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(54) Title: AN EYEWEAR ADAPTED FOR DEFOGGING DURING SURGERY

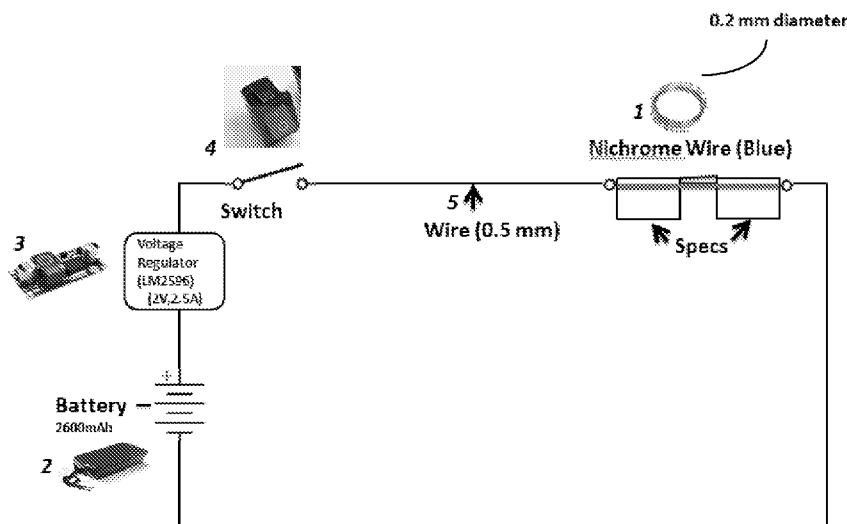


FIG. 1 Circuit Diagram for defogging of eye glasses

(57) **Abstract:** An Eyewear adapted for defogging in order to protect a user's eyes during surgery application, the eyewear comprising a frame and a pair of ear pieces coupled to the frame, the ear pieces configured to assist in holding the eyewear on a user's head, the eyewear further comprising a heating element characterized in that the eyewear comprises of a Nichrome 0.315Ω/cm resistance wire (N80CR20) in a groove in an overhang, attached to the upper rim of the frame of eye glasses connected with a circuitry including a power source, a voltage regulator, a rocker/micro switch and a plurality of connection wires; wherein the said Nichrome wire is preferably of diameter and length of 0.2 mm and 15 cm respectively which is used as a heating element of glass surface as shown in FIG. 1.



OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

- *as to the identity of the inventor (Rule 4.17(i))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

AN EYEWEAR ADAPTED FOR DEFOGGING DURING SURGERY

FIELD OF THE INVENTION

[001] This invention relates to eyewear, and especially eyewear used for safety
5 and/or activities such as during surgery. More particularly, the present invention
discusses about the defogging of eye glasses for a clear vision of surgeons and other
experts, while operating patients.

BACKGROUND AND PRIOR ART

10 [002] Eyewear for safety applications in industrial use are used to protect a user's
eyes. Such eyewear is usually designed to fit relatively closely to a user's face, so that
noxious fog contaminants, and the like, do not touch or affect a user's eye(s). Safety
and some eye glasses or eyewear are often designed and formed such that they are
bulky and heavy to wear. Some hinder vision when they fog under cool conditions
15 which result in moisture condensation on the eyewear.

[003] This results in poor compliance in users donning and wearing the eye wear;
the poor compliance occurs especially when the eyewear does not enhance a user's
ability to see, but hinders it. Such occurrences increase the risk to a user in either a
medical use of the eyewear, rather than decreasing it. Therefore, safety and/or
20 medical eyewear which is lightweight and reduces or eliminates fogging and/or
condensation by warming of the lenses is desirable. Such eyewear may provide
warming to the lens and/or other portions of the eyewear via electrical current from a
battery. The conductive elements may include wires, heating elements, such as thin
film heating elements, and so forth. In addition, such eyewear may provide some
25 design features which makes it more attractive to wear, also increasing compliance.

[004] In the prior art, an U.S. 4,209,234A describes eye glasses comprising an
electrical circuit designed to heat the lenses by means of electrical contacts and a
conductive element on the surface of the lenses. Also U.S. 3,377,626A describes

goggles formed of a lens structure comprising two spaced lenses with a sealed gap between.

[005] There has been considerable interest in the study of fogging and defogging of the glasses. A numerical procedure for prediction of fogging and defogging phenomenon on a surface simulating windshield has been given by Croce et al. The advances in technology are typified by an investigation of the growth of single-layer graphene defoggers by Tan et al. The authors emphasised that the defogging devices do not consider the local weather. The role of a windshield defroster has been analysed by Sorato.

10 [006] Probably the most extensive investigation on anti-fogging devices on windshields has been made in a US Patent No. 8,399,805 B2. The invention provides an anti-fogging device having flexible sheet of substantially transparent material. The heating element formed at the flexible sheet and an adhesive element disposed at the periphery of the device for adhering. The heater element material is not light-transmissive and the spaces between adjacent parts of the heater element allowing user to view. This invention may works well on helmets but such product cannot be recommended for defogging of eye specs at the time of operations, the subject of present investigation. The heating material is attached to glasses. Removal of such materials can lead to damaging or scratching of glasses.

20 [007] The following inventions relate to devices which can be used as defogging of viewing elements such as visors, helmet glass, wind screens and the like.

[008] U.S. Pat. No. 8,399,805 discloses a face shield for a helmet. The system has 2 lens one is inner face lens and other is an outer weather lens. An electro conductive film is formed across the surface of the inner face lens, which gets heated by passing an electric current. Use of 2 lenses might be appropriate for specs as it may change the actual power of specs which might affect the vision of doctor.

[009] US Pat. No. 4,682,007 discloses an electrically conductive heating circuit printed on the inner surface of the face shield of helmet through screen printing. The

heating elements may get damaged (due to scratching) to the extent. This can affect the defogging functionality of device. Thus may cause replacement of whole glass of eye specs.

[0010] DE-A-3229021 discloses an electrically conductive film having heating
5 element which can be heated for defogging. Slots need to be made into the glass in order to fix the heating element. Making of slots in eye specs is not an intelligent way to get your specs defogged as that may cause damaging of glasses.

[0011] U.S. Pat. No. 4,584,721 and U.S. Pat. No. 6,701,537 discloses a defogging
10 device for helmet having a removable electric heating element embedded in the helmet glass screen. The devise mentioned in the cited prior art is attached with the surface of whole surface of glass or viewing element. After removing this element much number of times from the surface of glass there is a serious risk that the active surface will get scratched affecting of the vision of doctor through eye glass.

[0012] Some of the defogging devices not able to prevent the water condensation on
15 the glass screen (Biddell et al). They modify the nature of the condensed water to reduce fogging. This can cause the formation of larger water droplets in the visor, which acts like a small lenses causing discomfort while viewing from visor, especially while operating.

[0013] The defects in the prior art was fogging of eye glasses affects the performance
20 of surgeons and other experts, who need a clear vision for a long time at a stretch while operating patients. Thus there is a definite requirement of a solution which should be effective, reliable, and inexpensive and require zero or little maintenance and restriction of the field of view. In this note, to report a discussion and supporting experiments proof of a concept towards this end.

25 [0014] Further the existing prior art can be used for defogging of larger bodies such as wind screen of cars. This structure is unsuitable for small glass structure such as eye glasses [Lifang et al]. The proposed design is also complex when going for implementation in such smaller bodies. It can also affect the vision of person [Croce

et al]. The mounting structure increases the weight of specs and thus also increases the discomfort. The devise mentioned above is attached with the surface of whole surface of glass or viewing element. After removing this element much number of times from the surface of glass there is a serious risk that the active surface will get
5 scratched affecting of the vision of doctor through eye glass.

[0015] The present invention overcomes the abovementioned problems

OBJECT OF THE INVENTION

[0016] Accordingly, the primary object of the invention is to produce an effective,
10 reliable, and inexpensive eyewear which requires zero or little maintenance and restriction in the field of view.

[0017] Another object of the invention is to produce an eyewear when going for implementation in such smaller bodies.

[0018] The further object of the invention is to remove the possibility of having
15 scratches affecting of the vision of doctor through eye glass.

[0019] How the foregoing objects are achieved will be clear from the following description. In this context it is clarified that the description provided is non-limiting and is only by way of explanation.

20 SUMMARY OF THE INVENTION

[0020] An Eyewear adapted for defogging in order to protect a user's eyes during surgery application, the eyewear comprising a frame and a pair of ear pieces coupled to the frame, the ear pieces configured to assist in holding the eyewear on a user's head, the eyewear further comprising a heating element characterized in that the
25 eyewear comprises: a Nichrome $0.315\Omega/\text{cm}$ resistance wire (N80CR20) in a groove in an overhang, attached to the upper rim of the frame of eye glasses connected with a circuitry including a power source, a voltage regulator, a rocker/micro switch and a

plurality of connection wires; wherein the said Nichrome wire is preferably of diameter and length of 0.2 mm and 15 cm respectively which is used as a heating element of glass surface.

5 BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0021] The nature and scope of the present invention will be better understood from the accompanying drawings, which are by way of illustration of a preferred embodiment and not by way of any sort of limitation. In the accompanying drawings:

10 [0022] Figure 1 illustrates the circuit Diagram for defogging of eye glasses in accordance with the present invention;

[0023] Figure 2 illustrates the relationship between Current (in A) through the Nichrome wire and distance of defogging (in mm) glasses in accordance with the present invention.

15 DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention consists of putting a Nichrome $0.315\Omega/\text{cm}$ resistance wire (N80CR20) in a groove in an overhang, attached to the upper rim of the frame of eye glasses (Fig. 1); this is in contrast to having uniform heating over the condensing surface. Thus the present concept is much more practical than the one employed for
20 larger areas. When an electric current passes through the Nichrome wire the glass gets heated. Moisture is simulated by placing the glasses over a pot of hot water. The whole area of glasses remained defogged. Fig. 2 displays the relationship between the current (I) flowing through the wire and the distance D from the wire upto which defogging takes place. Around 1.65 A current from source with 2V is enough to
25 defog whole glass.

Function of Components Used

S.No.	Item	Specification	Description
1	Nichrome wire	Resistance/cm: 0.315Ω/cm Diameter: 0.2 mm Weight: 0.00029 Kg/m Density: 8400 kg/m ³ Melting point: 1400 ⁰ C	The heating material used for whole specs (15 cm)
2	Li-Po Rechargeable Battery	2600 mAh, 7.8 V, 4 amp	For providing supply to the circuit
3	LM2596 Module	Input: 3V to 40V (DC) Output: 0V to 25 V Maximum output current : 3 A Dimensions: 45 (l) x 20 (w) x 14 (h) mm	To limit the output voltage and current in order to avoid over heating of Nichrome wire.
4	Rocker Switch	Dimensions: 12 (l) x 20 (w) Rated Voltage and Current: 6A, 250VAC Life Cycle: >10000 times	To turn on the power supply
5	Connecting wire (copper)	0.5 mm diameter (5-10 cm)	For circuit connections

Description of material

[0025] The device has a Nichrome wire (1) (N80CR20) of length 15 cm which is used as a heating element of glass surface. The wire has diameter and length of 0.2 mm and 15 cm respectively. The Li-Po batteries (2) (7.8 V, 2600 mAh) is used here for providing power supply. The Li-Po batteries are used as a power source connected with the said Nichrome resistance via a micro-switch / rocker switch. LM2596 (3) is used as a voltage regulator and current limiter in order to limit the flow of maximum current from the batteries. This will avoid overheating of Nichrome wire in order to protect glasses from melting at the point of contact with Nichrome wire. The LM2596 IC is a very commonly known voltage regulator. One switch (4) is also added into the system in order to turn ON/OFF the system. A plurality of connecting wires (5) is used to connect the Nichrome wire with other parts of circuit. The connecting wire

has diameter of 0.5 mm. During application, the said Nichrome wire is inserted into the groove placed above the eye glasses when compared to earlier devices where heating element need to be printed on active glass surface or electrode is inserted into the active surface.

- 5 [0026] The table shows the brief description of materials and their associated cost.

S.No.	Item	Description	Cost (in \$)
1	Nichrome wire	The heating material used for whole specs (15 cm)	0.413
2	Li-On Rechargeable Battery (7.8 V,4 amp)	For providing supply	6.2
3	LM2596 Module	To limit the output voltage and current	2.1
4	Rocker Switch	Switch to turn ON the circuit	0.2
5	Connecting wire	0.5 mm diameter (5-10 cm)	0.27
		Total	\$ 9.1

Advantages

- 10 [0027] Nichrome wire is light weight; it has weight of 0.00029 Kg/m. We are using only 15 cm of Nichrome wire i.e equivalent to 0.000043 Kg. The Nichrome wire is also highly resistive to corrosion. The proposed design does not damage the active surface or viewing region of eyeglass.

- 15 [0028] The disclosed system is unique in term Design, and require Nichrome wire to be inserted into the groove placed above the eye glasses when compared to earlier devices where heating element need to be printed on active glass surface or electrode is inserted into the active surface. Thus can be adapted easily.

[0029] In earlier presented devices the heating element covers the whole surface of the glass thus affects the vision of the viewer, especially in case of eye specs where doctors have to be focused while operating patients. In proposed system the device placed in the upper part of glass and thus does not affect the vision of person.

- 5 [0030] Having described several embodiments, it will be recognized by those of skill in the art that various modifications, alternative constructions, and equivalents may be used without departing from the spirit of the invention. Additionally, a number of well-known processes and elements have not been described in order to avoid unnecessarily obscuring the present invention. Accordingly, the above description
- 10 should not be taken as limiting the scope of the invention.

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I/We claim:

1. An Eyewear adapted for defogging in order to protect a user's eyes during surgery application, the eyewear comprising a frame and a pair of ear pieces coupled to the frame, the ear pieces configured to assist in holding the eyewear on a user's head, the eyewear further comprising a heating element characterized in that the eyewear comprises:
a Nichrome $0.315\Omega/\text{cm}$ resistance wire (N80CR20) in a groove in an overhang, attached to the upper rim of the frame of eye glasses connected with a circuitry including a power source, a voltage regulator, a rocker/micro switch and a plurality of connection wires; wherein the said Nichrome wire is preferably of diameter and length of 0.2 mm and 15 cm respectively which is used as a heating element of glass surface.
2. The eyewear as claimed in claim 1, wherein the power source is of a rating of (7.8 V, 2600 mAh)
3. The eyewear as claimed in claim 1, wherein the said voltage regulator and current limiter LM2596 (3) is used in order to limit the flow of maximum current from the batteries and thereby avoid overheating of Nichrome wire in order to protect glasses from melting at the point of contact with Nichrome wire.
4. The eyewear as claimed in claim 1, wherein the said voltage regulator and current limiter LM2596 (3) is configured to supply around 1.65 A current from source with a voltage of 2V, enough to defog whole glass.
5. The eyewear as claimed in claim 1, wherein the said connecting wire has diameter of 0.5 mm

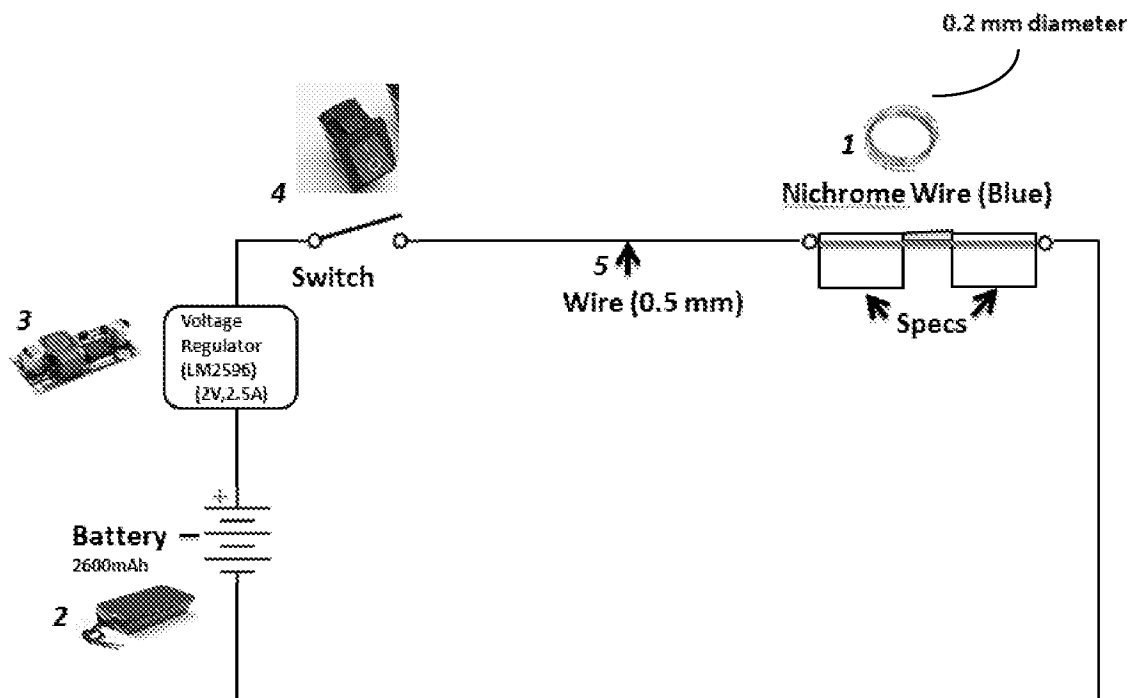


FIG. 1 Circuit Diagram for defogging of eye glasses

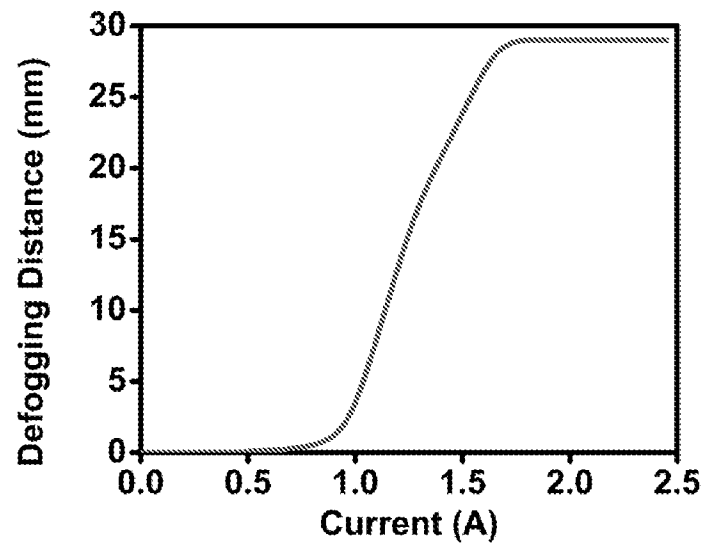


FIG. 2: The relationship between Current (in A) through the Nichrome wire and distance of defogging (in mm)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2019/050929

A. CLASSIFICATION OF SUBJECT MATTER
G02C11/08 Version=2020.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases used: Total Patent One, IPO Internal Database
Searched Keywords: eyewear, defogging, Nichrome wire, heat

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP2013658 B1 (KIMBERLY CLARK CO) 14.05.2014 (14 May, 2014) refer abstract, paragraphs [0030]- [0036], [0043], [0050], figures 1-4, 6, 8, claims 1-3, 5, 7-8. -----	1-5
X	JP2001350125 A (SAITO TSUTOMU) 21.12.2001 (21 December, 2001) refer whole document.	1-5

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Citation	Pub.Date	Family	Pub.Date
EP 2013658 B1	14-05-2014	CA 2648688 C	21-03-2017
		WO 2007125444 A1	08-11-2007
		US 7648234 B2	19-01-2010