(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 616 070 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
31.05.2000 Bulletin 2000/22

(51) Int. Cl.[7]: **D06F 58/26**, D06F 39/04

(21) Application number: **94301863.0**

(22) Date of filing: **16.03.1994**

(54) **Washer/Dryer**

Waschmaschine/Trockner

Machine à laver/sèche-linge

(84) Designated Contracting States:
BE DE ES FR GB IT NL SE

(30) Priority: **17.03.1993 GB 9305426**

(43) Date of publication of application:
21.09.1994 Bulletin 1994/38

(73) Proprietor:
GB Gas Holdings Limited
Slough, Berkshire SL1 2HA (GB)

(72) Inventor: **Blake, Matthew John**
Hanwell, London WC7 3QD (GB)

(74) Representative:
Calderbank, Thomas Roger et al
MEWBURN ELLIS
York House
23 Kingsway
London WC2B 6HP (GB)

(56) References cited:
FR-A- 1 164 718
GB-A- 1 107 345
US-A- 2 827 783

EP 0 616 070 B1

Description

[0001] The present invention relates to a washer/drier.

[0002] FR 1164718 discloses a washer/drier in which during a washing cycle hot gas convects through a heat exchanger for heating washing water, and during a drying cycle is pumped into the drum containing clothes. This prior art forms the preamble of independent claim 1.

[0003] The present invention provides an apparatus for washing and drying items comprises a drum to receive items to be washed and/or dried the drum having a first inlet to receive water during a wash cycle to wash the items, a second inlet to receive hot exhaust gas during a drying cycle to dry the items, a first outlet to discharge the water, and a second outlet to discharge the hot exhaust gas from the drum, a heat exchanger through which, during a wash cycle, the water circulates from and to the drum and also through which, during the wash cycle, the hot exhaust gas passes to heat the water before it re-enters the drum , and a fan for forcing hot exhaust gas into the drum and a fuel fired burner to provide hot exhaust gas, the hot exhaust gas leaving the burner to pass to the heat exchanger, and another fan for forcing hot exhaust gas into the heat exchanger and control means for selectively operating the fans.

[0004] Preferably the first inlet is connected to a hot water pipe and to a cold water pipe.

[0005] Suitably the first inlet is connected to a soap powder receptacle whereby soap powder can be transported into the drum by the water.

[0006] Conveniently means is provided to heat the water after it enters the drum.

[0007] Preferably means is provided to circulate the water between the heat exchanger and the drum during the wash cycle.

[0008] Suitably the circulating means is a pump. Preferably the fan forcing hot exhaust gas into the heat exchanger is located in the hot gas outlet of the drum and the fan forcing hot exhaust gas into the drum is located in a hot gas outlet of the heat exchanger.

[0009] An embodiment of the present invention will now be described by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of the functional elements of a washer/dryer;
Fig. 2 is a flow chart diagram of a typical washer/dryer washing cycle; and
Figure 3 is flow chart diagram illustrating a typical washer/dryer drying cycle;

[0010] Figure 1 illustrates a washer/dryer comprising a burner 1, control means 2 for controlling the operation of the burner and ducts 3 for directing hot exhaust gas separately from the burner to a drum 4 by a fan 5 on the hot gas outlet side of the drum. Alternatively, the hot gases are directed through a heat exchanger 6 by a fan 7 for heating water within the drum or while not shown while being supplied to the drum.

[0011] In either event the relevant fan units vent the gas into the surrounding atmosphere.

[0012] In Figure 1, the burner 1 is shown to be connected to two ducts 8,9. The first duct 8 feeds hot gases from the burner to the washing drum 4 of a washing machine. Movement of hot gases along the duct 8 and through the drum 4 is determined by the operation of fan 5. When fan 5 is in an off condition fan 7 is operable to force hot gases from the burner along duct 9 through heat exchanger 6 thereby heating water which has been introduced into drum 4 for washing a load of washing (not shown). A circulating pump 10 is provided to assist in circulating the water from the drum through the heat exchanger 6 and back to the drum 4.

[0013] Water for washing enters the drum 4 by way of a first inlet pipe 11, the water being supplied by hot and cold water pipes 12 and 13 respectively supplying hot water, e.g. domestic gas boiler heated water at say 40°C or above and domestic cold water. The pipes 12 and 13 are connected to the first drum inlet pipe 11 by a soap powder receptacle 14 as conventional, the receptacle, in use, having compartments for soap powder or detergent and possibly softener. Normally at the start of a washing cycle hot and cold water are both run in via their pipes 12 and 13 and mix in the soap dish or receptacle 14 prior to entering the drum 4 via the inlet pipe 11. The supply of the water, both hot and cold, is controlled by two open-close type solenoid valves 15 and 16 respectively located in pipes 12 and 13.

[0014] Water leaves the drum 4 via an outlet 17 and either circulates between the heat exchanger 6 and the drum 4 during a washing cycle or, if the washing or rinse cycle has ended, is discharged from an outlet 18 located between the circulating pump 10 and the heat exchanger 6. The discharge of waste water is controlled by an open-close type solenoid valve 19 located in the outlet 18. The valve 19 is of course only open when water is being discharged from the drum 4. During a rinse cycle not surprisingly only cold water from the cold water pipe 13 is run into the drum 4, the solenoid valve 15 of hot water pipe 12 remaining closed. It will be appreciated that in this specification "washing" cycle includes rinsing cycle as well.

[0015] The operation of these mechanically interconnected parts is controlled by a micro-electronic control unit 2 which is connected to receive signals from a washer/dryer mechanical programmer 20 and a washer/dryer drying timer 21 which is also controlled directly from the mechanical programmer 20 as indicated by the connection 22 therebetween. The mechanical programmer 20 is shown connected to the circulating pump 10 and fan 7 so as to control the circulation of water within the drum 4 and operation of the fan 7 to force hot gases from the drum along the duct 9. Fan 5 is connected to drying timer 21. The micro-electronic

control unit 2 is connected also to a gas supply on/off valve 23 and to both an ignition and flame failure electrodes 24, 25 respectively. The programmer 20 also controls the solenoid valves 15, 16 and 19.

[0016] The operation of the washer/dryer will now be described with reference to a typical washing cycle for the gas fired system with particular reference to the flow charts of Figures 2 and 3 where once the washing machine is loaded the mechanical programmer 20 is operated to select a particular wash cycle in which the water temperature is to be say K°C. Such selection is illustrated diagrammatically at 30 in the flow diagram of Figure 2. Once the program is selected the machine begins to fill as represented at step 31 until a predetermined quantity of mixed hot and cold water is fed into the machine. The blowers and drum motor are then switched on step 32. After X seconds the gas supply is switched on at step 33 followed by gas ignition at step 34.

[0017] Once the gas has ignited the flame sensor 25 determines whether or not a flame is present in the burner. If a flame is present the control unit maintains the gas supply valve 23 in an on condition whereupon the water in drum 4 is heated until it reaches the correct temperature when the load is washed. The temperature of the water is monitored at 37 to determine whether or not the temperature of the water is greater than or equal to the temperature K°C. If the water is less then temperature K°C a check is made as to whether or not a flame is still present. If the flame is still present the water is reheated until the temperature reaches or is greater than temperature K°C. If on igniting the gas no flame is sensed a signal is fed to the gas igniter and the igniter is switched on to re-ignite the flame, step 38. A check is then made at step 39 to test whether the gas has lit within a certain time period say Y seconds and if the gas has lit a signal is passed back to step 35 where the flame is sensed and the washing of the load proceeded with an indicated at step 36. If at step 39 it is determined that the gas has not lit within the required time period a signal is supplied to the gas on/off supply valve 23 and the gas supply is switched off automatically.

[0018] When the wash load has been completed and the water temperature is sensed as being greater than or equal to K°C. the washing cycle is then completed by going through the steps of emptying drum wash water 41, filling drum with cold water 42, rinsing the washing load 43, emptying the water from the drum 44 and finally spin drying 45.

[0019] Referring now to Figure 3, there is shown a flow chart for a drying cycle and after completing the spin cycle at step 45 the electronic controller determines whether or not the timer is set step 50, Figure 3, and if the timer is not set a no-signal results in the complete stoppage of the washing machine, see step 51.

[0020] If the timer has been set the number of minutes the timer has been set is determined at step 52. The drying blower and drum motor are switched on as indicated at step 53 and after a certain number of seconds a check is made that the gas supply is on, step 54, and subsequently at step 55 that the gas igniter has been applied. A flame sensor 56 then determines whether or not a flame is present and if not the controller at step 57 re-applies the gas igniter 1 and if there is no gas ignition within Y seconds at step 58 the gas supply is switched off, step 59. However, if the gas is sensed as being lit, a signal is fed to the flame sensor 56 whereupon the flame sensor again senses whether or not there is a flame present. With the burner operating correctly a check is made at step 60 as to whether the actual operating time t is greater than or equal to the timer set time T-5 seconds. With the actual operating time t less than T-5 a NO signal is returned to the flame sensor step and the dryer or drying process is continued. When the operating time t is greater than or equal to the set time T-5 seconds a suitable signal is transmitted to stage 61 where the gas supply valve 18 is operated to switch off the gas supply to the burner 1. At this time the blower and drum motor remain on to continue to feed any residual hot air to the drum. During this period the actual operating time t is compared with the set time T and if the actual time t is not greater than or equal to the set time no further instruction is issued and the control unit simply monitors the operating time until it is greater than or equal to the set time T. When this condition applies the blower and drum motor are switched off, stage 62, and the washing/drying cycle is finished stage 64.

[0021] Although the above invention incorporating Applicants' invention has been described with reference to a particular washing cycle the cycle described is a general cycle and can be varied according to various preset cycles set within the manual programming unit which may take the form of a rotary switch or a series of push button switches or electronic switches for instructing the electronic control unit as to the particular cycle selected.

Claims

1. An apparatus for washing and drying items comprising a drum (4) to receive items to be washed and/or dried, the drum (4) having a first inlet (11) to receive water during a wash cycle to wash the items, a second inlet (8) to receive hot exhaust gas during a drying cycle to dry the items, a first outlet (17) to discharge the water, and a second outlet to discharge the hot exhaust gas from the drum (4), a heat exchanger (6) through which, during a wash cycle, the water circulates from and to the drum (4) and also through which, during the wash cycle, the hot exhaust gas passes to heat the water before it re-enters the drum (4), a fan (7) for forcing hot exhaust gas into the drum (4), and a fuel fired burner (1) to provide hot exhaust gas, the hot exhaust gas leaving the burner (1) to pass to the

heat exchanger (6), characterised by a another fan (5) for forcing hot exhaust gas into the heat exchanger (6) and control means (2) for selectively operating the fans (5, 7).

2. An apparatus according to claim 1, wherein the first inlet is connected to a hot water pipe (12) and a cold water pipe (13).

3. An apparatus according to claim 1 or claim 2, wherein the first inlet (11) is connected to a soap powder receptacle (14) whereby soap powder can be transported into the drum (14) by the water.

4. An apparatus according to any of claims 1 to 3, wherein means (10) is provided to circulate the water between the heat exchanger (10) and the drum (4) during the wash cycle.

5. An apparatus according to claim 4 wherein the circulating means is a pump (10).

6. An apparatus according to any preceding claim, wherein the fan (5) forcing hot exhaust gas into the heat exchanger is located in the hot gas outlet of the drum and the fan (7) forcing not exhaust gas into the drum is located in a hot gas outlet (9) of the heat exchanger.

Patentansprüche

1. Vorrichtung zum Waschen und Trocknen von Gegenständen, umfassend eine Trommel (4) zum Aufnehmen der zu waschenden und/oder zu trocknenden Gegenstände, wobei die Trommel (4) einen ersten Einlass (11) zum Aufnehmen von Wasser während eines Waschzyklus zum Waschen der Gegenstände, einen zweiten Einlass (8) zum Aufnehmen von heißem Abgas während eines Trocknungszyklus zum Trocknen der Gegenstände, einen ersten Auslass (17) zum Ablassen des Wassers sowie eine zweiten Auslass zum Ablassen des heißen Abgases aus der Trommel (4), einen Wärmetauscher (6), durch den während eines Waschzyklus das Wasser von der zur Trommel (4) zirkuliert und durch den während des Waschzyklus das heiße Abgas hindurchgeht, um das Wasser zu erhitzen, bevor es wieder in die Trommel (4) eintritt, einen Ventilator (7), um heißes Abgas in die Trommel (4) zu drängen, sowie einen brennstoffbetriebenen Brenner (1), um heißes Abgas bereitzustellen, wobei das heiße Abgas den Brenner (1) verlässt, um zum Wärmetauscher (6) zu gelangen, gekennzeichnet durch einen weiteren Ventilator (5), um heißes Abgas in den Wärmetauscher (6) zu drängen, und Steuermittel (2) zum selektiven Betreiben der Ventilatoren (5, 7).

2. Vorrichtung nach Anspruch 1, worin der erste Einlass an eine Heißwasserleitung (12) und eine Kaltwasserleitung (13) angeschlossen ist.

3. Vorrichtung nach Anspruch 1 oder 2, worin der erste Einlass (11) an einen Seifenpulverbehälter (14) angeschlossen ist, wodurch Seifenpulver vom Wasser in die Trommel (4) befördert werden kann.

4. Vorrichtung nach einem der Ansprüche 1 bis 3, worin ein Mittel (10) vorgesehen ist, um das Wasser während des Waschzyklus zwischen dem Wärmetauscher (6) und der Trommel (4) zirkulieren zu lassen.

5. Vorrichtung nach Anspruch 4, worin das Mittel zum Zirkulierenlassen eine Pumpe (10) ist.

6. Vorrichtung nach einem der vorangegangenen Ansprüche, worin der erste Ventilator (5), der heißes Abgas in den Wärmetauscher drängt, im Auslass für heißes Abgas der Trommel angeordnet ist, und der zweite Ventilator (7), der heißes Abgas in die Trommel drängt, in einem Auslass (9) für heißes Abgas des Wärmetauschers angeordnet ist.

Revendications

1. Appareil pour laver et sécher des objets, comprenant un tambour (4) pour recevoir les objets à laver et/ou à sécher, le tambour (4) présentant une première entrée (11) pour recevoir de l'eau pendant un cycle de lavage destiné à laver les objets, une deuxième entrée (8) pour recevoir des gaz d'échappement chauds pendant un cycle de séchage destiné à sécher les objets, une premier sortie (17) pour décharger l'eau et une deuxième sortie pour décharger les gaz d'échappement chauds du tambour (4), un échangeur de chaleur (6) à travers lequel, pendant un cycle de lavage, l'eau circule vers et depuis le tambour (4) et également à travers lequel, pendant le cycle de lavage, les gaz d'échappement chauds passent pour chauffer l'eau avant qu'elle pénètre à nouveau dans le tambour (4), un ventilateur (7) pour refouler les gaz d'échappement chauds dans le tambour (4) et un brûleur (1) alimenté en combustible pour fournir des gaz d'échappement chauds, les gaz d'échappement chauds quittant le brûleur (1) pour traverser l'échangeur de chaleur (6), caractérisé par un autre ventilateur (5) servant à refouler les gaz d'échappement chauds dans l'échangeur de chaleur (6), et par un moyen de commande (2) pour faire fonctionner les ventilateurs (5, 7)sélectivement.

2. Appareil selon la revendication 1, dans lequel la première entrée est reliée à un tuyau d'eau chaude (12) et à un tuyau d'eau froide (13).

3. Appareil selon la revendication 1 ou la revendication 2, dans lequel la première entrée (11) est reliée à un réceptacle (14) à poudre de savon, la poudre de savon pouvant être transportée dans le tambour (4) par l'eau.

4. Appareil selon l'une quelconque des revendications 1 à 3, dans lequel un moyen (10) est prévu pour faire circuler l'eau entre l'échangeur de chaleur (10) et le tambour (4) pendant le cycle de lavage.

5. Appareil selon la revendication 4, dans lequel le moyen de mise en circulation est une pompe (10).

6. Appareil selon l'une quelconque des revendications précédentes, dans lequel le ventilateur (5) refoulant les gaz d'échappement chauds dans l'échangeur de chaleur est situé dans la sortie des gaz chauds du tambour, et le deuxième ventilateur (7) refoulant les gaz d'échappement chauds dans le tambour est situé dans une sortie (9) de gaz chauds de l'échangeur de chaleur.

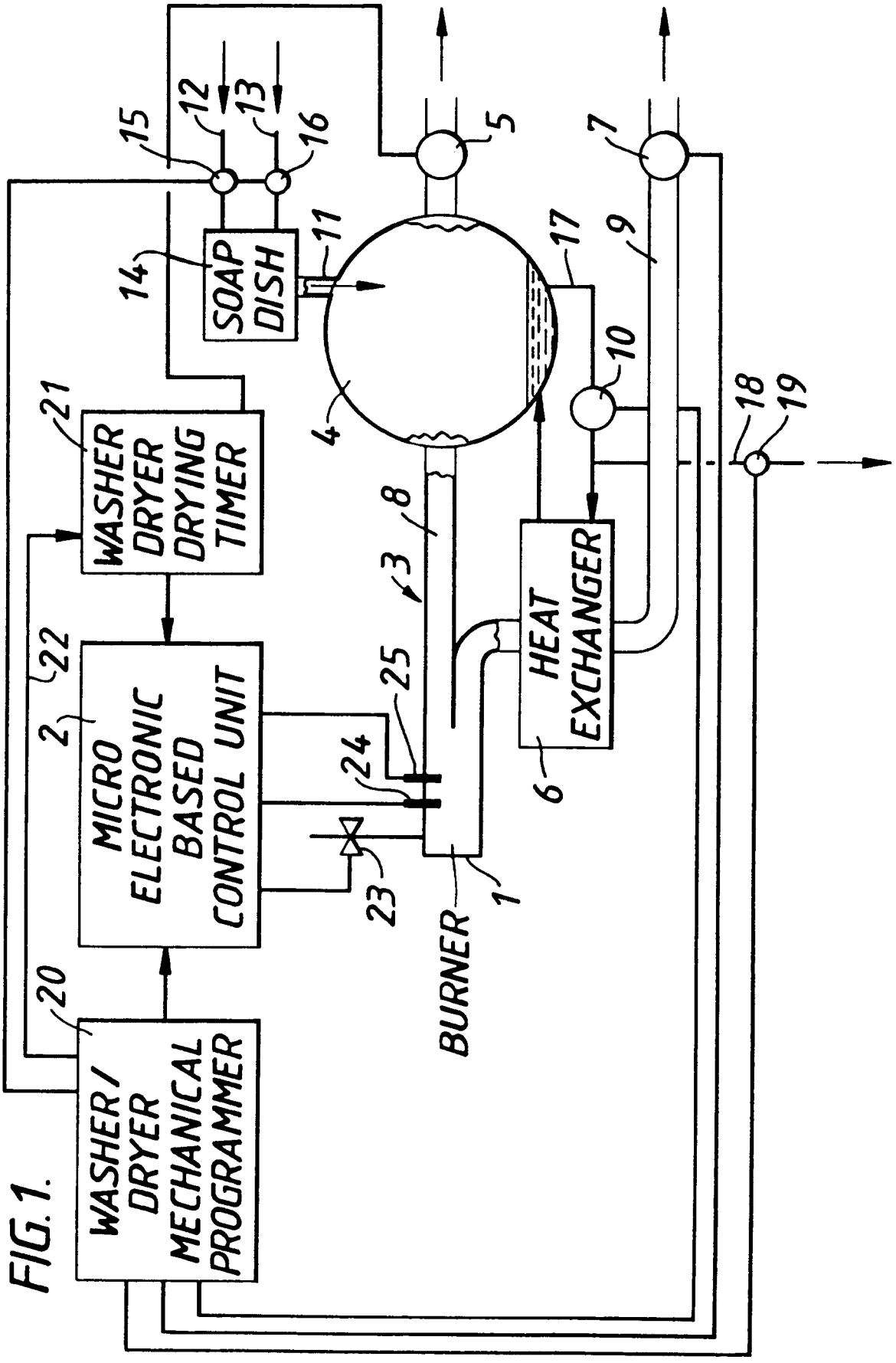

WASHER / DRYER MECHANICAL PROGRAMMER
MICRO ELECTRONIC BASED CONTROL UNIT
WASHER DRYER DRYING TIMER
SOAP DISH
HEAT EXCHANGER
BURNER
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

FIG. 1.

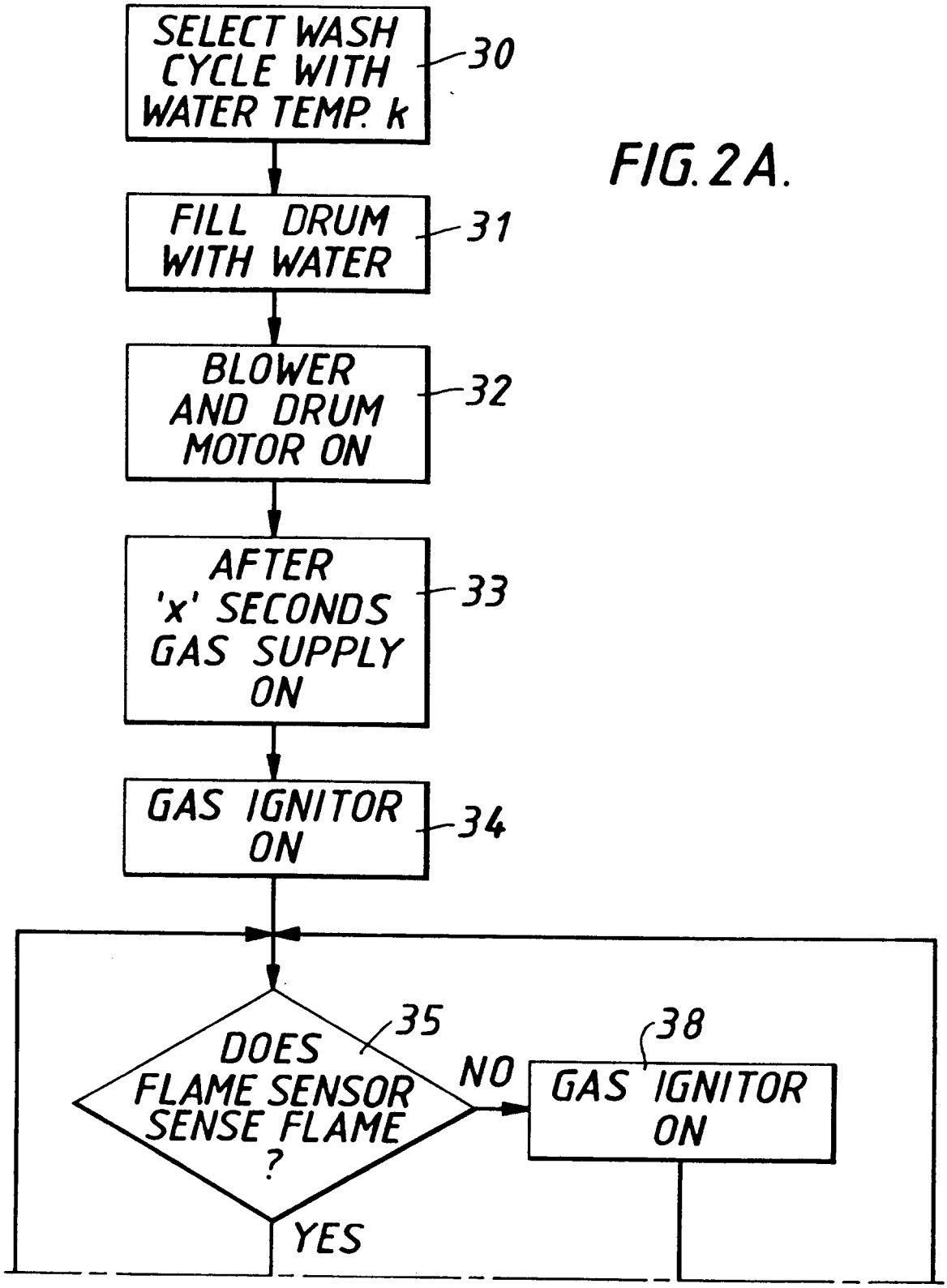

SELECT WASH CYCLE WITH WATER TEMP. k
30
FILL DRUM WITH WATER
31
BLOWER AND DRUM MOTOR ON
32
AFTER 'x' SECONDS GAS SUPPLY ON
33
GAS IGNITOR ON
34
DOES FLAME SENSOR SENSE FLAME ?
35
NO
GAS IGNITOR ON
38
YES

FIG. 2A.

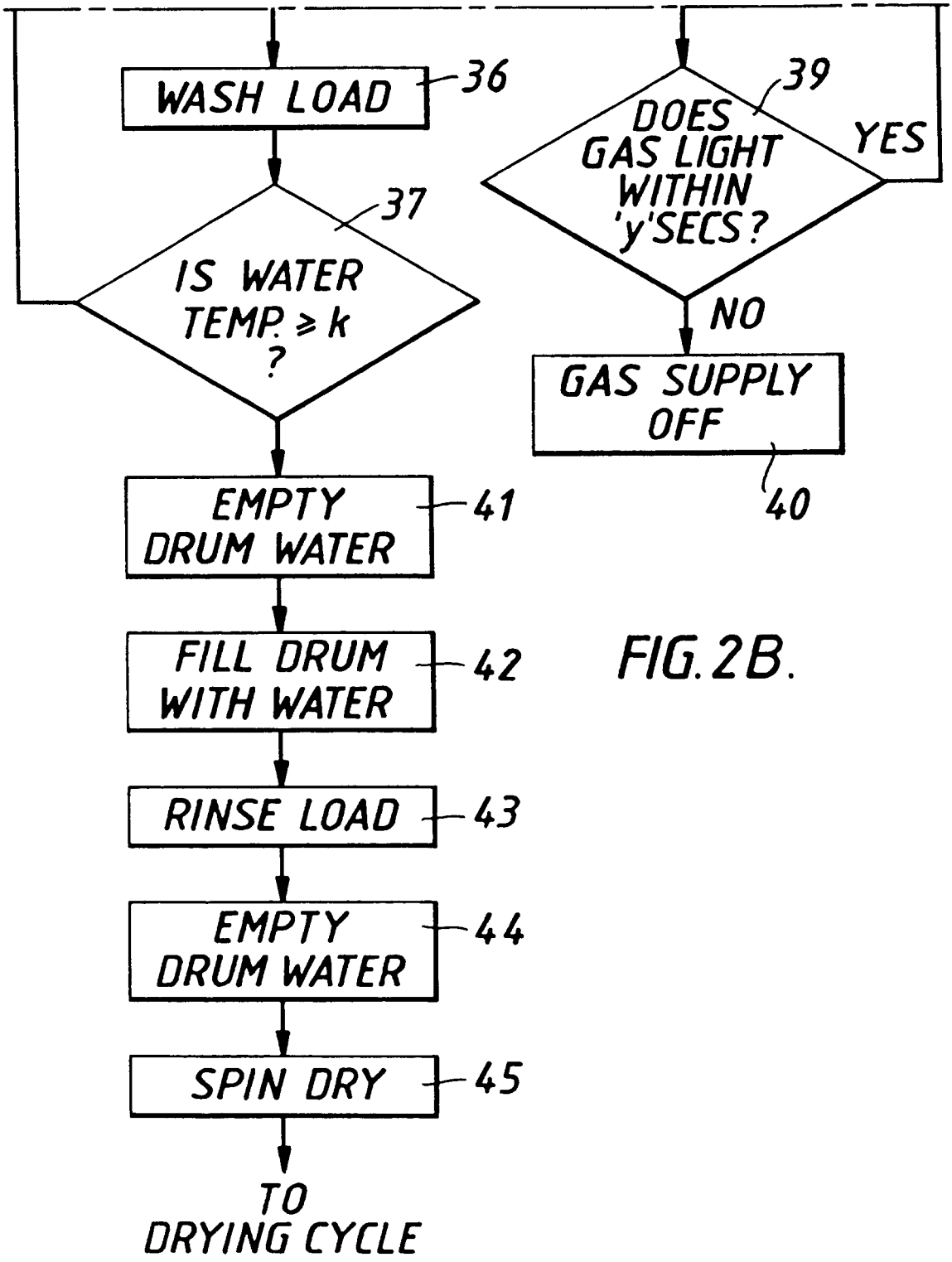

WASH LOAD
36
IS WATER TEMP. ≥ k ?
37
EMPTY DRUM WATER
41
FILL DRUM WITH WATER
42
RINSE LOAD
43
EMPTY DRUM WATER
44
SPIN DRY
45
TO DRYING CYCLE
DOES GAS LIGHT WITHIN 'y' SECS?
39
YES
NO
GAS SUPPLY OFF
40

FIG. 2B.

FIG.3A.

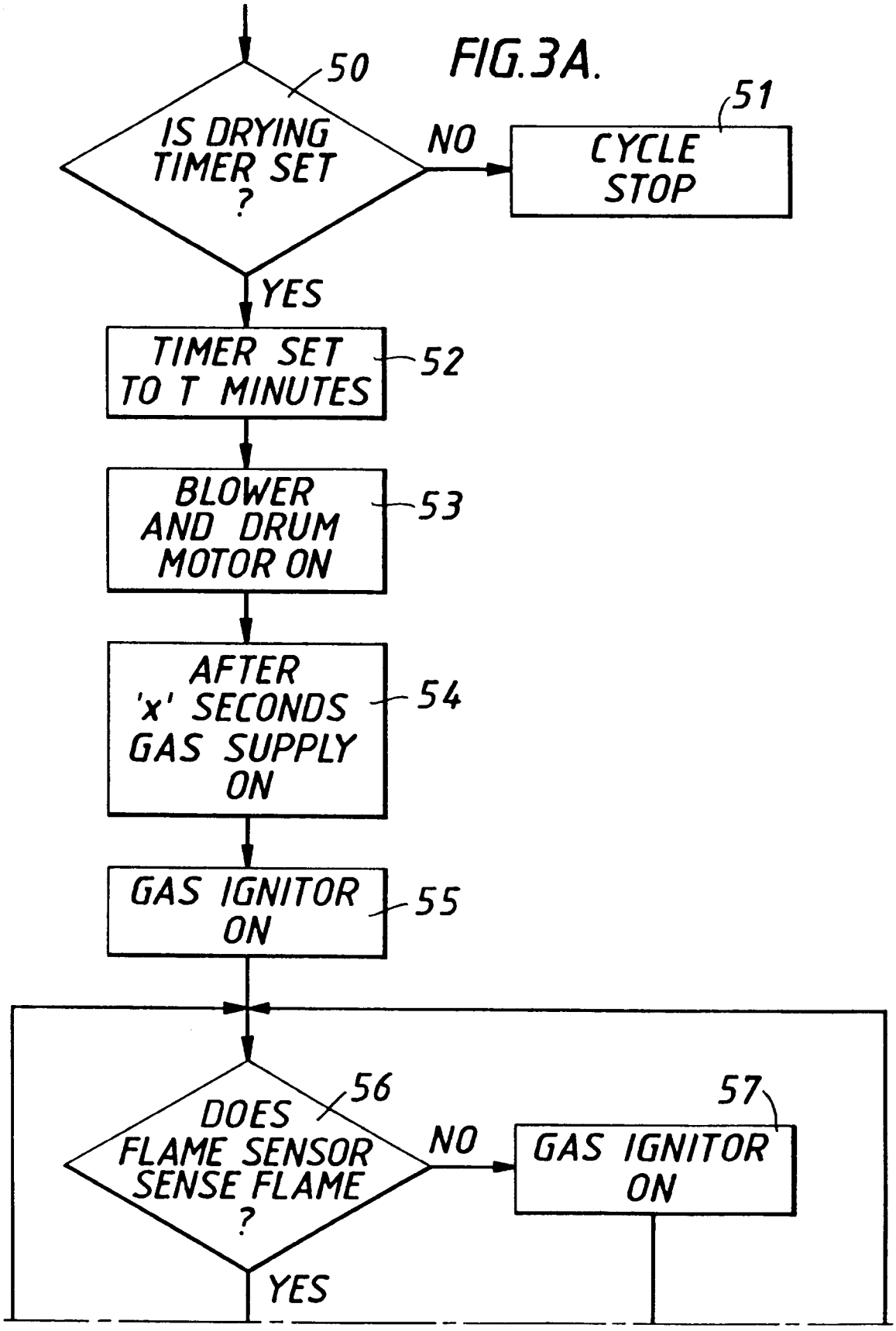
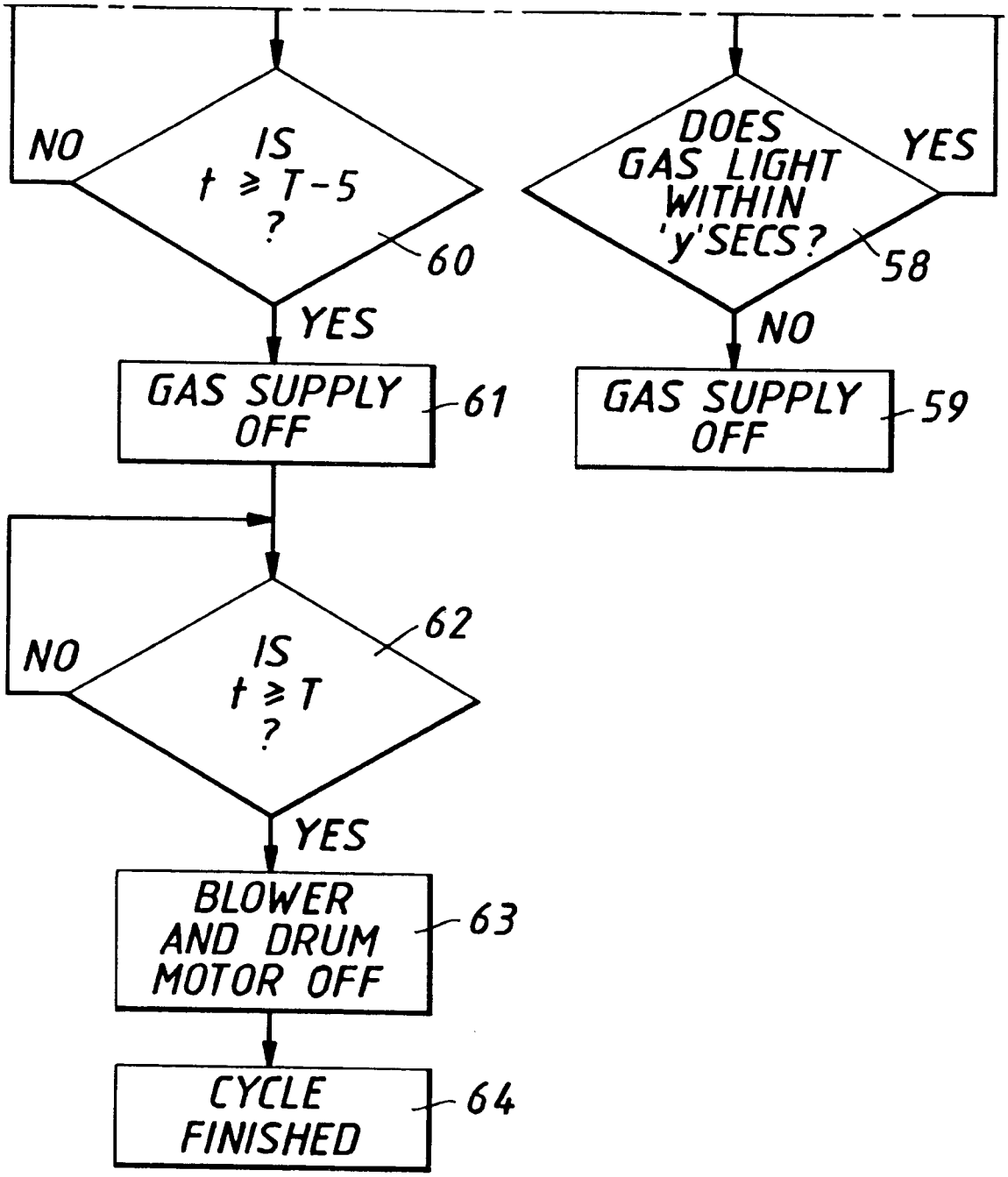

50
IS DRYING TIMER SET ?
NO
51
CYCLE STOP
YES
TIMER SET TO T MINUTES
52
BLOWER AND DRUM MOTOR ON
53
AFTER 'x' SECONDS GAS SUPPLY ON
54
GAS IGNITOR ON
55
56
DOES FLAME SENSOR SENSE FLAME ?
NO
57
GAS IGNITOR ON
YES

FIG.3B.


NO
IS
t ≥ T-5
?
60
YES
GAS SUPPLY
OFF
61
DOES
GAS LIGHT
WITHIN
'y'SECS?
58
YES
NO
GAS SUPPLY
OFF
59
NO
IS
t ≥ T
?
62
YES
BLOWER
AND DRUM
MOTOR OFF
63
CYCLE
FINISHED
64