward/positive reversing roller **603** via transport roller **602**.

When the trailing edge of the sheet arrives at sheet sensor SE**61**, forward/positive reversing roller is driven in an opposite direction. As a result, the sheet is returned to the printer. This sheet passes through horizontal transport rollers **88***a*, **88***b* and **88***c* to be sent to a timing roller **84** to attain a standby state.

When a plurality of sheets are fed continuously, a predetermined interval is provided between each sheet so that they will not overlap each other. The sheets are sent to sheet refeed unit **600** with such a predetermined interval. Since the length of the sheet transportation path is constant, the number of sheets of one circulation by sheet refeed unit **600** and horizontal transport rollers **88***a*–**88***c* (the maximum number of circulating sheets) depends upon the sheet size.

FIG. **2** is a plan view of an operation panel of the digital copy machine of FIG. **1**.

The operation panel includes a liquid crystal touch panel **201** to display the status and to set various modes, a ten-key **202** for entering numerical conditions of copy (number of copies, magnification rate, and the like), a clear key **203** to reduce the numerical conditions to the default values, a panel reset key **204** to initialize the copy mode, a stop key **205** for designating copy cessation, a start key **206** for designating initiation of a copy operation, a document specify key **209** for specifying a single-sided document or a double-sided document, a copy mode key **201** to switch between simplex copy and duplex copy, and an interruption key **208** for actuating interruption or to cancel interruption.

An ID card inlet **211** is provided at the operation panel to insert an ID card **212**.

FIGS. **3** and **4** are block diagrams showing a structure of a control unit **100** of a copy machine.

Referring to FIGS. **3** and **4**, a control unit **100** is formed based on seven CPUs **1**–**7**. ROM **111**–**117** in which respective programs are stored and RAM **121**–**127** corresponding to the work area for program execution are provided for CPU **1**–**7**, respectively. It is to be noted that CPU **3** is provided in memory unit **30**.

CPU **1** provides control associated with signal input from various operation keys of the operation panel and the display of liquid crystal touch panel **201**. CPU **2** provides control of each element of image signal processing unit **20** and the drive of scanning system **10**. CPU **4** provides control of print processing unit **40**, laser optical system **60** and image forming system **70**. CPU **4** also provides control of main motor M1. CPU carries out the process for adjusting the entire timing of control unit **100** and for setting an operation mode.

CPU **3** controls memory unit **30** so that the image data read out is temporarily stored in a memory (image memory **304** in FIG. **6**). CPU **3** provides the image data in the

memory to print processing unit **40**. Memory unit **30** includes a function to implement interface with an external device. Input and output of image data and control data are carried out through memory unit **30**.

A signal from sheet size detection sensors SE1 and SE2 is applied to the I/O under control of CPU **4**. The size of a copy sheet is under control of CPU **4**.

CPU **6** provides control of document transportation by document feeder unit **500**. CPU **7** provides control of sheet refeed unit **600**.

FIG. **5** is a block diagram of image reader IR and image signal processing unit **20**. In FIG. **5**, CPU **2**, ROM **112**, RAM **122** and line sensor (CCD) **17** correspond to respective components of FIG. **3**.

Referring to FIG. **5**, an image read synchronizing signal is supplied to each block from a timing control unit **21**. CCD (Line sensor) **17** converts the document information photoelectrically to generate an electrical signal. That signal is amplified by an amplifier (AMP) **23** and then converted into a 8-bit digital signal by an A/D converter **25**. The digital signal is subjected to a process to removing distortion caused by optical system **60** and CCD **17** by a shading correction unit **26**. Then, a process is carried out at a density conversion unit **27** to convert reflection data to density data and to apply a gamma correction.

The signal output from density conversion unit **27** is applied to an electrical variable scale magnification unit **28**. A variable scale magnification process is carried out electrically in the main scanning direction from the set magnification rate information. The image data subjected to an editing process by an editing process unit **29** is supplied to printer unit P and memory unit **30**.

An image monitor memory **24** stores one line of image data upon designation from CPU **2**. CPU **2** provides the overall control of image reader IR such as setting the parameters towards each of image processing units **26–29**, scanning control by the drive of scanner motor M2, and communication with CPU **5** (host CPU) of timing control unit **21**.

The method of detecting the document size and the direction of arrangement of a document will be described hereinafter.

Determination of which portion of the readout image corresponds to the document is made according to the amount of reflected light. For example, employing the document cover as a mirror face, the document is scanned and the portion that has a great amount of reflected light is determined as corresponding to a document. The determination can be made easily since there is almost no reflected light in the case of a mirror plane. Therefore, the position of a document can be identified even when scanning is carried out with the document cover open.

CPU **2** effects preliminary scanning upon receiving an instruction of a document size detection operation from CPU **5**. CPU **2** controls scanner motor M2 according to the scanner position information from a scanner position sensor SE-IR to drive first scanner **11** in the subscanning direction. At a timing corresponding to the subscanning direction, the document size and the lengthwise/crosswise arrangement of the document are detected from the contents of the image data and the scanner position information. The detected result is transmitted to host CPU **5**.

The accurate location of the placed document, for example, the amount of offset or inclination angle with respect to the standard position, is similarly detected. The detected result is transmitted to CPU **5**.

At the time of image readout, CPU **2** controls the speed of scanner motor M2 at a scanning speed conforming to the magnification information sent from CPU **5**.

FIG. **6** is a block diagram of memory unit **30**.

Referring to FIG. **6**, memory unit **30** includes a bus switch unit **301** for switching the route of image data to image signal processing unit **20**, print processing unit **40**, and external IF unit **310**, a region discrimination unit **303** for discriminating between a simple binary region and a half tone region of the input image data, a binarization processing unit **302** for generating binary data according to the parameter setting from CPU **3**, an image memory **304** having a capacity corresponding to two pages, a code processing unit **305** with a compressor **311** and an expander **312** that are operable independently, a multiport code memory **306**, an editing processing unit **307** to effect rotation, magnification, shiting, and the like, a multi-value processing unit **308** for carrying out a multi-value process according to the parameter setting from CPU **3**, a smoothing processing unit **309** for carrying out a smoothing process, and a CPU **3** that provides the overall control thereof.

Switching unit **301** transfers image data with an external device via external IF unit **310**. The image transfer between code memory **306** and external IF unit **310** can be carried out parallel to the copy process of the main body. Here, image data is compressed/expanded at code processing unit **305**, if necessary.

In a copy operation of a memory mode where an image read out by scanning a document or an image applied from an external device through external IF unit **310** is temporarily stored, multi-value image data of 8 bits is applied to binarization processing unit **302** of memory unit **30** from image signal processing unit **20** via a bus switching unit **301** and region discrimination unit **303**. Binarization processing unit **302** carries out a process such as error diffusion, dither, and the like to convert the multi-value image data into binary image data in a restorable range. The image data after binaiization is temporarily witten into image memory **304**.

When image data is written into image memory **304**, code processing unit **305** reads out and compresses the data to generate code data (compressed data). The code data is written into code memory **306**. Code processing unit **305** reads out the code memory that is to be printed out from code memory **306** to expand the data. The obtained image data is written into image memory **304**. Compressor **311** and expander **312** are implemented to be operated independent of each other and concurrently to improve the copy speed. Data is DMA-transferred between these components and code memory **306** by a DMA controller not shown.

When the expanded image data is transferred to image memory **304**, an editing process such as rotation, scale magnification, and the like is carried out, if necessary, by editing processing unit **307**.

When image data of one page is reproduced by the expansion and editing process, that data is read out from image memory **304**. The readout data is restored to multi-value data, depending upon the mode, by multi-value processing unit **308** and smoothing processing unit **309**. The multi-value image data is transferred to print process unit **40** or to an external device via external IF unit **310**.

In such a temporary storage of a document image, code memory **306** is under control of administration table MT1 provided within RAM **123**.

FIGS. **7** and **8** show the relationship between administration table MT1 and code memory **306**.

Code memory **306** is divided into memory regions of 32 Kbytes in unit. Code data on a page-by-page basis is stored

in respective regions on account of allowing simultaneous control of writing (reading an image) and read out (printing).

A number indicating a region in code memory **306**, a page number (document image number) PN of image data assigned in the order of writing (in the order of scanning a document), the number of a concatenated region, and various additional information required in the compress/expand process such as the type of the compression method, data length, and the like are stored in administration table MT1. Code memory **306** is administered dynamically under these information.

In FIG. **7**, "preceding-concatenation" indicates the connection in the preceding direction of each 32 Kbyte-region in each page. A preceding-concatenation of "00" implies that it is the first storage region of data of one page. Similarly, "succeeding-concatenation" indicates the connection in the succeeding direction. When the succeeding-concatenation is "FF", the region is the last region. A value other than "FF" indicates the number of the next connected region.

In reading out image data from image memory **304** for compression, CPU **3** controls compression unit **311** so that image data is stored into code memory **306** while referring to the information in administration table MT1. When image data is to be output, an operation opposite to the above operation is carried out to read out code data from code memory **306**. The information in administration table MT1 is erased when information of the relevant page is properly read out and copy of the number of sheets (number of copies) M specified by the user is completed.

The operation sequence of the digital copy machine will be described hereinafter focusing on a request command (Q), report (A) and data flow between respective CPUs.

FIG. **9** shows a schematic sequence of a memory write operation. In a write operation, image data is transferred from image signal processing unit **20** to image memory **304**.

Referring to FIG. **9**, CPU **5** providing the entire sequence control requests CPU **3** to prepare the memory. In response, CPU **3** provides various settings with respect to the internal hardware such as specifying the bus connection status to transfer image data from image signal processing unit **20** to image memory **304**, the mode for binaiization, the head address of a writing region into image memory **304**, the XY length information, and the like.

When the preparation of these settings is completed, CPU **3** notifies CPU **5** that preparation of the memory is completed.

In response to CPU **5** sending a read request to CPU **3** and CPU **2**, CPU **2** requests the internal document scanning unit to carry out a scanning operation.

A scanning operation is initiated by the document scanning unit. When first scanner **11** arrives at the image region, readout data (image data) is sent from image signal processing unit **20** to memory unit **30** according to the image processing mode set by CPU **2**.

When the scanning operation ends and completion of readout is notified from CPU **2** and CPU **3** to CPU **5**, CPU **5** sends a request to CPU **3** for data compression. In response, CPU **3** sets the readout address from image memory **304**, the XY length information, the write address to code memory **306**, the mode of compression unit **311** (for example, arithmetic coding method, or a MH method), and the like. Then, actuation of a relevant element is effected. Thus, a compression process is carried out to store code data into code memory **306**.

When the compression process ends, CPU **3** notifies compression completion to CPU **5**. If code memory **306** is full, a compression complete report including a parameter indicating that compression is disallowed is sent to CPU **5**. Therefore, CPU **5** becomes aware that code memory **306** is full.

FIG. **10** shows a schematic sequence of a memory read out operation.

In a memory read out operation, image data is read out from image memory **304**. A copy image is printed out on a sheet according to the image data.

Referring to FIG. **10**, CPU **5** sends a data expansion request to CPU **3**. CPU **3** sets the readout address from code memory **306**, the data amount, the write address to image memory **304**, the XY length information, the mode of expander **312** (for example, the arithmetic coding method or MH method), the editing process mode such as rotation, and the like to actuate a relevant component. Thus, an expand process is carried out, whereby image data is written into image memory **304**.

When the expand process ends, a complete report is sent from CPU **3** to CPU **5**. Then, CPU **5** sends a memory preparation request to CPU **3** in order to read out image data from image memory **304**. In response, CPU **3** specifies various settings with respect to the internal hardware such as the bus connection state to output image data from image memory **304** to print processing unit **40**, the head address of the readout region of image memory **304**, the XY length information, and the like.

When these settings end and a preparation complete notification is received by CPU **5**, CPU **5** sends a print request to CPU **3** and print processing unit **40**. A sheet feed report indicating the sheet transportation state is sent from print processing unit **40** to CPU **5**. Then, image data read out from image memory **304** is output to print processing unit **40** to be printed out.

Upon completion of the print operation, CPU **3** and print processing unit **40** send a print completion report and an eject completion report to CPU **5**. CPU **5** receiving these reports sends a memory clear request, as necessary, to CPU **3**.

FIG. **11** is a main flow chart of CPU **1** that provides control of the operation panel.

Referring to FIG. **11**, when the power is turned on, CPU **1** executes initialization to initialize the RAM, the register, and the like (#**11**). Then, an internal timer defining the length of one routine is set (#**12**). A key input process receiving a key operation (#**13**), a panel display process providing a display according to the key input (#**14**), and a miscellaneous process (#**15**) are carried out. Then, expiration of an internal timer is detected. The processes of #**12**–#**16** are carried out repeatedly. Furthermore, communication with another CPU is effected appropriately as an interruption process. The details of the panel display process (#**14**) and the miscellaneous process (#**15**) will be described afterwards.

FIG. **12** is a main flow chart of CPU **3** providing control of memory unit **30**.

Following the execution of the initial setting process (#**31**), CPU **3** repeatedly executes the command reception process (#**32**), the status transmission process (#**33**), the image memory write process (#**34**), the compress control process (#**35**), the expand control process (#**36**), the image memory read out process (#**37**) and the miscellaneous process (#**38**).

FIG. **13** is a main flow chart of a CPU **4** providing control of printer unit P.

Following the initialization (#41), CPU 4 repeatedly executes the processes of setting an internal timer (#42), controlling the development and transfer system (#43), controlling the transportation system (#44), controlling the fix system (#45), controlling the print processing unit (#46), the miscellaneous process (#47), and detecting the expiration of the internal timer (#48).

FIG. 14 is the main flow of CPU 5 providing the overall control of the copy machine.

Following the initialization (#51), CPU 5 repeatedly executes the processes of setting an internal timer (#52), the input data analysis process of checking input data from another CPU (#53), the mode set process of determining the operation mode (#54), the interruption switch process (#55), the command set process according to the mode (#56), output data setting for a command to queue at the communication port (#57), the miscellaneous process (#58), and detecting the expiration of the internal timer (#59).

FIG. 15 is a flow chart of the panel display process (#14) of FIG. 11.

Referring to FIG. 15, determination of what screen is to be displayed on liquid crystal touch panel 201 is made at step #101. If the screen to be displayed is the basic screen, the program proceeds to step #102 to provide a basic screen display.

When the screen to be displayed is a job administration screen at step #101, the program proceeds to step #103 to determine which screen of the job administration screen is to be displayed. When the screen to be 30 displayed is the job administration basic screen, the program proceeds to step #104 to provide a job administration basic screen display.

When determination is made that the screen to be displayed is a job number display screen at step #103, the program proceeds to step #105 to display a job number display screen. When determination is made that an ID code is input through ten-key 202 or by an ID card 212 at step #106, the program proceeds to step #107 to display a registered job corresponding to the ID code. At step #108, a correction key is displayed on liquid crystal touch panel 201.

The user can correct the task content of the job corresponding to that ID code by depressing this correction key.

When determination is made that the screen to be displayed is a list display screen at step #103, the program proceeds to step #109 to provide a list of registered jobs on liquid crystal touch panel 201. At step #110, determination is made whether an ID code is input. When YES, the program proceeds to step #111 to mark a displayed job corresponding to that ID code. Then, the program proceeds to step #112 to provide a correction key display.

When determination is made that the screen to be displayed is the miscellaneous screen at step #101, the program proceeds to step #113 to display a corresponding screen.

FIG. 16 shows the basic screen displayed at step #102 of FIG. 15.

Referring to FIG. 16, a job administration key TP1, a filing key TP2, a finish key TP3, a document→copy key TP4, a basic key TP5, a message display unit TP6, a number of copies display TP7, and a job registration key TP8 are displayed on the basic screen.

In response to the user depressing job administration key TP1, a job administration basic screen that will be described afterwards is displayed on liquid crystal touch panel 201. By depressing job registration key TP8, read out of new image data is carried out. The user inputs the task content (number of copies, copy magnification scale, and the like) to register a new job. The process corresponding to the key input is carried out at step #13 of FIG. 11.

FIG. 17 shows a job administration basic screen displayed at #104 of FIG. 15.

Referring to FIG. 17, a job number display key TP9 and a list display key TP10 are indicated on the job administration basic screen. By depressing respective keys, a registered job can be provided on the display. By depressing basic key TP5, the screen of FIG. 16 is provided on liquid crystal touch panel 201.

FIG. 18 shows a job number display screen provided at step #105 of FIG. 15.

Referring to FIG. 15, a display prompting input of an ID code appears on the job number display screen. Also, an EXIT key TP11 is displayed on this screen. The screen display returns to the job administration basic screen when exit key TP11 is depressed.

FIG. 19 shows the state when an ID code is input subsequent to the state of FIG. 18.

In this case, the input ID code is displayed. The number of a registered job (JOB-No.) corresponding to the input ID code, the end time of that job, and the remaining amount of memory when that job is executed are provided on the screen. Also, a job content correction key TP12 appears on the screen. By depressing job content correction key TP12, the task content of the currently displayed job (number of copies, sheet size, magnification, and other mode) can be corrected.

FIG. 20 shows the form of a job administration table for supervising the registered jobs.

Referring to FIG. 20, the registration number of a job (registration number), image data capacity of that job CAPA (n), the time required to execute that job TIME(n), the time until the currently-executed job ends REST(n), the time starting from the current time to the end of respective jobs TSUM(n), the amount of image data recorded in the memory CSUM(n), the available capacity of the memory SPACE(n), and the ID code of the person who registered that job ID(n) are registered for each job in the job administration table.

In the screen of FIG. 19, the registration number of the job corresponding to the input ID code, the value of variable TSUM(n), and the value of variable SPACE(n) are provided.

FIG. 21 shows a list display screen appearing at step #109 of FIG. 15.

Referring to FIG. 21, a display TP15 of a list of registered jobs appears on the screen. Also, an up key TP13 and a down key TP14 are provided for scrolling through job list display TP15.

In this screen, the registration numbers of all the jobs registered in the job administration table of FIG. 20, the value of variable TSUM(n), and the value of variable SPACE(n) are indicated in job list display TP15. However, the value of ID(n) is not displayed. Therefore, the user cannot specifically identify which job he/she has registered.

When an ID is input under the state of FIG. 21, a screen of FIG. 22 is provided.

Referring to FIG. 22, the ID code input at the position of a job corresponding to the ID code input on job list display TP15 is shown on liquid crystal touch panel 201. Therefore, the user can easily identify the ending time of his/her own registered job.

In the state where an ID code is entered, job content correction key TP1 appears on liquid crystal touch panel 201. Therefore, the user can correct the contents of the registered job for execution.

FIG. **23** is a flow chart showing the process of the miscellaneous process (#**15**) of FIG. **11**.

Referring to FIG. **23**, a process corresponding to an input of an ID code is carried out at step #**201**. Then, the program proceeds to step #**202** to carry out a process for entering a new job. At step #**203**, a process of correcting the content of a registered job is carried out. At step #**204**, a process of displaying a warning is carried out when the correction of a registered job is inconvenient.

FIG. **24** is a flow chart showing the contents of the ID input process (#**201**) of FIG. **23**.

Referring to FIG. **24**, determination is made whether an ID code is input through an ID card or a ten-key **202** at step #**210**. When YES, the input ID code is collated at step #**211**. At step #**212**, determination is made whether that ID code is a code of a user that is permitted to use the copy machine.

When YES at step #**212**, the program proceeds to step #**213** to set a flag JOB indicating the job accept state to "1".

When NO at step #**210** or #**212**, the program returns.

FIG. **25** is a flow chart showing the contents of the job input process (#**202**) of FIG. **23**.

Referring to FIG. **25**, determination is made whether flag JOB indicating the job accept state is "1" or not at step #**221**. When YES, determination is made whether a new job is input at step #**222**. A new job input is registration of a new job by depressing job registration key TP**8** of FIG. **16**.

When YES at step #**222**, the program proceeds to step #**223** to carry out the input process of a new job. More specifically, image data of the new job, the processing content (number of copies, copy magnification, sheet size, mode and the like), and the ID code of the operator registering the new job are stored.

At step #**224**, determination is made whether input of a new job is completed or not. When YES, the program proceeds to step #**225** to set the value of flag JOB indicating the job accept state to "0". Then, the program returns.

When NO at any of steps #**221**, #**222**, and #**224**, the program returns.

FIG. **26** is a flow chart showing the contents of the job correction input process (#**203**) of FIG. **23**.

Referring to FIG. **26**, determination is made whether flag JOB indicating the job accept state is "1" or not at step #**230**. When YES at step #**230**, the program proceeds to step #**231** to determine whether there is a job correction by job content correction key TP**12**. When YES at step #**231**, the program proceeds to step #**232** to carry out a process of correcting the content of a registered job corresponding to the ID code. More specifically, an input process of the number of copies, copy magnification rate, sheet size, mode, and the like is effected.

At step #**233**, determination is made whether input of a job correction is completed or not. When YES, the program proceeds to step #**234** to carry out a process of transferring the corrected contents to CPU **3**.

Then, the program proceeds to #**235** to set the value of flag JOB indicating the job accept state to "0". Then, the program returns.

When NO at any one of steps #**230**, #**231**, and #**233**, the program returns.

CPU **3** confirms the content of the corrected job transferred by step #**234** of FIG. **26** to determine whether the corrected content is appropriate or not. When determination is made that the corrected content is improper, a warning is issued to CPU **1**. Such an operation of CPU **3** will be described afterwards.

FIG. **27** is a flow chart showing the contents of the job correction warning display process (#**204**) of FIG. **23**.

Referring to FIG. **27**, determination is made whether the job content is corrected or not at step #**240**. When YES, the program proceeds to step #**241** to determine whether a warning is issued associated with the correction of the job content from CPU **3**. When YES, the program proceeds to step #**242** to display a warning on liquid crystal touch panel **201**. Then, the program returns.

When NO at step #**241**, completion of the job correction is displayed on liquid crystal touch panel **201**. Then, the program returns.

When NO at #**240**, the program returns.

FIG. **28** shows a message displayed on liquid crystal touch panel **201** according to the job correction warning display (#**242**) of FIG. **27**.

When the job content is corrected in the present embodiment, determination is made whether the time required to execute the corrected job is prolonged than that prior to correction. When the corrected job requires a longer period of time, the process of the corrected job is set as the last job. As a result, inconvenience that the ending time of a job registered by another user being delayed from a predetermined time will not occur.

Referring to FIG. **28**, a message is displayed indicating that the process of the corrected job is set as the last job in liquid crystal touch panel **201**.

FIG. **29** is a flow chart showing the contents of the miscellaneous process (#**38**) of CPU **3** of FIG. **12**.

Referring to FIG. **29**, a registration process of a new job is carried out at step #**300**. At step #**301**, a process of correcting a job that is already registered is carried out. At step #**302**, a process of monitoring a currently-executed job is carried out. At step #**303**, a process is canied out to calculate the time required for the registered job and the ending time. At step #**304**, a process of calculating the available capacity in the memory is carried out.

FIG. **30** is a flow chart showing the contents of the job registration process (#**300**) of FIG. **29**.

Refering to FIG. **30**, determination is made whether a new job is registered or not at step #**310**. When YES, the program proceeds to step #**311** to increment by 1 the variable n indicating the last registration number of the registered job at step #**311**. At step #**312**, a process of registering a new job is carried out. At step #**313**, the capacity of the image data of the new job is stored in variable CAPA(n). At step #**314**, the time required to execute that job is stored in variable TIME(n).

When NO at step #**310**, the program returns.

FIG. **31** is a flow chart showing the contents of the job correction registration process (#**301**) of FIG. **29**.

Referring to FIG. **31**, determination is made whether the registered job is corrected or not at step #**320**. When YES, the program proceeds to step #**321** to obtain a registration number r of a job to be corrected from the ID code and the like. At step #**322**, the time required to execute the corrected job is calculated. At step #**323**, determination is made whether the time required for the corrected job is prolonged or not. When YES, the program proceeds to step #**324** to set the job having a longer processing time as the last job. At step #**325**, a warning is issued to CPU **1**.

When NO at step #**323**, a process of correcting the content of a job is carried out at step #**326**. The values of variables CAPA(r) and TIME(r) are newly registered.

When NO at step #**320**, the program returns.

FIG. **32** is a flow chart showing the contents of the job monitor process (#**302**) of FIG. **29**.

Referring to FIG. **32**, determination is made whether a job is currently executed at step #**330**. When YES, the program proceeds to step #**331** to register the registration number of the currently-executed job to variable N.

At step #**332**, the value of variable N is sent to CPU **1**.

When No at step #**330**, the program returns.

FIG. **33** is a flow chart showing the contents of the job required time calculation process (#**303**) of FIG. **29**.

Referring to FIG. **33**, the in-process job number N is substituted for variable t at step #**341**. At step #**342**, the value of variable REST(t) is substituted for variable TSUM(t) (refer to FIG. **20**).

At step #**343**, the value of variable TSUM(t−1) is set to 0. At step #**344**, the value of variable t is incremented by 1. At step #**345**, determination is made whether the value of variable T exceeds the value of variable n. When YES, the program proceeds to step #**346** to substitute the value of TSUM(t−1)+TIME(t) for the value of variable TSUM(t). Then, the process from steps #**344** and et seq. is repeated.

When NO at step #**345**, the program returns.

By the above process, the value of TSUM(n) of each job can be obtained to identify the ending time of each job.

FIG. **34** is a flow chart showing the contents of the memory available capacity calculation process (#**304**) of FIG. **29**.

Referring to FIG. **34**, the value of variable n indicating the registration number of the last job that is registered is substituted for variable c at step #**350**. At step #**351**, the value of variable CSUM(c) is set to 0. At #**352**, the value of variable CSUM(c+1) is set to 0.

At step #**353**, the value of CSUM(c+1)+CAPA(c) is substituted for the value of variable CSUM(c) (refer to FIG. **20**). At step #**354**, the value of the total amount of the memory minus the value of CSUM(c) is inserted into the value of variable SPACE(c). At #**355**, the value of variable c is decremented by 1. At step #**356**, determination is made whether c<N. When YES, the program returns.

When NO at step #**356**, the process from steps #**353** and et seq. is carried out.

Second Embodiment

The hardware structure of a copy machine according to a second embodiment of the present invention is similar to that of the first embodiment. In the second embodiment, a process indicated by the flow chart of FIG. **35** is carried out instead of the job correction registration process of FIG. **31**.

Referring to FIG. **35**, the process of steps #**401**–#**404** and #**406** corresponds to the process of #**320**–#**323** and #**326**, respectively, of FIG. **31**.

According to the flow chart of FIG. **35**, a warning is issued to CPU **1** at step #**405** when determination is made at step #**404** that the corrected job takes a longer processing time. Only a warning is issued, and actual correction of the job content is not effected. In response, CPU **1** provides the screen of FIG. **36** by the job correction warning display process (#**242** of FIG. **27**). More specifically, a warning is issued to the user indicating that a correction that increases the processing time of a job cannot be carried out. Thus, delay of an ending time of a job registered by another user caused by increase in the processing time of a registered job can be prevented.

Third Embodiment

The hardware structure of a copy machine according to a third embodiment of the present invention is similar to that of the first and second embodiments. In the third embodiment, a process indicated by the flow chart of FIG. **37** is carried out instead of the job correction registration process of FIG. **31**.

Referring to FIG. **37**, the process of steps #**501**–#**504** and #**507** correspond to the process of steps #**320**–#**323** and #**326**, respectively, of FIG. **31**.

According to the flow chart of FIG. **37**, determination is made whether the completion time of a corrected job is prolonged than that prior to the correction. When the time of the corrected job is prolonged than that prior to correction, i.e., when determination is made that delay will occur, a portion of the process of the job prolonged due to correction is set as the last job. More specifically, the task that is prolonged by correction is postponed until all the jobs in queue have been completed.

Specific displayed contents will be described hereinafter. FIG. **38** corresponds to FIG. **36** of the second embodiment. The case where a job of job number 2 to take 5 copies is altered to take 9 copies by a job correction will be described.

Referring to FIG. **38**, the job for the 5 copies prior to correction is carried out at the preregistered order, that is as the second job. As for the remaining four copies, i.e., the task of four copies added by correction is carried out as the last process in all the jobs in queue. In other words, the process is executed after completion of job number 4. The task of the four copies increased by correction is registered as the fifth job.

As an occasion of the ending time of a job being delayed in addition to the above case where the number of copies to be taken is incremented, modification of a copy mode can be considered. In general, the copy processing speed in a duplex copy mode is slower than a simplex copy mode. Therefore, when the mode is altered from the simplex copy mode to duplex copy mode, the ending time of a job is delayed than that prior to correction of the copy mode. In this case, a process is carried out of postponing the task corresponding to the period of time prolonged until the jobs are completed.

More specifically, consider the case where there is a job registered to take 15 single-sided copies of 40 sheets of documents, and correction is made to obtain 15 double-sided copies of 40 sheets of documents. Assuming that the ratio of the time required to carry out a simplex copy operation to a duplex copy operation is 1:1.5 and the time required for a job to be completed is ten minutes prior to correction, the time required for completing a corrected job is 15 minutes. More specifically, there is a problem that the starting and ending time of all the jobs in queue subsequent to the corrected job is delayed respectively by 5 minutes. In this case, the process of the corrected job is terminated at the elapse of the ten minutes required for the job prior to correction. More specifically, the copy operation of the corrected job is interrupted at the elapse of 10 minutes where 10 copies are taken (refer to following equation (1)), and the copy operation of the remaining 5 copies for that job is executed after all the jobs in queue have been completed.

$$15 \text{ minutes}/10 \text{ minutes} = 15 \text{ copies}/X \text{ copies, where } X=10 \text{ copies} \qquad \text{equation (1)}$$

Operations that may cause delay in the ending time includes a staple process, punch control, and the like in addition to the above-described mode change. The task corresponding to the additional time (the prolonged time for processing) is deferred as the last process by the above-described operation.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

What is claimed is:

1. A controller for controlling a plurality of jobs for execution by an apparatus, said controller comprising:

memory means for storing an order of execution of said plurality of jobs whereby a first job is to be executed prior to a second job, and for storing first data that comprises execution information relating to said first job, wherein said execution information includes a period of time required for executing said first job;

change means for changing content of said first data; and

prevention means for preventing execution of said second job from being delayed when the change in the content of said first data increases the period of time required for executing the first job.

2. The controller according to claim **1**, wherein said prevention means prevents the second job from being delayed of execution by changing the stored order so that said first job is to be executed after execution of said second job.

3. The controller according to claim **1**, wherein said prevention means prevents the second job from being delayed of execution by changing the stored order so that a portion of said first job is to be executed after execution of said second job.

4. The controller according to claim **1**, further comprising:

an operation panel from which an operator inputs various commands;

wherein said change means changes the content of said first data in accordance with an input command.

5. The controller according to claim **4**, wherein said change means permits an operator to change the content of said first data in a case where specific data is input from said operation panel.

6. The controller according to claim **5**, wherein said operation panel comprises

a slot which detachably holds a card for storing said specific data of an operator,

said specific data being input from said card through said slot.

7. The controller according to claim **1**, wherein said apparatus is a printer, and said first and second jobs are print jobs.

8. The controller according to claim **7**, wherein said first data includes a print mode according to which said first job is executed by the printer.

9. A controller for controlling a job to be executed by an apparatus, said controller comprising:

memory means for storing an order of execution of a plurality of jobs including a specific job, said memory means further storing specific data related to the specific job;

input means for entering identity data for identifying an operator; and

notifying means for notifying the operator of an order of execution of said specific job among the plurality of jobs when said identity data input from said input means corresponds to the specific data of said specific job.

10. The controller according to claim **9**, wherein said input means comprises an operation panel from which the operator enters the identity data.

11. The controller according to claim **10**, wherein said operation panel comprises a slot for inserting a card that stores the identity data of the operator, said identity data being input from said card through said slot.

12. The controller according to claim **9**, wherein said apparatus is a printer, and said plurality of jobs are print jobs.

13. A method for controlling a plurality of jobs to be executed by an apparatus, said method comprising the steps of:

storing an order of execution of said plurality of jobs whereby a first job is to be executed prior to a second job, and storing first data that comprises execution information relating to said first job, wherein said execution information includes a period of time required for executing said first job;

changing content of said first data; and

preventing execution of the second job from being delayed when the change in the content of said first data increases the period of time reguired for executing the first job.

14. The method according to claim **10**, where in said prevention step prevents said second job from being delayed of execution by changing the stored order so that said first job is to be executed after execution of said second job.

15. The method according to claim **13**, wherein said change step changes the content of said first data in accordance with a command input from an operation panel.

16. The method according to claim **15**, wherein said change step permits an operator to change the content of said first data in a case where specific data is input from said operation panel.

17. The method according to claim **13**, wherein said operation panel includes a slot for inserting a card that stores the specific data of the operator, and wherein the specific data is input from the card through the slot.

18. The method according to claim **13**, wherein said apparatus is a printer, and said first and second jobs are print jobs.

19. The method according to claim **18**, wherein said first data includes a print mode according to which said first job is executed by the printer.

20. A method for controlling a job to be executed by an apparatus, said method comprising the steps of:

storing an order of execution of a plurality of jobs including a specific job, and further storing specific data related to the specific job;

entering identity data for identifying an operator; and

notifying the operator of an order of execution of said specific job among the plurality of jobs when said identity data corresponds to said specific data of said specific job.

21. The method according to claim **20**, wherein the operator enters the identity data from an operation panel.

22. The method according to claim **21**, wherein the operator inserts a card in a slot of said operation panel, said card for storing the identity data of the operator, wherein the identity data is input from said card through said slot.

23. The method according to claim **20**, wherein said apparatus is a printer, and the plurality of jobs are print jobs.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,983,051

DATED : November 09, 1999

INVENTOR(S) : Nobuhiro MISHIMA, et al.

It is certified that error appears in the above-identified patent and that said Letter Patent is hereby corrected as shown below:

On the Title page:

item **[54], after "PLURALITY" insert --OF--.**

Signed and Sealed this

Twentieth Day of March, 2001

Attest:

NICHOLAS P. GODICI

Attesting Officer

Acting Director of the United States Patent and Trademark Office