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(54) Automatic fire extinguishing equipment

(57) An automatic fire extinguishing equipment adapted to direct a nozzle (5a) towards the position of a flame starting within a supervised zone so as to discharge a fire extinguishing liquid for extinguishing the flame. The equipment comprises a flame detecting apparatus (3) including a detecting element (3a) for detecting a flame and device (3b, 3c) for scanning and driving the detecting element (3a) in a horizontal direction and a vertical direction, for searching the supervised zone and outputting data concerning the flames. A storage section stores detection data from the flame detecting apparatus. A fire extinguishment controlling section decides the sizes of the distributed flames on the basis of the stored data from said storage section. The equipment also has a nozzle assembly which includes the nozzle (5a) and device (5b, 5c, 6) for controlling the direction of the nozzle (5a) in response to a control signal from the fire extinguishment controlling section.

Fig. I

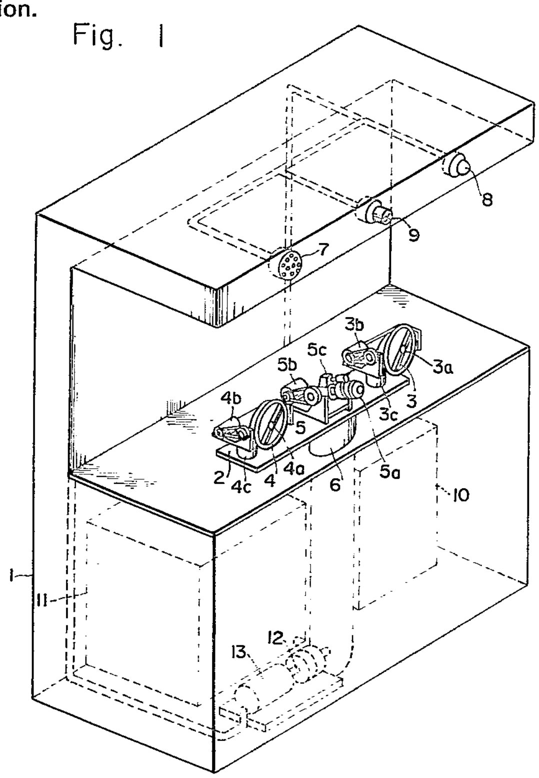

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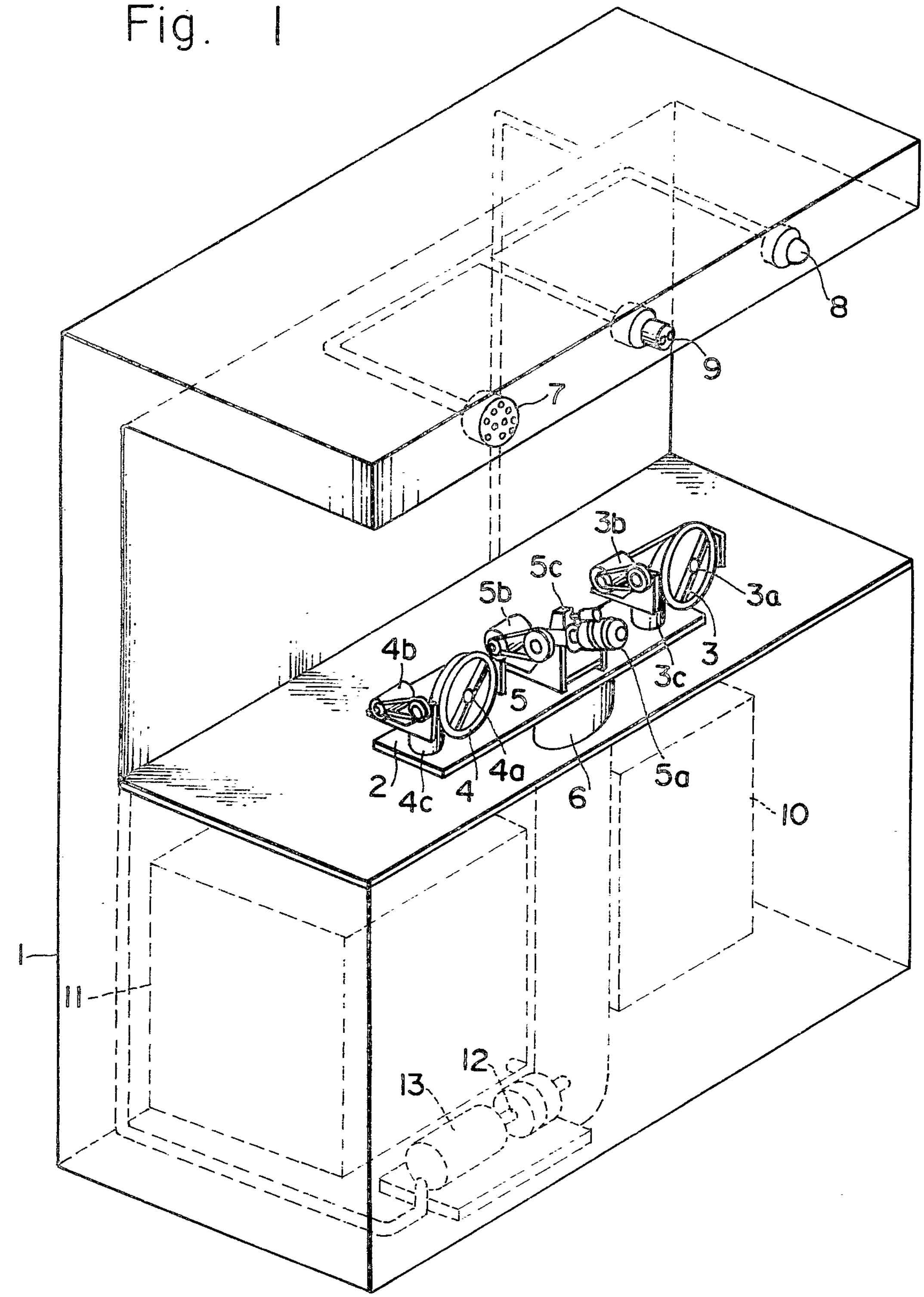
Fig. 1



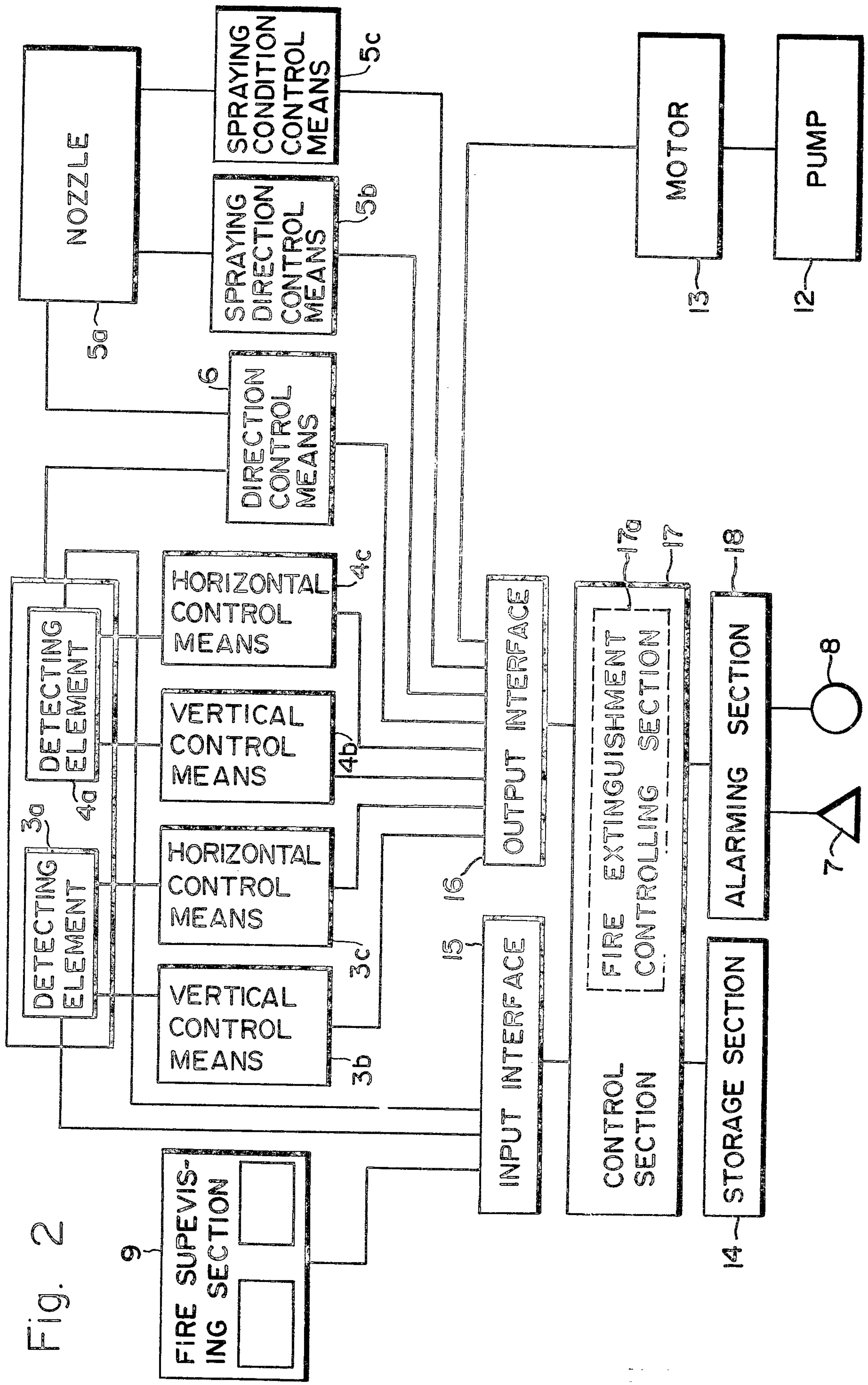

NOZZLE
5a
SPRAYING DIRECTION CONTROL MEANS
5b
SPRAYING CONDITION CONTROL MEANS
5c
MOTOR
13
PUMP
12
DIRECTION CONTROL MEANS
6
DETECTING ELEMENT
4a
HORIZONTAL CONTROL MEANS
4c
VERTICAL CONTROL MEANS
4b
DETECTING ELEMENT
3a
HORIZONTAL CONTROL MEANS
3c
VERTICAL CONTROL MEANS
3b
OUTPUT INTERFACE
16
INPUT INTERFACE
15
FIRE EXTINGUISHMENT CONTROLLING SECTION
17a
CONTROL SECTION
17
ALARMING SECTION
18
8
7
STORAGE SECTION
14
FIRE SUPEVIS-ING SECTION
9
Fig. 2

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Fig 3 (A)

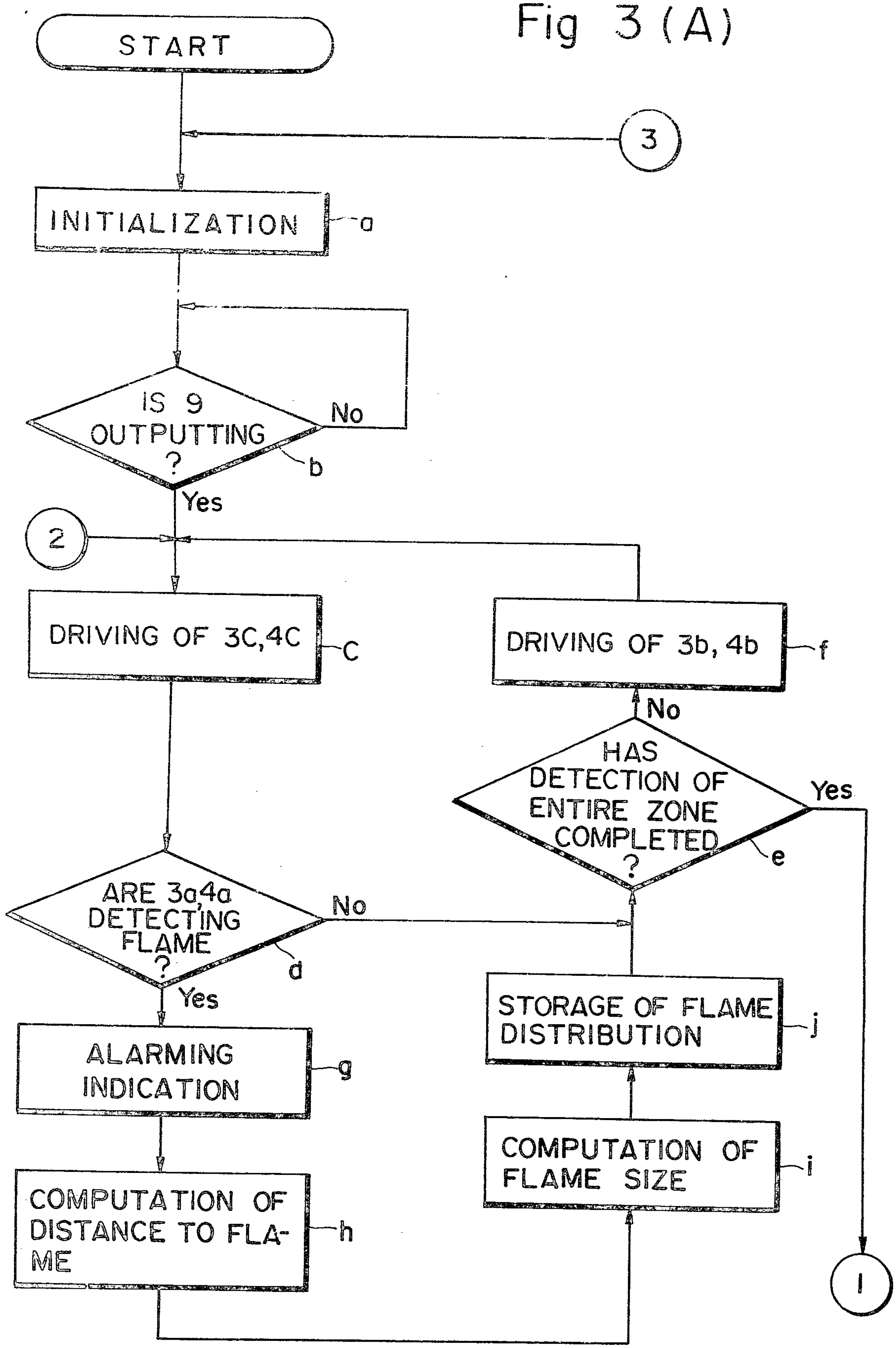


Fig. 3 (B)

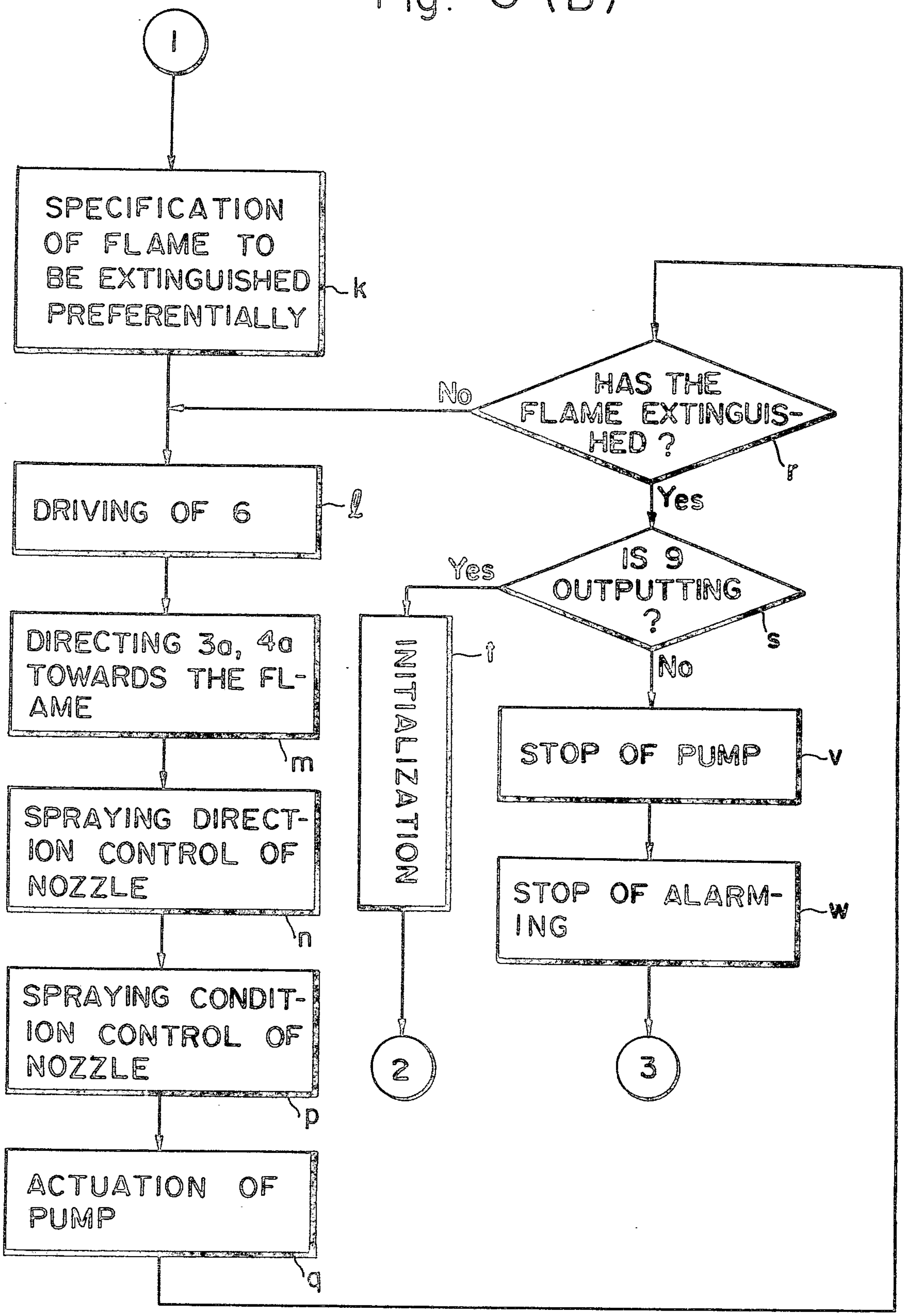
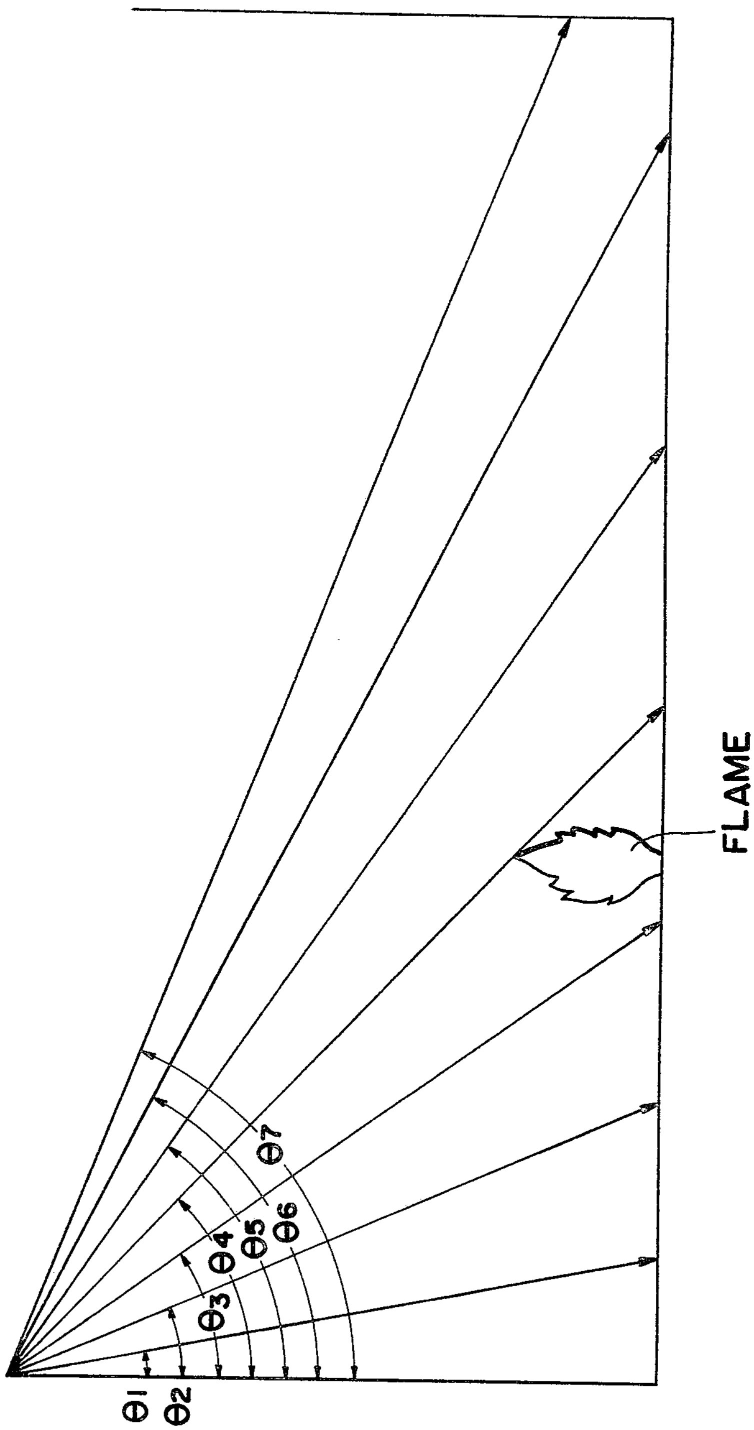

1
SPECIFICATION OF FLAME TO BE EXTINGUISHED PREFERENTIALLY
k
DRIVING OF 6
ℓ
DIRECTING 3a, 4a TOWARDS THE FL-AME
m
SPRAYING DIRECT-ION CONTROL OF NOZZLE
n
SPRAYING CONDIT-ION CONTROL OF NOZZLE
p
ACTUATION OF PUMP
q
HAS THE FLAME EXTINGUIS-HED ?
r
No
Yes
IS 9 OUTPUTTING ?
s
Yes
No
INITIALIZATION
t
STOP OF PUMP
v
STOP OF ALARM-ING
w
2
3

Fig. 4



POOR QUALITY

Fig. 5

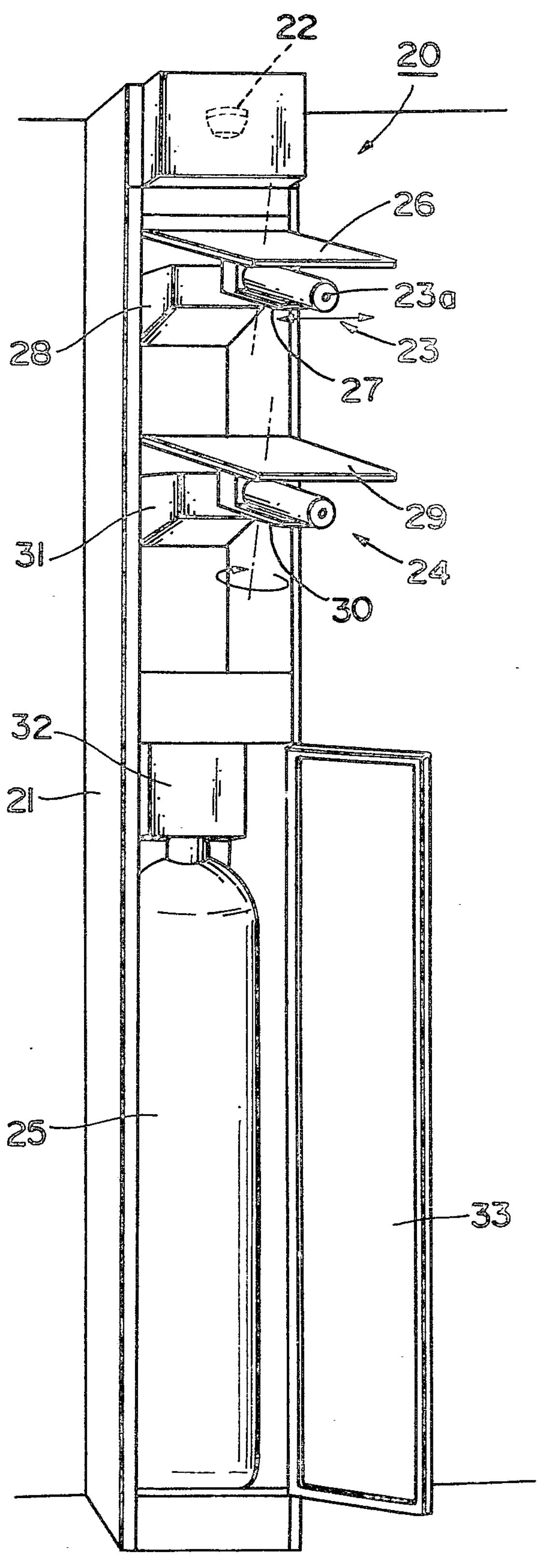
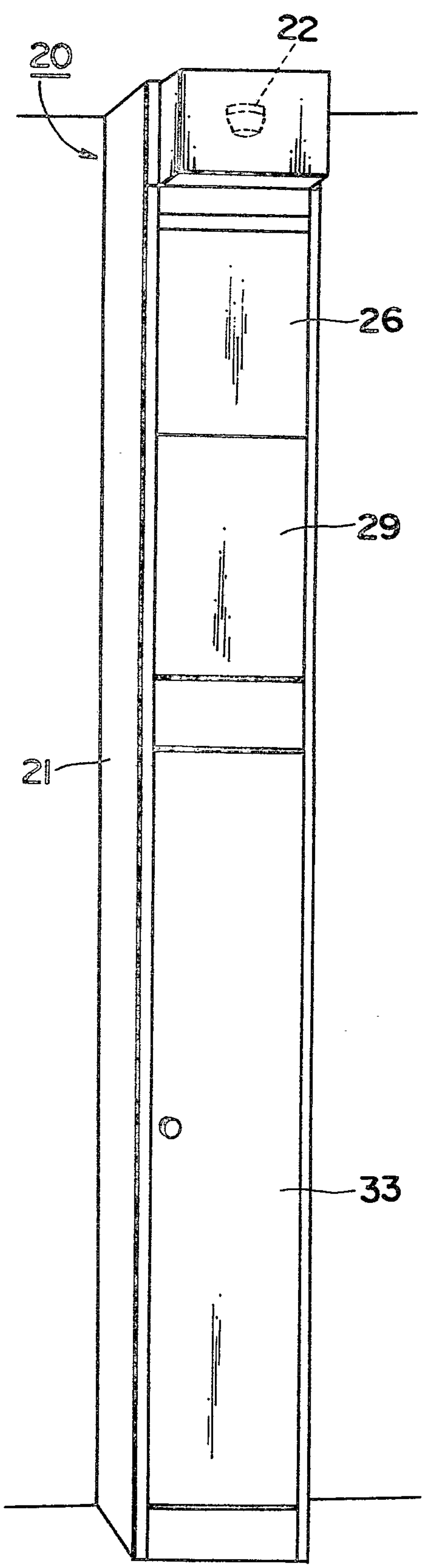


Fig. 6



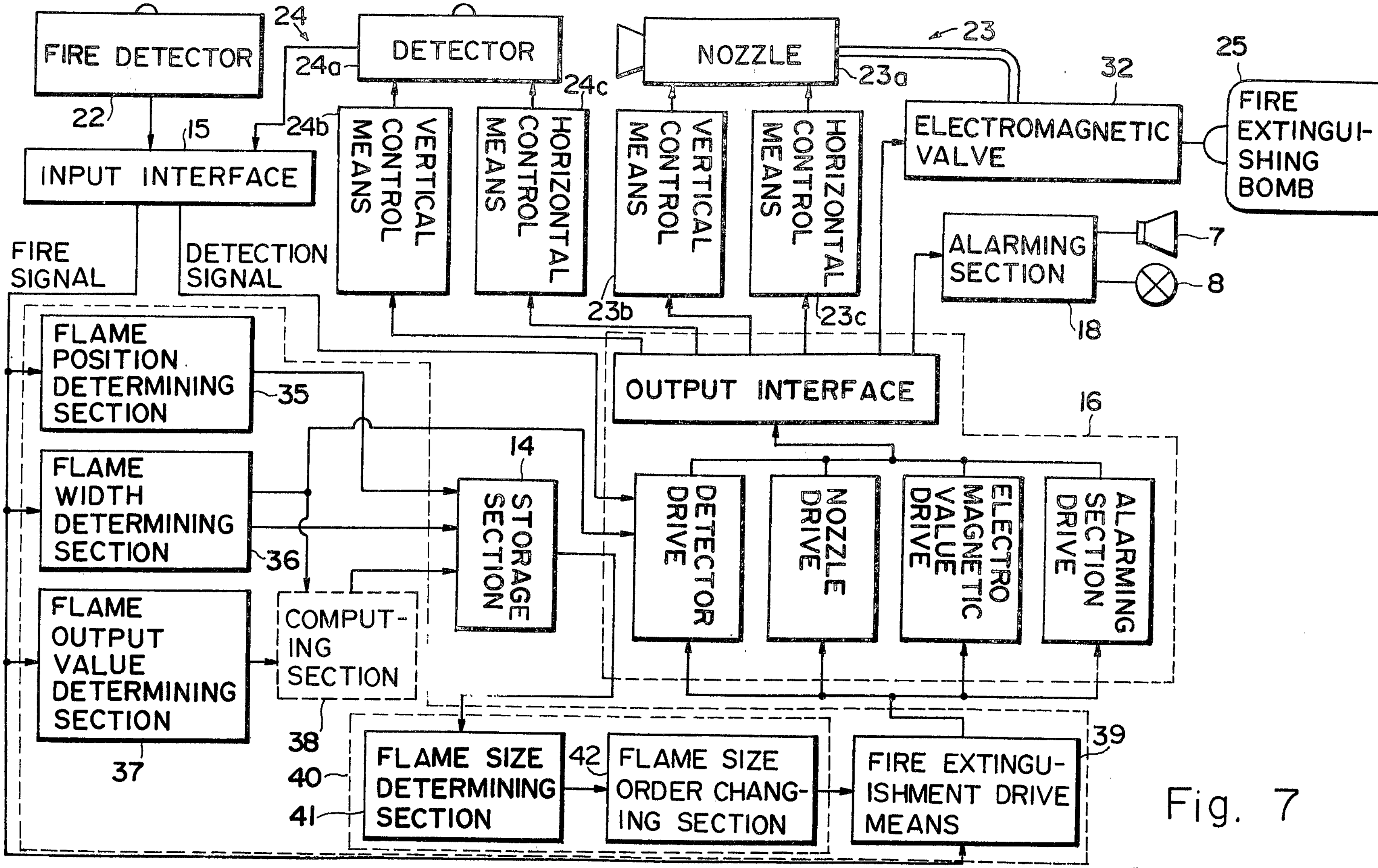

FIRE DETECTOR
22
15
INPUT INTERFACE
FIRE SIGNAL
DETECTION SIGNAL
24
24a
24b
24c
DETECTOR
VERTICAL CONTROL MEANS
HORIZONTAL CONTROL MEANS
NOZZLE
23
23a
23b
23c
VERTICAL CONTROL MEANS
HORIZONTAL CONTROL MEANS
32
ELECTROMAGNETIC VALVE
25
FIRE EXTINGUISHING BOMB
ALARMING SECTION
7
8
18
OUTPUT INTERFACE
16
FLAME POSITION DETERMINING SECTION
35
FLAME WIDTH DETERMINING SECTION
36
FLAME OUTPUT VALUE DETERMINING SECTION
37
COMPUTING SECTION
38
14
STORAGE SECTION
DETECTOR DRIVE
NOZZLE DRIVE
ELECTRO MAGNETIC VALUE DRIVE
ALARMING SECTION DRIVE
40
41
FLAME SIZE DETERMINING SECTION
42
FLAME SIZE ORDER CHANGING SECTION
39
FIRE EXTINGUISHMENT DRIVE MEANS

Fig. 7

SPECIFICATION

Automatic fire extinguishing equipment

This invention relates to an automatic fire extinguishing equipment.

The inventors of the present invention have previously proposed an automatic fire extinguishing equipment wherein a pair of flame detecting apparatuses are driven when a fire starting in a supervised zone is detected, the size of the flame is determined according to a computation made on the basis of detection information from the flame detecting apparatuses, and a nozzle is directed, when the flame size exceeds a predetermined level, to the position of the flame and discharge a fire extinguishing liquid so as to extinguish the fire.

In such an automatic fire extinguishing equipment, in order to quickly detect a flame starting in the supervised zone, the supervised zone is divided into two parts so as to allot these two parts to the two flame detecting apparatuses, respectively, whereby the respective flame detecting apparatuses may effect flame detection in the respectively allotted supervised regions. When one of the flame detecting apparatuses detects a flame, another flame detecting apparatus stops its flame detection operation and is caused to be directed towards the detected flame. Thus, detection information is obtained from each of the flame detecting apparatuses and the distance to the flame and the size of the flame are computed by utilizing a trigonometrical survey on the basis of the detection information obtained. The nozzles are directed according to the computation result, i.e., to the position of the first detected flame and discharge fire extinguishing liquid thereto.

However, if the supervised zone includes a construction material of high reflectance, such as a mirror, a window pane, etc., the light energy radiated from the flame is reflected from the mirror or the window pane and may be incident upon the flame detecting apparatus. Thus, there arises a situation as if two flames exist, i.e., an actual flame and a virtual flame image obtained by the reflection from the mirror or the window pane. In such a situation, if the flame detecting apparatus first detects the virtual flame image, a predetermined detection operation will be carried out without determining as to whether it is an actual flame or a virtual flame image. Furthermore, if the size of the virtual image flame is larger than the predetermined size, the fire extinguishing action will be taken by directing the nozzles to the virtual image flame and discharging the fire extinguishing liquid thereto. In such a case, not only is the fire extinguishing liquid wasted, but also water damage due to the extinguishing liquid may be caused. Furthermore, there is the more serious problem that the actual flame will spread in the meantime and will possibly cause fatal damage as a result.

It is an object of the present invention to provide an automatic fire extinguishing equipment which is capable of automatically distinguishing a flame starting within the supervised zone from a virtual image of the flame obtained through reflection by a water suface, a mirror, a window pane, etc., and is capable of directing a nozzle to the position of the actual flame for effecting a fire extinguishing operation.

An automatic fire extinguishing equipment in accordance with the present invention comprises a flame detecting apparatus, which includes a detecting element for detecting a flame and means for scanning and driving the detecting element in a horizontal direction and a vertical direction, and for searching the supervised zone and outputting data concerning flames detected; a storage section for storing detection data from the flame detecting appartus; a fire extinguishment controlling section which compares and decides the sizes of distributed flames on the basis of the stored data from said storage section; a nozzle assembly including a nozzle adapted to be directed towards the position of the flame starting within the supervising zone so as to discharge fire extinguishing liquid thereto for effecting fire extinguishing and means for controlling the direction of the nozzle in response to control signals from the fire extinguishment controlling section.

The present invention makes use of the experimental finding that the energy detected from the actual flame is larger than the energy obtained through reflection and it is so arranged that the sizes of the flames are measured in terms of the magnitudes of the detected energies and the nozzle is adapted to be directed onto the largest flame for extinguishing the same after comparison of the sizes of the flames.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, wherein:-

Fig. 1 is a perspective view of one preferred embodiment of the present invention;

Fig. 2 is a block diagram showing a circuit arrangement of the embodiment illustrated in Fig. 1;

Fig. 3(A) and Fig. 3(B) are flowcharts;

Fig. 4 is an explanatory diagram showing the direction of a nozzle;

Fig. 5 shows the entire structure of another embodiment of the present invention;

Fig. 6 is a perspective view of the structure of the embodiment illustrated in Fig. 5, showing it in its non-operating state; and

Fig. 7 is a block diagram of a circuit arrangement of the embodiment illustrated in Fig. 5.

The overall structure of the first embodiment will first be described referring to Figs. 1 and 2. Reference numeral 1 denotes the automatic fire extinguishing equipment as a whole. A pair of flame detecting apparatuses 3 and 4 are disposed at a distance apart on a table 2. One of the flame detecting apparatuses 3 comprises a detecting element 3a for detecting a flame, a vertical control means 3b for controlling the detecting element 3a in the vertical direction, and a horizontal control means 3c for controlling the detecting element 3a in the horizontal direction. Another flame detecting apparatus 4 similarly comprises element 4a for detecting a flame, a vertical control means 4b for controlling the detecting means 4a in the vertical direction and a horizontal control means 4c for controlling the detector 4a in the horizontal direction.

Each of the detecting elements 3a and 4a includes an infrared detector which detects infrared light energy radiated from a flame in an analog form and outputs flame detection data corresponding to the energy radiated from the flame, i.e., the intensity of the infrared rays.

The vertical control means 3b, 4b and the horizontal control means 3c, 4c each separately control the corresponding detectors 3a, 4a, respectively, so as to drive the detecting elements 3a, 4a in the vertical direction and in the horizontal direction in response to an instruction from a control section as will be described in detail later for detecting the position of the flame.

Reference numeral 5 denotes a nozzle assembly which is disposed around a rotational centre of a table 2 and comprises a nozzle 5a for spraying fire extinguishing liquid, a spraying direction control means 5b for directing the nozzlle 5a towards the flame position detected by the flame detecting apparatuses 3, 4, and a spraying condition control means 5c for controlling the spraying condition by adjusting the opening degree of the spout of the nozzle 5a according to the distance to the flame. Reference numeral 6 denotes a direction control means for controlling the rotation of the table 2 in the horizontal direction so as to direct the flame detecting apparatuses 3, 4 and the nozzle assembly 5 conjointly towards the flame.

Reference numeral 7 is a buzzer, 8 is a lamp and 9 is a fire supervising section for supervising the entire zone. When the fires supervising section 9 detects a flame due to a fire, it outputs fire detection data to a circuitry section 10.

The fire detection data from the fire supervising section 9 is output to the control section through an input interface 15 included in the circuitry section 10. The control section 17 makes a determination of a fire on the basis of the detection data from the fire supervising section 9 and, when it makes a fire determination, it gives a series of control operations as well as an instruction for an alarm indication through actuation of an alarm section, such as driving the buzzer 7 and lighting the lamp 8. The control section 17 is input, through the input interface 15, with the detection data from the flame detecting apparatuses 3, 4, i.e., an analog detection signal from each of the detecting elements 3a, 4a and it computes the sizes of flames distributed within the supervised zone on the basis of the detection data from the flame detecting apparatuses 3 and 4 which make searches of the supervised zone. The computation result is output to the storage section 14. In the storage section 14, the infrared light energies of the flames distributed within the supervised zone are stored in an analog form, at respectively alloted addresses, on the basis of the data from the control section 17. The control section includes the fire extinguishment controlling section 17a which compares and determines the sizes of the distributed flames on the basis of the stored data from the storage section 14 and specifies, on the basis of the determination result, which flame is to be preferentially extinguished, i.e., the largest flame of the plural distributed flames, to control the extinguishing of the same. For the control of section 17, a fire extinguishing program for the fire extinguishment controlling section 17, programs such as a computing program for computing the size and the position of the flame, etc. have been set, and it outputs, on the basis of the preliminarily set control program, a control signal to the flame detection apparatuses 3, 4 and the nozzle assembly 5 through an output interface 16 so as to effect control.

In Fig. 1, the reference numeral 11 denotes a tank for storing fire extinguishing liquid such as a fire extinguishing agent or fire extinguishing water, 12 is a pump for feeding the fire extinguishing liquid from the tank 11 to the nozzle 5a, and 13 is a motor. When the motor 13 is actuated on the basis of the control from the control section 17 obtained through the output interface 16, the fire extinguishing pump 12 is driven so as to feed the fire extinguishing liquid to the nozzle 5a for initiating a fire extinguishing operation.

The operation will be described referring to Figs. 3(A) and 3(B) and Fig. 4. In Fig. 3(A), at block a, initialization for a normal time is made. For example, the vertical direction control means 3a, 4a are controlled so that the deflection angles of the detecting element 3a, 4a may be vertically downward angles. At block b, the fire supervising section supervises a fire occurring within the supervising zone and when the fire supervising section 9 detects a fire, the step proceeds from block b to block c. At block c, the horizontal direction control means 3c, 4c are driven. More particularly, horizontal scanning is made for searching for flames while keeping the deflection angles in the virtual direction of the detection elements 3a, 4a at the set vertically downward angles. At block d, determination is made as to whether the detecting elements 3a, 4a detect flames and if flames are not detected, the step proceeds to block e. At block e, determination is made as to whether flame detection of the entire supervisory zone has been completed or not, and as the flame detection of the entire supervising zone has not been completed, the step proceeds to block f. At block f, the vertical direction control means 3b, 4b are driven to reset the deflection angles in the vertical direction of the detecting elements 3a, 4a upwardly by a predetermined angle Θ_1 from the initial angle, i.e., the vertically downward angles. The step further proceeds to block c to again drive the horizontal direction control means 3c, 4c to continue the flame detecting operation. More particularly, horizontal scanning within the supervising zone is made while keeping the deflection angle reset at block f.

Similarly, the deflection angles in the vertical direction of the detecting elements 3a, 4a are stepwise reset upwardly from Θ_2 to Θ_7 according to a preset deflection angle setting program and the detecting elements 3a, 4a are caused to scan in the horizontal direction at each of their deflection angles to repeat a flame detecting operation of the entire supervised zone.

When the detecting operations by the detecting elements 3a, 4a proceed and if at least one of the detecting elements 3a, 3b detects infrared light energy from a flame, the step proceeds from block d to block g to drive the alarm section 18 for effecting an alarm indication. At block h, the distance to the flame is computed by the trigonometrical survey on the basis of the detection data from the detecting elements 3a, 4a. At block i, the size of the flame is likewise computed on the basis of the detection data from the detecting elements 3a, 4a. At block j, the computed distance to the flame and the computed size of the flame together with the address indicating the position of the flame are stored in the storage section 14. At block e, supervision is made as to whether flame detection of the entire supervising zone has been completed or not and when the flame detection of the entire supervising zone has been completed, the step proceeds from block e to block k of Fig. 3(B) through ①.

At block k, if a plurality of flames exist in the supervised zone, the size of the distributed flames are compared and determined on the basis of the storage data from the storage section 14 and the flame to be preferentially extinguished is specified on the basis of the determination result. More particularly, the position of the largest flame of the plural flames is specified and the step proceeds to block l. At block l, the direction control means 6 is driven to control the rotation of the table 2 so as to face the flame detecting apparatuses 3, 4 and the nozzle assembly 5 conjointly towards the flame to be extinguished. At block m, the horizontal angles of the detecting elements 3a, 4a are readjusted because the angles are deviated from the flame to be extinguished according to the rotation of the table 2 and the vertical direction control means 3b, 4b and the horizontal direction control means 3c, 4c are driven to direct the detecting elements 3a, 4a towards the largest flame to be extinguished. At block n, the spraying direction control means 5d of the nozzle assembly 5 is driven to adjust the directing angle of the nozzle 5a in the vertical direction so as to direct the spout of the nozzle 5a towards the flame to be extinguished. At block p, the spraying condition control means of the nozzle assembly 5 is driven to adjust the opening degree of the spout of the nozzle 5a for controlling the spraying condition of the fire extinguishing liquid. More particularly, the opening of the spout is set according to the size of the flame to be extinguished and the distance to the flame. At block q, the motor 13 is actuated to operate the fire extinguishing pump 12 so as to discharge the fire extinguishing liquid from the nozzle 5a for starting a fire extinguishing operation. At block r, supervision is made as to whether the corresponding flame has been extinguished or not on the basis of the data from the detecting elements 3a, 4a. When the flame has not been completely extinguished, the step proceeds to block l and block m so as to readjust the direction control means 6 and the vertical direction control means 3b, 4b and the horizontal direction control means 3c, 4c. Further, at block n and block q, the spraying direction and spraying condition of the nozzle 5a are readjusted to continue the fire extinguishing operation. At block r, if it is confirmed that the corresponding flame has been completely extinguished, the step proceeds to block s for making determination as to if there is any flame within the supervising zone. More particularly, if detection data is obtained from the fire supervising section 9, the step proceeds from block s to block t for making initialization and the step further proceeds to block c of Fig. 3(A) through ② for controlling flame detection of the entire supervised zone.

If the largest flame, i.e., the actual flame is extinguished, a virtual image flame obtained from an infrared ray emitted from the actual flame which has been reflected from a floor or window pane of high reflectance is also extinguished simultaneously. As a result, no output is obtained from the fire supervising section 9 and the step proceeds from block s to block v to stop the fire extinguishing pump 12 for terminating the fire extinguishing operation. At block w, the buzzer 7 and the lamp 8 are turned off to stop the alarm and the step returns to block a of Fig. 3(A) through ③ for resetting the directing angles of the detecting elements 3a, 4a to the initial conditions, respectively, for continuously conducting the fire supervision.

A second embodiment will now be described, referring to Figs. 5 to 7.

In this embodiment, a single flame detecting apparatus is used for detecting the size and the position of a flame. The automatic fire extinguishing equipment 20 of this embodiment comprises an elongate casing 21 and a smoke detector 22 disposed at a top portion of the casing 21, a nozzle assembly 23, a flame detecting apparatus 24 and a fire extinguishing agent bomb 25 which are disposed within the casing 21 in this order.

The smoke detector 22 corresponds to the fire supervising section for entire supervision in the foregoing embodiment, and it may for example be an ionization-type smoke detector. Of course, another type of smoke detector may alternatively be employed.

The nozzle assembly 23 is mounted on the rear side of a cover 26 through a base 27 and a nozzle 23a is freely rotatable in the horizontal and vertical directions by a drive 28 disposed within the casing 21. The drive 28 includes a vertical direction control means 23b and a horizontal direction control means 23c for controlling the directions of the nozzle 23a as in the foregoing embodiment. However, a spraying condition controlling means for the nozzle 23a is omitted to simplify the apparatus.

A flame detecting apparatus 24 is also mounted on the rear side of a cover 29 through a base 30 in a similar manner to that of the nozzle assembly 23 and a detection element 24a including an infrared detector may be rotated in the horizontal and vertical directions by a drive 31 disposed within the casing 21. However, the rotation in the horizontal direction is uni-directional so as to simplify the construction of the apparatus. The drive 31 also includes a vertical direction control means 24b and a horizontal direction control means 24c as in the foregoing embodiment. However, they differ from those of the foregoing embodiment in that they suffice to be such ones that can output the direction angles as data.

More particularly, when the smoke detector 22 detects smoke and generates a fire signal, the detecting element 24a of the present embodiment rotates somewhat upwardly in the vertical direction to push the cover 29 upwardly and to assume a first deflection angle position set to substantially vertically downward direction. Then, the detecting element 24a rotates while keeping this state and is rotated upwardly by means of the vertical direction control means 24b so as to assume a second deflection angle while it is directed within the casing 21. A series of operations such as the rotation, scanning and changing of the deflection angle are sequentially repeated for effecting the scanning of the entire supervised zone.

The fire extinguishing bomb 25 contains a given amount of a fire extinguishing agent including water and chemicals and a gas of a predetermined pressure and is provided at the top thereof with a solenoid valve 32. The fire extinguishing bomb 25 is connected to the nozzle 23a through the electromagnetic valve 32 and when the solenoid valve 32 is opened, the fire extinguishing agent is fed to the nozzle 23a by the pressure of the gas.

In this connection, it is to be noted that the cover 26 for the nozzle assembly 23 and the cover 29 for the flame detecting apparatus 24 may be closed together with the corresponding apparatus and assembly, respectively, and under the condition where the smoke detector 22 is not detecting smoke, they are closed as shown in Fig. 6. Of course, a cover for the fire extinguishing agent bomb 25 may be normally closed and openable manually when required.

The circuit arrangement of the present invention will be described referring to Fig. 7. In Fig. 7, portions similar to or the same as those of Fig. 2 are designated by the same numerals. An explanation of the same or similar portions is omitted here.

A control section 34 of the present embodiment comprises a flame position determining section 35, a flame width determining section 36, a flame output value determining section 37, a computing section 38, a fire extinguishing drive control section 39 and a fire extinguishment controlling section 40.

Each of the determining sections 35, 36 and 37 is input with detection date from the flame detecting apparatus 24, i.e., an analog detection signal from the detecting element 24a. The flame position determining section 35 determines the position of the flame from the directing angle in the vertical direction of the detection element 24a and the rotational angle in the horizontal direction thereof when the detecting element 24a receives infrared energy from the flame and from the position in height where the flame detecting apparatuses are installed, and outputs the determination data to the storage section 14. The flame width determining section 36 transmits a control signal to the vertical direction control means of the flame detecting apparatus 24 through a detecting element drive in the output interface 16 when a flame detection signal is input to the detecting element 24a. When the vertical direction control means 24b receives the control signal, it stops changing the deflection angle of the detecting element 24a, so that the detecting element 24a makes a predetermined number of turns while keeping the deflection angle at the time when it outputs the detection signal for repeating scanning of the same area of the supevising zone several times.

This operation is adapted to the so called flickering characteristic of the flame by which the width of flame varies largely within a short period of time. More specifically, during the rotation of the detecting element 24a, while keeping the same deflection angle, if the flame detection signals are output at different angles, the determination is made that the detection signals represent an actual flame. In other cases, the detection signals are determined as being false ones due, for example, to the ambient sunlight.

The flame width determining section 36 outputs data concerning the width of the flame to the storage section when the detection by the detection element 24a is determined as an actual flame and generates an output to the vertical direction control means 24b which has suspended the changing of the deflection angle of the detecting element 24a so as to sequentially change the deflection angles of the detecting element 24a. In this connection, it is to be noted that, since the flickering of the flame also varies the height of the flame, a flame height determining section may alternatively be provided in place of the flame width determining section 36.

The flame output determining section 37 determines the output values of the flame input from the detecting element 24a in the form of the intensities of the infrared energies and outputs predetermined signal values to the computing section 38.

The computing section 38 is a circuit which integrates the output values of the flame output over the width of the flame and computes the average value thereof. The thus obtained average value is output to the storage section 14 as an output value of the flame. The storage section 14 stores, as in the foregoing embodiment, the position, width and output value of the flame at the respective addresses. The computing section 38 may employ a peak value holding circuit so that the maximum value of the output values of the flames may be output to the storage section 14.

The fire extinguishment controlling section 40 comprises a flame size comparing and determining section 41 and a fire extinguishment preference determining section 42. The flame size comparing and determining section 41 compares and determines the sizes of the destributed flames on the basis of the stored data from the storage section 14. More specifically, the positions of the flames input from the flame position determining section 35 to the storage section and stored therein are combined with the output values and the widths (or heights) of the flames to correct the output values or widths (or height) of the flames according to the positions of the flames so as to effect accurate flame size comparison. More concretely, since the light energies reaching the detecting element 24a differ when the distances between the flames and the flame detecting apparatus 24 and the angles of view from the detecting element 24a also differ, they are corrected so as to enable accurate flame size comparison. The combinations of the data are the width of the flame and the position of the flame; the output value of the flame and the position of the flame; and the width of the flame, the output value of the flame and the position of the flame. Of course, the height of the flame may alternatively be employed instead of the width of the flame.

The fire extinguishment preference determining section 42 determines the preference of the flames to be extinguished on the basis of the output from the flame size comparing and determining section 41. It generates an output to control the fire extinguishment drive control section 39 so as to start the fire extinguishment preferentially on the flame which has been determined as being the largest. The fire extinguishment drive control section 39 drives relevant devices and equipments through a nozzle drive section, a solenoid valve drive section and an alarm drive section of the output interface 16.

While in the first-described embodiment the output from the fire 9 is supervising section 9 is also input to the control section through the input interface 15 so as to drive the flame detecting apparatuses based on the determination by the control section 17, in the present embodiment, a fire signal is immediately input from the input interface 15, when the smoke detector generates an output, to the detecting element drive section of the output interface for driving the fire detecting apparatus 24 in the present embodiment.

Although the operation flowchart of the present embodiment is not shown, it is substantially the same as the flowchart shown in Figs. 3(A) and (B) for the foregoing embodiment.

In both the embodiments as described above, the entire supervised zone is again searched whenever the flame is extinguished, i.e., the largest flame has been extinguished, but alternatively the order of the flames to be extinguished may be set so that when the flame to be first extinguished has been extinguished, the detecting element may be directed to the flame to be extinguished secondly for determining as to whether the flame is an actual flame or a virtual image flame. In this case, the fire extinguishment activity may be carried out quickly.

Furthermore, although in the present embodiment preference for fire extinguishment is given on the basis of the order of the flame size which is determined in accordance with processed output from the detecting element showing the strength of energy intensity radiated from a flame, preference may alternatively be given based on the order of energy intensity radiated from a flame without a determination of the flame size. Alternatively, when a determination is to be made in the case of plural flames having substantially the same flame size, preference for fire extinguishment may be given to the flame having the most intense energy.

CLAIMS

1. An automatic fire extinguishing equipment adapted to direct a nozzle towards the position of a flame starting within a supervised zone so as to discharge a fire extinguishing liquid to extinguish that flame, which equipment comprises a flame detecting apparatus including a detecting element for detecting flames and means for scanning and driving the detecting element in a horizontal direction and a vertical direction and for searching the supervised zone and outputting data concerning flames detected; a storage section for storing detection data from the flame detecting apparatus; a fire extinguishment controlling section which decides the sizes of distributed flames on the basis of the stored data from said storage section; and a nozzle assembly including said nozzle and means for controlling the direction of the nozzle in response to a control from the fire extinguishment instructing section.

2. An automatic fire extinguishing equipment as claimed in claim 1, wherein said data concerning the distributed flames output from the detecting apparatus includes at least one of the flame characteristics comprising the widths, the heights and energy outputs of the flames, in addition to the positions of the flames, and said fire extinguishment controlling section includes means for correcting the comparison and determination of the sizes of the flames on the basis of a combination of plural kinds of data.

3. An automatic fire extinguishing equipment as claimed in claim 2, wherein said fire extinguishment controlling section includes means for specifying the largest one among the distributed flames and controlling fire extinguishment thereof.

4. An automatic fire extinguishing equipment as claimed in claim 2 or 3, wherein a pair of detecting apparatuses are provided for enabling a trigonometrical survey for establishment of the position of the flames.

5. An automatic fire extinguishing equipment as claimed in claim 2 or 3, wherein a single detecting apparatus is provided and the detection of the position of the flames is effected on the basis of the scanning angles in the horizontal and vertical directions.

6. An automatic fire extinguishing equipment as claimed in claim 5, wherein said detecting apparatus causes the detecting element to repeat scanning several times by means of said scanning and driving means, while keeping the same scanning angle in the vertical direction, when said detecting element generates a detection signal and ouputs said detection data when there is produced a difference between the detection angles due to flickering of the flames.

7. An automatic fire extinguishing equipment as claimed in claim 1 or 6, wherein said detecting element includes an infrared detector which detects infrared energy radiated from the flames in analog form and generates a corresponding electrical output.

8. An automatic fire extinguishing equipment substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

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