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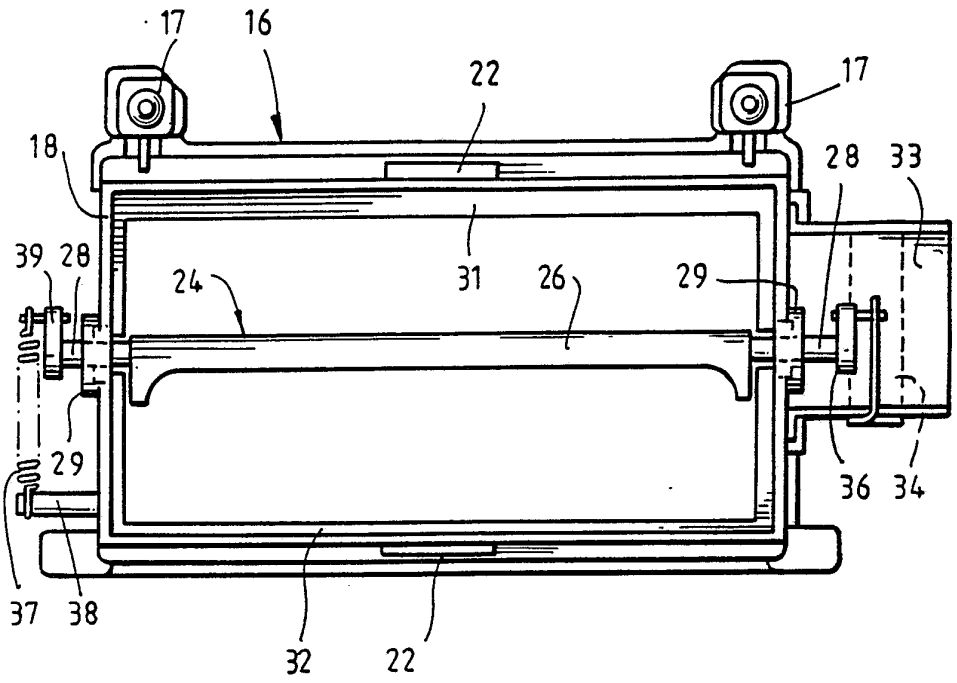
(54) Title: WELDING HELMET



(57) Abstract

A welding mask (12) incorporates a pivotally mounted filter lens (24) which pivots on a shaft (28) on or close to its centre of gravity and which is moved to and held in the open position by a solenoid (33) operable in response to the open circuit voltage across the welding electrodes of an electric arc welder. The solenoid (33) becomes de-activated and a spring (37) causes the filter lens (24) to move the closed position as soon as the electrode voltage drops below a predetermined voltage such as when an arc is drawn between the electrodes.

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WELDING HELMET

Field of the Invention

This invention relates to welding masks and relates particularly to a welding mask incorporating a filter lens which is moveable between a position whereat the filter lens does not obscure a user's vision of work to be welded and an operative position in which the filter lens shields the eyes of the user from the UV light and other harmful radiation emitted during electric arc welding.

The eyes of a welder must be protected against damage from such radiation during any form of welding operation.

Background of the Invention

It has been the practice to provide either a hand held welding mask having a filter lens formed of a darkened window which is moved in front of the eyes on commencement of welding or a mask which is worn by the welder and which is generally moveable between an operative position at which the welder looks through the filter lens and an inoperative position at which the mask is tilted back on the head of the user or the filter lens moved on a pivot allowing clear vision of the work.

Such masks, however, are unsafe due to the tendency of the user to strike an arc before the mask is properly in place thus subjecting the user's eyes to the damaging radiation. The problem is accentuated when welding is carried out in conditions of poor light where it is impossible for the welder to see the work through the filter lens before the arc is struck.

The problem of eye damage caused by the radiation emitted from a welding arc has dramatically increased with the increasing use of hobby arc welders which are now commonly available and used by amateur welders without

any formal training or experience. However, the problem also exists for trained and experienced welders who can accidentally be exposed to the radiation.

Background Art

It has been proposed to provide welding masks with a filter lens which becomes darkened or opaque in the presence of UV and other radiation but which clarifies in the absence of such radiation. However, the time taken for such a lens to become opaque is such that some radiation can impinge on the eyes of a user.

Australian Patent No. 515,177 discloses a hand held mask having a trigger which actuates a hinged filter lens mechanism and a light switch. When the trigger is actuated, the filter lens swings out of the line of vision of the user to enable the work to be viewed. Greater trigger pressure actuates the light switch to cause the work to be illuminated by the self-contained light. On release of the trigger, the filter lens swings back into the shielding position.

With this construction, it is possible for the user to strike an arc while the filter lens is out of the line of vision so that the user is subjected to radiation.

Australian Patent No. 419,674 discloses another construction of mask in which a moveable opaque filter lens is pivoted along it's upper edge and is moveable by a lever mechanism operable by the chin of the user to open or close the filter lens. Again, correct operation of this mask depends on proper actuation by the user.

Other similar devices have been shown in Australian Patent specification Nos. 120,050 and 261,265.

It is, therefor, desirable to provide an improved construction of welding mask whereby the filter lens does not obscure, or substantially obscure, vision of the work when there is no arc but which protects the eyes of the user against radiation when an arc is struck.

It also desirable to provide an improved welding mask which is able to be used with a variety of arc welding equipment.

It is also desirable to provide an improved welding mask which is effective in automatically preventing radiation reaching the eyes of a user but which enables the user to clearly see the work and leaves one hand free to position the work piece to be welded or to hold on to a support in hazardous locations.

It is also desirable to provide a welding mask which has the above features and which is also economical to manufacture.

Summary of the Invention

According to the invention there is provided a welding mask comprising an opaque face shield having a viewing opening therein, a filter lens pivoted to the face shield adjacent the viewing opening, moving means to move the filter lens from a closed to an open position, said moving means including electrical transducer means to cause pivotal movement of said filter lens, restoring means to restore the filter lens to the closed position, and electrical control means for said transducer means, said control means including electrode voltage sensing means to sense electrode voltage of an arc welder and circuit means responsive to sensed electrode voltage to energise said transducer means when the voltage rises above a predetermined maximum value and to de-energise the transducer when the sensed voltage falls below a predetermined minimum value.

Preferably, the mask is of the face shield type adapted to be worn on the head, although it will be appreciated that the invention is applicable to hand held shields.

In a preferred form of the invention, the filter lens is pivotally mounted on a frame forming part of or attached to the face shield. The pivotal axis of the

lens is generally horizontal and passes either through the centre of gravity of the lens or adjacent thereto. With this arrangement, the operation of the transducer acts to pivot the lens about it's axis of symmetry, thus requiring less operational forces as compared to physically moving the lens away from the viewing opening. In the open position, the filter lens is substantially centrally located in the viewing area but extends perpendicular thereto so that the user can look passed the lens to the work.

In a preferred form of the invention, the transducer means comprises a solenoid mounted on the face shield and connected by a crank lever to the lens pivot shaft. The restoring means comprises a tension spring which is also connected by a crank lever to th lens pivot shaft and which also constitutes part of the circuit means. With this arrangement, if the spring fails, no current will flow to the solenoid and the filter lens will remain in a closed position.

The welding mask of the invention can be designed for a standard electric arc welder which has an operating voltage in the range of 50 to 80 volts a.c. between the welding electrode and the work. When the arc is struck, the voltage across the arc drops by approximately 50 percent.

In an alternative embodiment, the welding mask is designed for use with a standard rod arc welder, a MIG, an a.c. TIG or a d.c. TIG. In this embodiment, a switch is provided, preferably mounted on the face shield or lens frame, to enable the user to switch the electrical control means to suit the particular welder in use. Thus, in the normal MIG and TIG type welders, direct current is normally employed and the welder is operated by a switch mounted on the electrode holder. For this embodiment, the control circuit must take account of both a.c. and d.c. electrode voltages as well as the polarity differences between MIG and TIG d.c. welders.

The invention will be more readily understood

by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings.

Description of the Drawings

Figure 1 is a perspective view, part cut away, showing a welding mask in accordance with one embodiment of the present invention,

Figure 2 is a sectional, side elevational view showing the filter lens frame and cover therefor,

Figure 3 is a front elevational view of the filter lens and mounting frame,

Figure 4 is one side elevational view of the filter lens frame,

Figure 5 is a side elevational view of the filter lens frame taken from the opposite side to that of Figure 4

Figure 6 is a circuit diagram illustrating a control circuit for a standard electric arc welder, and

Figure 7 is a circuit diagram illustrating a control circuit for a welding mask for use with different types of arc welders.

Description of the Preferred Embodiments

Figures 1 to 5 illustrate a welding mask 12 which comprises a face shield 14 and a lens frame 16 mounted to the face shield 14 by mounting brackets 17. The face shield 14 has an internal head band (not shown) enabling the face shield to be worn by a welder.

The lens frame 16 projects from the face shield 14 and includes an inner frame part 18 and a cover 19. The cover 19 has a clear glass or glass-like protective front 21 and upper and lower clips 22 which are adapted to engage upstanding ribs 23 on the inner frame part 18. Thus, the cover 19 is removeable from the inner frame part 18 to provide access to the filter lens 24 which

is mounted on the inner frame part 18.

The filter lens 24 includes a lens holder 26 which releaseably carries the filter lens glass 27, thus permitting easy replacement, if required. The lens holder 26 is provided with opposed outwardly extending pivot axles 28 which extend through bearings 29 on each side of the inner frame part 18. The axis of the pivot axles 28 is substantially horizontal in normal use of the welding mask 12 and is located slightly offset from the axis through the centre of balance of the filter lens 24 so that the lens 24 normally lies in a vertical plane.

The inner frame part 18 is provided with upper and lower stops 31 and 32 against which the filter lens 24 engage when moved to the vertical, closed position.

A solenoid 33 is mounted on one side of the lens frame 16. The solonoid plunger 34 is connected by a crank 36 to one of the pivot axles 28 so that vertical movement of the plunger 34 causes rotational movement of the filter lens 24. On the opposite side of the lens frame 16, a spring 37 engaged on a pin 38 extending from the lens frame 16 is connected to a second crank 39 fixed to the other of the pivot axles 28. The spring acts to move the filter lens 24 about the pivot axis to the closed position.

The solenoid 33 is actuated through a control circuit, components of which are mounted on a printed circuit board 41 mounted on one side of the lens frame 16. The control circuit may be that illustrated in Figure 6, in which case the welding mask 12 is able to be used only with a normal, a.c. arc welder. Alternatively, the control circuit may be that illustrated in Figure 7, in which case the welding mask 12 includes a change-over switch 42 which enables the circuit to be switched to suit the various types of arc welders.

Referring to Figure 6, the control circuit illustrated is suited for a normal, a.c. arc welder. The circuit includes inputs 43, one of which is connected to the welding electrode while the other of which is connected to

the work. A reed switch coil 44 is connected across the inputs 43 in series with a voltage dropping resistor 46. The reed switch coil has an operating voltage of approximately 10 volts and the resistor 46 is selected so that a voltage of between 50 and 80 volts a.c. across the inputs 43, which corresponds to the open circuit electrode to work voltage, causes operation of the reed switch 47. The switch 47 connects the resistor 48 to the gate 49 of the triac 51 causing the triac to conduct and thus closing the circuit to the bridge rectifier 52. The bridge rectifier rectifies the input voltage and applies this to the solenoid coil 53. The coil is therefor energised and the plunger 34 of the solenoid 33 holds the filter lens 24 in the open position as shown in Figure 2.

As soon as the welding electrode contacts the work in order to strike an arc, the voltage across inputs 43 drops below a level at which the reed switch coil 44 will hold the reed switch 47 closed. The gate 49 is, thus, open circuited and the triac 51 immediately ceases to conduct, thereby open circuiting the solenoid coil 53. The restoring spring 37 immediately acts to rotate the filter lens 24 about the pivot axis to the closed position at which radiation from the welding arc is prevented from damaging the eyes of the welder.

Immediately the arc is broken, the voltage between the electrode and the work increases, causing the reed switch coil 44 to close the reed switch 47 thus actuating the solenoid coil 53 to open the filter lens 24.

The circuit illustrated in Figure 7 includes a change over switch 42 which enables the circuit to be used for the various types of electric arc welders. The change over switch 42 is a 3 pole, 3 way switch to enable the control circuit to take account of the input voltage being a.c. or either polarity of d.c.. Referring to Figure 7, the input 54 is connected to the work while the input 55 is connected to the anode. The inputs are connected to switch poles 56 and 57, respectively. The poles 56/57/58 can be switched between positions a,b and c which

correspond to MIG, TIG a.c. and TIG d.c. respectively. The switch is shown in Figure 7 at position a. As will be seen, the difference between MIG and TIG d.c. positions is simply a reversal of polarity.

The input voltage (in the case of TIG a.c., rectified by the bridge rectifier 59) is applied to the voltage regulator circuit incorporating transistor 61 and zenner diode 62. While the voltage is higher than the zenner voltage, the transistor 61 conducts thus energising the solenoid coil 63. As soon as the voltage across the inputs drops due to the contact of the electrode with the work, the transistor ceases to conduct and the coil is open circuited causing the spring 37 to close the filter lens 24.

In the preferred embodiment illustrated in Figure 7, the transistor is an npn type 2N3055 while the zenner diode is a 12 volt diode with the biasing resistor 64 preferably 150 ohms.

A relay coil 66 is connected across the transistor 61 and actuates a single pole, double throw relay switch 67. Thus, if any of the circuit components such as the zenner diode 62 or transistor 61 malfunction, the relay actuates to open circuit the solenoid coil 63 causing the filter lens 24 to be moved to the closed, or safe, position.

In the preferred embodiments of the invention, the spring 37 is preferably part of the electrical circuit to solenoid 33 so that, in the event of the spring failing, the solenoid cannot be energized to open the filter lens 24.

It has been found that with the welding mask of the embodiments described, when the welding electrode touches the work prior to striking the arc, the lens closes within approximately 3 milliseconds. This time is generally less than the time required to actually strike the arc. Further, as soon as the arc breaks, the lens opens at a slower rate than the closing rate, and any subsequent contact of the electrode with the work causes

the lens to re-close within the 3 millisecond period. Similar times are applicable to MIG and TIG welders using switch controls.

CLAIMS

1. A welding mask comprising a face shield having a viewing opening therein, a filter lens pivotally mounted relative to the face shield adjacent the viewing opening, and moving means to move the filter lens from a closed to an open position characterized in that the moving means includes electrical transducer means to cause pivotal movement of the filter lens, restoring means to restore the filter lens to the closed position, electrical control means for said transducer means, said control means including electrode voltage sensing means to sense electrode voltage of an electric arc welder, and circuit means responsive to sensed electrode voltage to operate said transducer means when the voltage rises above a predetermined maximum value.

2. A welding mask according to Claim 1 characterized in that said circuit means de-activates said transducer means when sensed electrode voltage falls below a predetermined minimum value to enable said restoring means to move the filter lens from the open to the closed position.

3. A welding mask according to Claim 1 characterized in that said transducer means comprises a solenoid mounted on said face shield and the circuit means includes a voltage controlled switching circuit and rectifier means to supply d.c. voltage to the solenoid.

4. A welding mask according to Claim 3 characterized in that said restoring means comprises at least one spring.

5. A welding mask according to Claim 3 characterized in that said spring comprises part of the circuit means.

6. A welding mask according to Claim 1 characterized in that said filter lens is pivotally mounted on a frame forming part of or attached to the face shield, the pivotal axis of the lens passing through or adjacent the centre of the filter lens such that, in the open position, the filter lens is substantially centrally located in the viewing area and substantially perpendicular thereto.

7. A welding mask according to Claim 6 characterized

in that the pivotal axis is generally horizontal in use.

8. A welding mask according to Claim 7 characterized in that the pivotal axis is adjacent a parallel axis through the centre of gravity of the filter lens whereby the lens tends to move to the closed position under the influence of gravity.

9. A welding mask according the Claim 1 characterized in that the electrical control means includes voltage input terminals to be connected to the welder electrode and the work to receive the voltage therebetween, a reed switch held in a closed position when the voltage across a reed switch coil is above said predetermined maximum value, a triac whose gate is in the reed switch circuit and which is held on while the reed switch is closed to energize the solenoid through a bridge rectifier, said reed switch open-circuiting the triac gate when the electrode voltage falls below said predetermined minimum value.

10. A welding mask according to Claim 1 characterized in that the electrical control means includes a 3 pole, 3 way control switch, voltage input terminals on the switch to be connected to the welding anode and the work, a voltage regulator circuit including a transistor controlled by a zenner diode to switch on the transistor to energise the solenoid when the voltage across the zenner diode is greater than said predetermined maximum value and to turn off the transistor when the voltage falls below the zenner voltage, the control switch being operable to enable the control circuit to operate with an a.c. input voltage or a d.c. input voltage of either polarity.

11. A welding mask according to Claim 10 characterized in that a safety cutout is connected in the solenoid circuit to de-energize the solenoid in the event of a failure of the zenner diode or transistor.

12. A welding means according to Claim 10 characterized in that said control switch is mounted on said face shield.

13. A welding mask substantially as hereinbefore described with reference to the accompanying drawings.

AMENDED CLAIMS
[received by the International Bureau on 13 June 1988 (13.06.88)
original claims 1-13 replaced by amended claims 1-7 (2 pages)]

1. A welding mask comprising a face shield having a viewing opening therein, a filter lens pivotally mounted relative to the face shield adjacent the viewing opening, and a solenoid to move the filter lens from a closed to an open position characterized in that the solenoid is connected to a crank to pivot the filter lens about an axis with passes either through the centre of the lens or adjacent thereto, restoring means to restore the filter lens to the closed position, electrical control means for said solenoid, said control means including electrode voltage sensing means to sense electrode voltage of an electric arc welder, circuit means responsive to sensed electrode voltage to operate said solenoid when the voltage rises above a predetermined maximum value, and to deactivate said solenoid when sensed electrode voltage falls below a predetermined minimum value to enable said restoring means to move the filter lens from the open to the closed position, the electrical control means including voltage input terminals to be connected to the welder electrode and the work to receive the voltage therebetween, a reed switch held in a closed position when the voltage across a reed switch coil is above said predetermined maximum value, a triac whose gate is in the reed switch circuit and which is held on while the reed switch is closed to energize the solenoid through a bridge rectifier, said reed switch open-circuiting the triac gate when the electrode voltage falls below said predetermined minimum value.

2. A welding mask according to Claim 1 characterized in that said restoring means comprises at least one spring.

3. A welding mask according to Claim 2 characterized in that said spring comprises part of the circuit means.

4. A welding mask according to Claim 1 characterized in that said filter lens is pivotally mounted on a frame forming part of or attached to the face shield, the pivotal axis of the lens passing adjacent the centre of the filter lens such that, in the open position, the filter lens

is substantially centrally located in the viewing area and substantially perpendicular thereto but moves under gravity to the closed position in the absence of any opening force.

5. A welding mask comprising a face shield having a viewing opening therein, a filter lens pivotally mounted relative to the face shield adjacent the viewing opening, and moving means to move the filter lens from a closed to an open position characterized in that the moving means includes electrical transducer means to cause pivotal movement of the filter lens, restoring means to restore the filter lens to the closed position, electrical control means for said transducer means, said control means including electrode voltage sensing means to sense electrode voltage of an electric arc welder, circuit means responsive to sensed electrode voltage to operate said transducer means when the voltage rises above a predetermined maximum value and to deactivate said transducer means when sensed electrode voltage falls below a predetermined minimum value to enable said restoring means to move the filter lens from the open to the closed position, said electrical control means including a 3 pole, 3 way control switch, voltage input terminals on the switch to be connected to the welding anode and the work, a voltage regulator circuit including a transistor controlled by a zenner diode to switch on the transistor to energise the solenoid when the voltage across the zenner diode is greater than said predetermined maximum value and to turn off the transistor when the voltage falls below the zenner voltage, the control switch being operable to enable the control circuit to operate with an a.c. input voltage or a d.c. input voltage of either polarity.

6. A welding mask according to Claim 5 characterized in that a safety cutout is connected in the solenoid circuit to de-energize the solenoid in the event of a failure of the zenner diode or transistor.

7. A welding means according to Claim 5 characterized in that said control switch is mounted on said face shield.

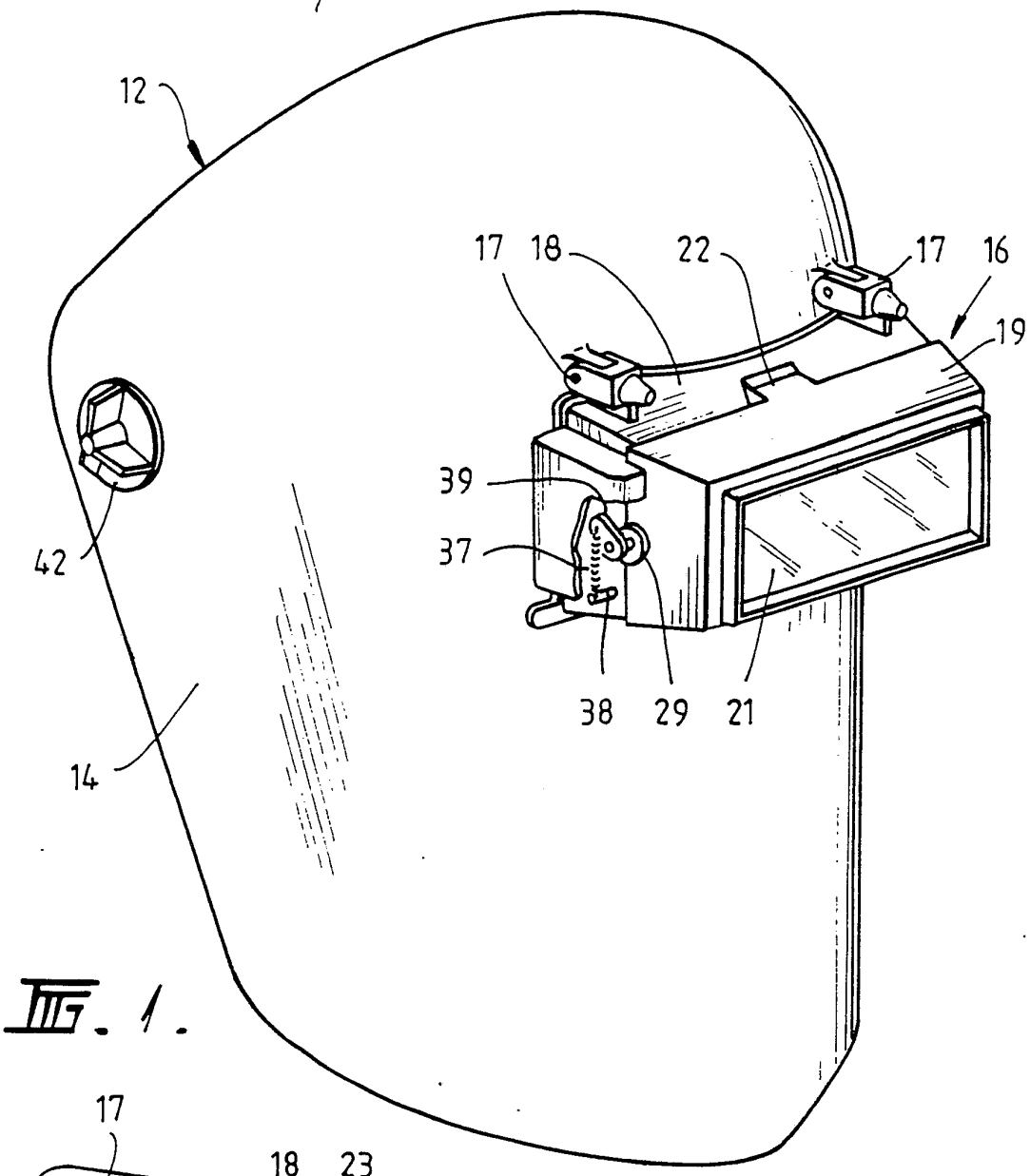
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FIG. 1.

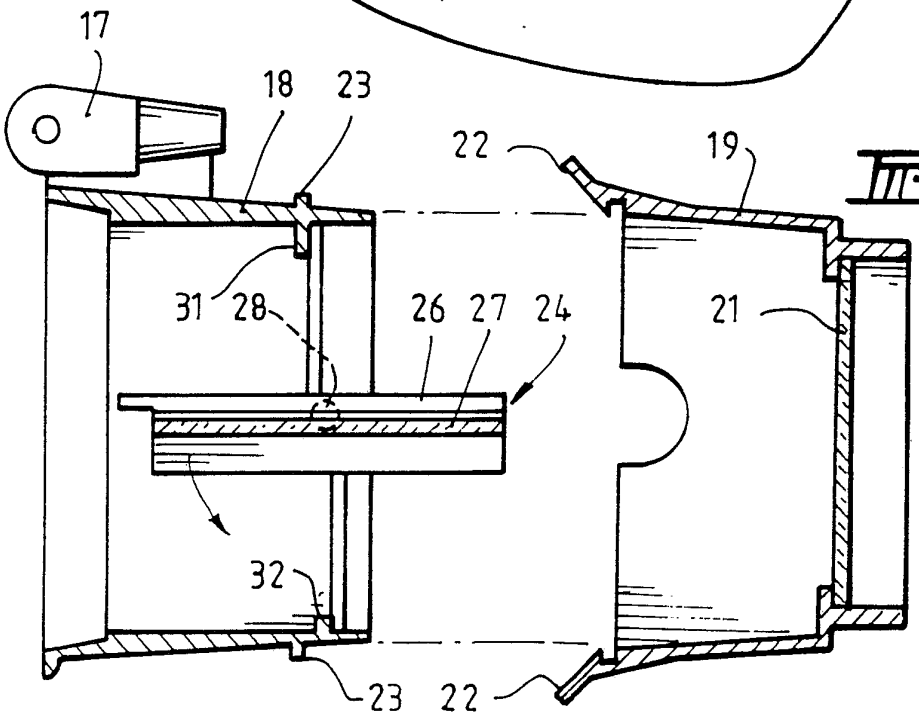
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FIG. 2.

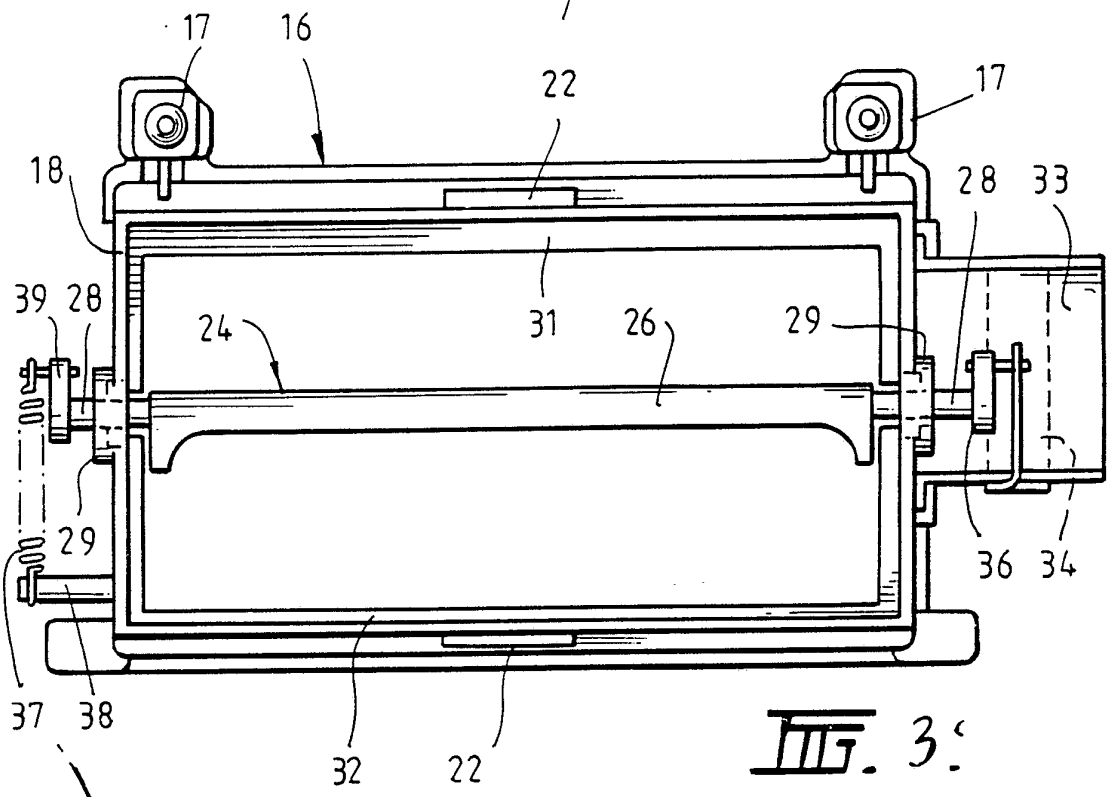


FIG. 3.

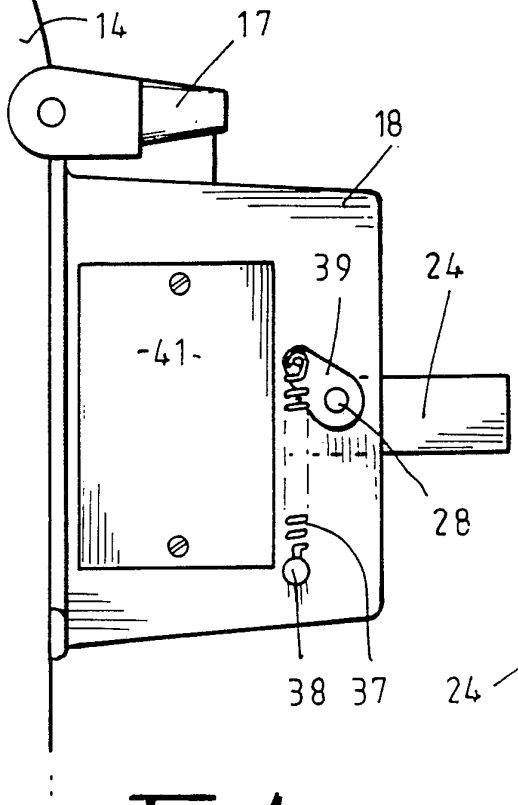


FIG. 4.

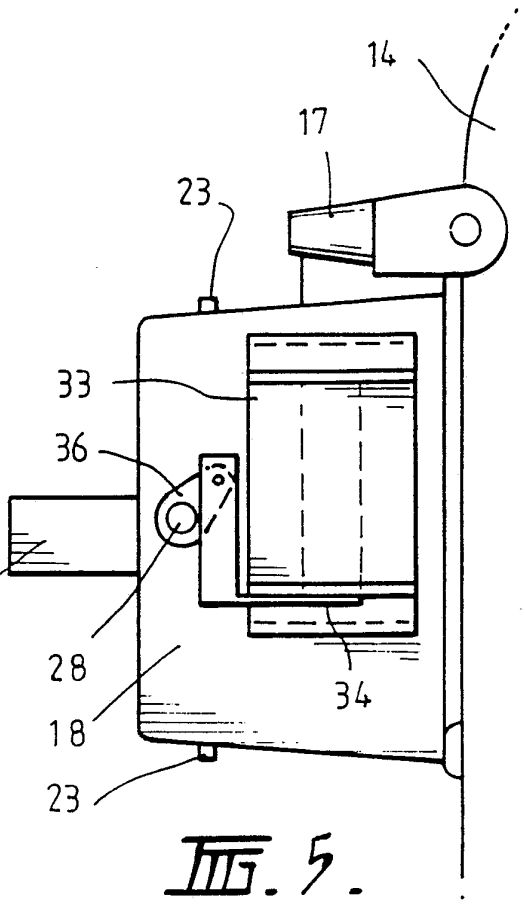


FIG. 5.

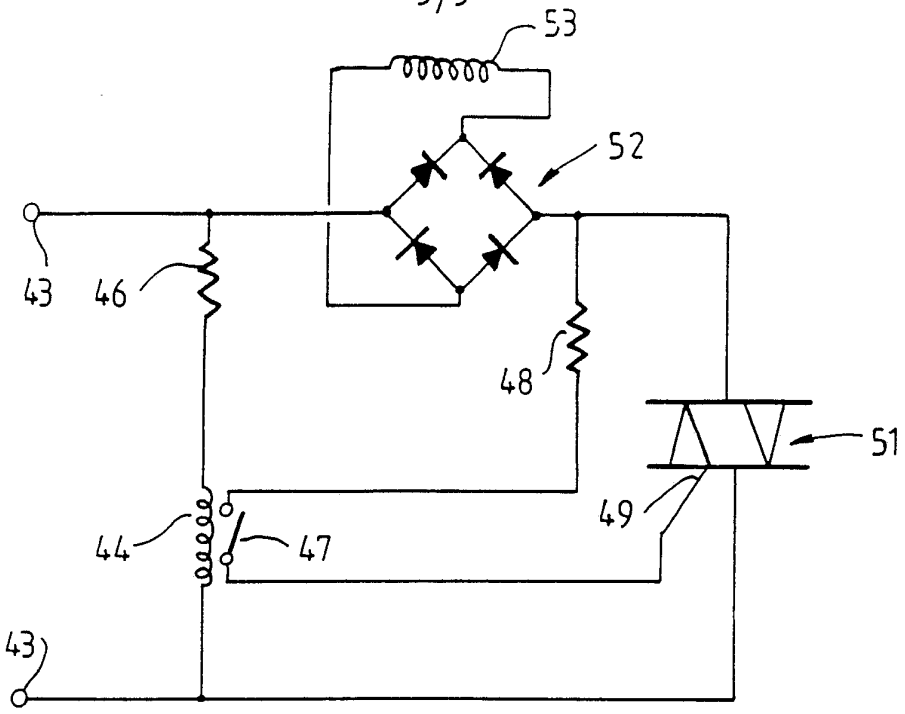
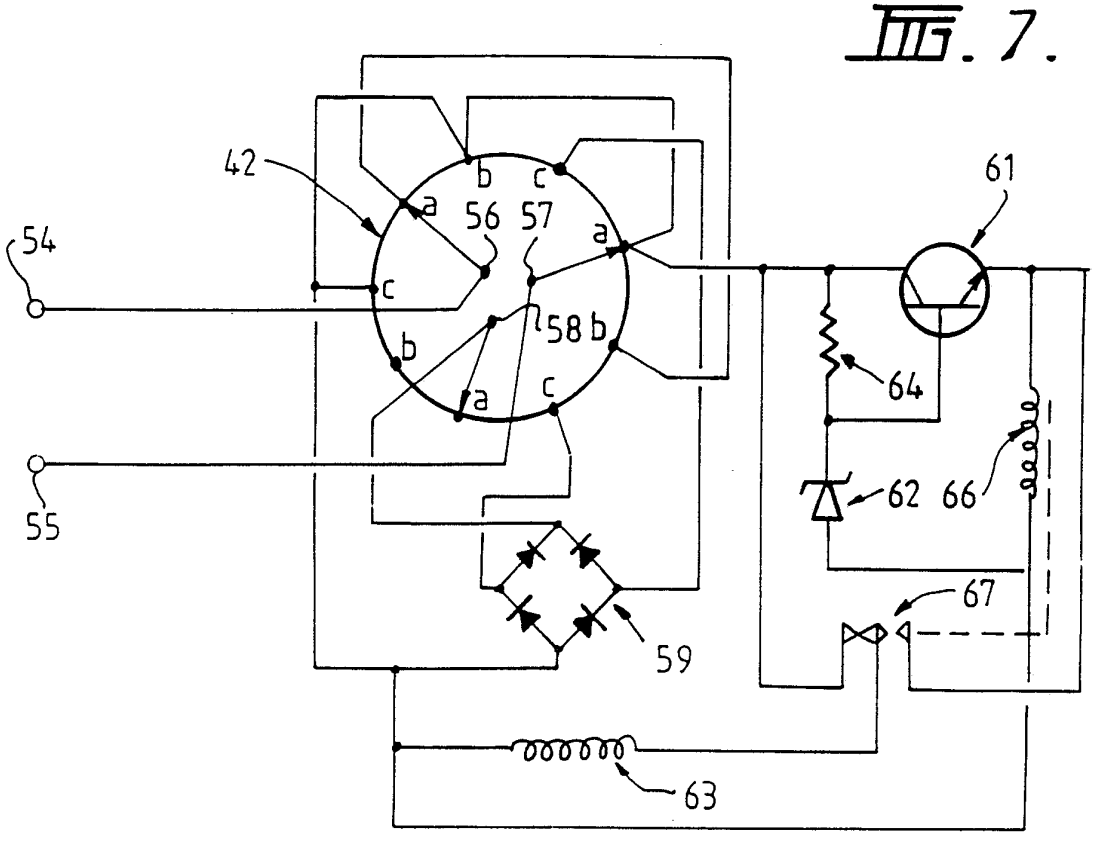


FIG. 6.

FIG. 7.



INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 87/00422

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] A61F 9/06

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	A61F 9/06

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X,Y	US,A, 2036224 (LINCOLN et al) 7 April 1936 (07.04.36)	(1,2)
X,Y	GB,A, 959413 (BURMEISTER) 3 June 1964 (03.06.64)	(1,2)
X,Y	US,A, 4418267 (PFANZELT) 29 November 1983 (29.11.83)	(1-3)
Y,A	US,A, 2904669 (TOEBE) 15 September 1959 (15.09.59)	(1,2)
Y,A	GB,A, 666219 (GOODWIN) 6 February 1952 (06.02.52)	(1,2)
A	GB,A, 878847 (SONNBERGER) 4 October 1961 (04.10.61)	(1,2)
Y,A	CH,A, 375459 (FRICK) 15 April 1964 (15.04.64)	(1,2)
Y,A	CH,A, 483291 (MAIER) 13 February 1970 (13.02.70)	(1,2)

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 March 1988 (24.03.88)	(06.04.88) 6 APRIL 1988
International Searching Authority: Australian Patent Office	Signature of Authorized Officer: A. HENDRICKSON

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 87/00422

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members			
US 4418267	DE 3017215 DE 3017241	FR 2484828	JP 57001575	

END OF ANNEX