

FORM 2
THE PATENT ACT 1970
(39 OF 1970)
AND
The patent rules, 2003
COMPLETE SPECIFICATION
(See section 10: rule 13)

1. **TITLE OF INVENTION**

Device for detecting Glaucoma

APPLICANTS

Name	Nationality	Address
AbhaykumarKuthe	Indian	Visvesvaraya National Institute of Technology, South Ambazari Road, Nagpur 440 010, Maharashtra.
Mahesh B Mawale	Indian	Kavikulguru Institute of Technology and Science, Ramtek, Dist- Nagpur-441106

3. **PREAMBLE TO THE DESCRIPTION**

COMPLETE

Following specification particularly describes the invention and the manner in which it is to be performed.

4. DESCRIPTION

Technical field of invention:

The present invention relates to the field of Ophthalmic Medical Science and more specifically to the detection of the glaucoma. More particularly relates to a device for the detection of the glaucoma by the screening based on applanation and indentation principles.

Prior art:

Glaucoma is the second leading cause of blindness and it affects several people worldwide. Glaucoma is a progressive, asymptomatic disease of optic nerve that is always associated with a vision loss. In the normal eye, the aqueous humor is produced in the ciliary body and drained out at constant rate from the eye. If the blockage produced in the drainage system of the eye it increases the intraocular pressure in the eye (IOP). Although the advance treatments are available for the patient's having glaucoma but detection is the major problem. If glaucoma is untreated in its early stages it results into irreparable vision loss of the eye. To avoid the damage to optic nerve of eye detection of glaucoma in early stage is essential. The disease is not yet fully understood, however elevations in intraocular pressure (IOP) have been identified as major risk factor. In diagnosis of glaucoma measurement of IOP becomes important and the most widely used devices for intraocular pressure measurement are applanation tonometer, indentation tonometer, rebound tonometry, Pascal dynamic contour tonometry and so on. Although the Goldmann Applanation tonometry is considered the standard procedure for measuring IOP, it has number of disadvantages.

Recently the inventors have developed the new methods to measure IOP. In Hsu's patent No.US4928697, patent No.US6030343 and US patent No.5375595 the inventors are used Ultrasound non-contact tonometry for IOP measurement. In US patent No. US2003/0187343A1 Inventor used vibrational approach to measure the IOP. Many other devices developed are

US patent No. US1743461A discloses a tonometer which is placed on eyelid to measure the intraocular pressure eliminates the necessity of applying local anesthesia to the eye. In the present invention a weighted slid able rod is placed into the cylinder and device is rested on the closed eyelid for obtaining reading of the intraocular pressure. This can be obtained due to weighted rod pressing the eyeball inwardly to a greater or lesser extent than the sliding cylinder in accordance with the internal pressure of the eye.

US patent No. US2882891A this patent sighted a measuring device to find out intraocular pressure similar to tonometer by placing it directly on the eyelid of an eye when it is closed. This device consists of a base of an accurate shape with a curvature conforming the contours of an eye with a closed eyelid. In operation the base is placed on the upper eyelid with closed eye directing downward. The bottom of the plunger will rest on the surface of lid and the pressure is applied through the cap holding the spring. The spring in the cap measures the pressure applied the pressure applied will transmitted to plunger and it will indent the eye. The distance is being measure to show the pressure required to produce an indentation of 4mm in the eye.

US patent No. US5197473A describes a method in which a ball falls onto an eyelid-covered cornea and the kinetic energy of the falling ball is conserved into a force which deforms the cornea. The amount of the ball rebound varies based on the amount of intraocular pressure in

the eye. The IOP can be judged against the amount of ball rebound. For this the device developed is an ocular tonometer has a tubular housing where provision is made for a free falling of the ball by fixing a special holder at one of the end of the housing. The other end of the housing is placed on the eyelid in such a manner that the falling ball interacts with the cornea through the eyelid. The amount of ball rebound will depend upon the amount of intraocular pressure. This can be measured with the help of scale or special measuring instrument.

US patent No. US534995A describes a tonometer which is adapted to measure intraocular pressure of an eye. The device comprises a simple cylinder and pressure rod inside. The pressure rod is pushed against via its eyelid. This tonometer arrangement is simple and compact, operationally safe, and comfortable the closed eyelid and load applied to the pressure rod at that point is determined by the load sensor. In this arrangement the intraocular pressure of the eye can be determined from the relationship between detected load and the amount of eyeball displacement produced by the pressure exerted against the eyelid by the pressure member. According to this invention, the eye can be examined with the closed eyelid.

US patent No. US5735275A describes a tonometer for measuring intraocular pressure using hydraulic pressure. The tonometer comprises an eyepiece having a conduit extending through the outer surface. The outer surface of the eyepiece is concave and the plunger extends through the conduit having head at first end and probe at second end. The probe extends beyond the outer surface and contacts the eyeball. The tonometer is also having a top and bottom reservoir. The bottom reservoir is sealed by membrane that is in juxtaposition with the head of the plunger. The fluid used is mineral oil or gauge oil. The method involved is to measure the fluid displacement caused by

contacting the eyeball to the eyepiece. This fluid displacement measurement is proportional to the intraocular pressure of the eyeball.

US Patent No. US6251071B1 relates a tonometer for determining intraocular pressure, basically this invention falls under the category of PPT tonometer which uses a pressure phosphene technique. The invented device has a transparent tubular body. A plunger is fixed within the body passing through coil spring. A marker is attached to the body and is displaced relative to the external scale on the body. In application the tonometer is placed against the eyelid of closed eye and the body displaced relative to the head of the plunger until the pressure is sufficient to create pressure phosphene. Further the device is removed and the displacement of the marker is read. This reading is the indicative of intraocular pressure.

US Patent No. US7713197B2 describes a contact type tonometer for IOP measurement with a closed eyelid with the use of vibrator. In this invention the inventor has found that there is a characteristic that, when a predetermined alternating current voltage is applied to a vibrator, such as bimorph type vibrator for continuously driving it, a current flowing through the vibrator is changed corresponding to a material which is in contact with the vibrator. The value of current flowing through the vibrator is changed according to an intraocular pressure. The eyeball is vibrated by the vibrator to measure the intraocular pressure by measuring the current value. According to this principle further the tonometer is designed and developed to measure the intraocular pressure.

US patent No. US9005125B1 represents a tonometer is an improvement in the tonometer disclosed in US patent No. 7288067. The device includes a pair of arms connected at proximal ends to pivot and having solid state contact member at a distal end of one of the arm. The

arms are manually moveable between an open position where the distal ends can be separated and connected to exert a pressure on eye during measurement. The eyelid is closed during operation and contact member is passed directly against the eyelid. The contact member is a resilient pad in physical contact with the pressure transducer. The pressure transducer is disposed at the distal ends of the arm. The transducer gives an electrical signal in proportion to the deflection of the contact member, which deflects in proportion to the magnitude of the intraocular pressure of the eye being measured.

US patent No. US20040210123A1 describes an improved applanation tonometer for the measurement of intraocular pressure of an eye is configured for use with a conventional slit lamp. This tonometer has a force sensor that senses the force applied by the probe to flatten the cornea. The device is incorporated with a force sensor which senses the forces applied by the probe to the cornea of the patient's eye and generate a signal corresponding to the sensed force. The applanation probe contains a prism system which when viewed through microscope assembly shows the desired area of the cornea of a patient's eye has been flatten. This tonometer can be used with a conventional microscope assembly, such as bio microscope slit lamp, in a manner that is familiar to and widely accepted by medical Practitioners, to measure the intraocular pressure of patient's eye. The present tonometer permits measurement of intraocular pressure of patient's eye without the need of complex mechanical calibration of internal weights, springs and bearings of prior art devices.

US publication No. US20040236204A1 describes aapplanation tonometer consisting of applanator formed of an optics array, a force transducer, an image sensor and a processing circuit configured to calculate intraocular pressure of the eye using pairs of measured force

and applanated area. The tonometer device is provided with a disposable tip and the applanating surface has a matte finish. The intraocular pressure can be calculated using a predetermined relationship between intraocular pressure and the slope of the line defined by data relating to the forces required to applanate the eye and the geometry of applanated portion of the eye. The tonometer is portable, hand held and used in conjunction with a slit lamp.

US Publication No. US20040267108A1 relates a Non-invasive electro-mechanical tonometer for intraocular pressure measurement through the eyelid. The tonometer consists of a frame, a strain gauge for force measurement. A linear variable displacement transducer mounted with respect to the frame, and a processing unit in communication with the strain gauge. The linear variable transducer measures the tip distance. The processing unit is programmed to synchronize the signals receive from the strain gauge and transducer and identify the change in the relationship between time- synchronized measurements of the force distance. This change in force/ distance relationship which co-relates with the intraocular pressure of a patient may be observed.

Patent No. 1) 5176139 2) 5349955 3) 5735275 4) 5836873 5) 6524243B1 represents eyelid tonometer. These patents and patent applications do not detail how the eyelid affects the measured IOP and the describe method are nonspecific. Thus there is a dire need for cost effective device for early detection and management of glaucoma. In the present invention we proposed a simple mechanical device which can be used for detecting glaucoma in patient's eye. The device can be made to operate based on indentation and applanation principle. Applanation force and indentation depth for non-glaucomatous eye can be found out and transferred on the glaucoma scale in terms of force and displacement. This will be treated as base value for non-glaucomatous

eye. If the value of force and displacement is higher than the base value then the patient's eye will be treated as glaucomatous eye. This device will help to the Ophthalmologist for screening the patients and further attention can be given to the patient's having glaucoma. It will also serve the general medical practitioners those are working in remote and rural areas.

Due to prevalent shortcomings in the existing art there was a long felt need to provide an economical, easy to construct and use device for detection of Glaucoma. The present disclosure addresses problems associated with existing systems used for detection of Glaucoma, including those mentioned above, and provides a level of transparency and economic advantage. For this reason, it is believed to constitute progress in science and the useful acts, for which Letters Patent are hereby expressly requested.

Object:

1. The primary object of the present invention is to provide a device to detect the glaucoma in the patient's eye with a closed eyelid.
2. Other object of the present invention to detect the glaucoma in patient's eye without adding anesthetic drops in patient's eye to numb the eye.
3. Another object is to make the contact of the plunger with the eyelid normal to it.

4. Another object of present invention is to calibrate the scale on main cylinder into levels of glaucoma.
5. Another object of the present invention to calibrate transfer applanation force on the compression spring.
6. Another object of the present invention is to provide a scale on displacement cylinder to measure the displacement.
7. Yet another object of the present invention to allow the displacement cylinder to slide into the main cylinder.
8. Yet another object of the present invention is to allow the plunger displacement up to the normal displacement required for non-glaucomatous eye.
9. Yet another object is to allow the proper movement of pointer on the scale indicating levels of glaucoma.
10. Further object of the present invention is to provide a device that is handy portable cost effective and can be used without aid of expert ophthalmologist and does not required any clinical aid, can be used by anyone.

Other objects, features and advantages will become apparent from detail description and appended claims to those skilled in art.

STATEMENT:

Accordingly present invention provides a device for the detection of the glaucoma by the screening based on applanation and indentation principles. The device can be placed on closed eyelid and by applying a pressure (applanation force) on the eyelid through plunger with its tip the calibrated scale present on the cylinder will indicate the level of glaucoma in patient's eye. The device is simple and convenient for use. The device is built by using simple mechanical arrangement to be cost effective and economical. Further it can be used externally through eyelid and does not require anesthetic drops to be added in patient's eye. The device is used for screening patient's eye whether it is glaucomatous or non-glaucomatous, further focusing more insight on the patients having glaucoma. It helps the Doctors or medical practitioners to find out the level of glaucoma in patient's eye. This serves the patient to avoid the further damage to his/her eyesight. The main body of the device comprises a main cylinder enclosing small displacement cylinder and compression spring inside. The pointer attached to the spring is moveable on the upper surface of the main cylinder inside a slot comprising a scale with levels of glaucoma. The displacement cylinder carries a piston and plunger inside which allows the movement of the plunger. The top surface of the piston attached to the plunger is connected to the compression spring enables the compression of the spring due to the movement of the plunger. The tip of the plunger is provided with a flat circular cross section with a diameter of 3.06 mm required to applanate the cornea. The scale provided on the plunger records the indentation of the plunger into the eye. In normal working the tip of the plunger is placed normal to the eyelid on patient's eye with a closed eyelid. The plunger exerts a pressure on eyelid to applanate the

cornea. The pressure exerted by the plunger on eyelid will transfer through piston on compression spring the spring will transfer this applanated force into the level of glaucoma on the scale through calibrating it simultaneously the scale on the plunger records the indentation depth. The recorded values will be directly indicated on the scale into the levels of glaucoma.

BRIEF DESCRIPTION OF DRAWING:

This invention is described by way of example with reference to the following drawing where

Figure 1 of sheet 1 shows diagram for an isometric view of device for detecting glaucoma.

Where,

1 denotes the tip of the plunger

2 denotes the plunger

3 denotes the piston

4 denotes the displacement cylinder

5 denotes the slot (scale) present on outer cylinder

6 denotes the outer cylinder

7 denotes the compression spring

8 denotes the knob on piston

9 denotes the top knob on outer cylinder

Figure 2 of sheet 2 shows the sectional view of device for detecting glaucoma

Where

10 denotes the top hole of displacement cylinder

11 denotes the clearance between displacement cylinder and outer cylinder

12 denotes piston clearance inside displacement cylinder

13 denotes the gap between plunger and displacement cylinder

Figure 3 of sheet 2 shows the complete plunger.

Figure 4 of sheet 3 shows the displacement cylinder.

Figure 5 of sheet 3 shows the outer cylinder.

Figure 6 of sheet 4 shows the compression spring.

In order that the manner in which the above-cited and other advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be referred, which are illustrated in the appended drawing. Understanding that these drawing depict only typical embodiment of the invention and therefore not to be considered limiting on its scope, the invention will be described with additional specificity and details through the use of the accompanying drawing.

Detailed description:

The present invention relates a device for the detection of the glaucoma by the screening based on applanation and indentation principles.

The present invention provides a device for detecting glaucoma where the device can be placed on closed eyelid and applying a pressure (applanation force) on the eyelid through plunger with its tip the calibrated scale present on the cylinder will indicate the level of glaucoma in patient's eye.

In other innovation aspects, the present invention relates to the main body of the device which comprises a main cylinder enclosing small displacement cylinder and compression spring inside.

In another embodiment of the present invention relates to the pointer attached to the spring is moveable on the upper surface of the main cylinder inside a slot comprising a scale with levels of glaucoma.

Another embodiment of the present invention relates to the displacement cylinder which carries a piston and plunger inside which allows the movement of the plunger.

Yet another embodiment of the present invention relates to the top surface of the piston which is attached to the plunger and is connected to the compression spring enabling the compression of the spring due to the movement of the plunger. The tip of the plunger is provided with a flat circular cross section with a diameter of 3.06 mm required to applanate the cornea.

Yet another embodiment of the present invention relates to the scale provided on the plunger records the indentation of the plunger into the eye. In normal working the tip of the plunger is placed normal to the eyelid on patient's eye with a closed eyelid. The plunger exerts a pressure on eyelid to applanate the cornea. The pressure exerted by the plunger on eyelid will transfer through piston on compression spring the spring will transfer this applanated force into the level of glaucoma on the scale through calibrating it simultaneously the scale on the plunger records the indentation depth. The recorded values will be directly indicated on the scale into the levels of glaucoma.

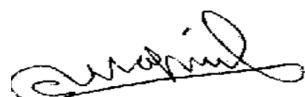
Best method of performance of the invention:

The complete working of the device is represented in the drawing. As shown in figure 1 of sheet 1 the contact plunger (2) is provided with constant flat area (1). This tip of the plunger (1) is allowed to make the contact with the eyelid another end of the plunger is connected to the piston (3). The piston gets displaced inside the displacement cylinder (4), it contains openings on either ends shown in Figure 2. The clearance (13) shown in Figure 2 allows free movement of the plunger. The opening (10) of Figure 2 permits the compression spring (7) to pass through it. The displacement cylinder permits free and restricted movement of piston. At top of the piston it carries a protruded rod (8) to fix the compression spring. The compression spring is provided with a pointer moves on scale (5). The complete assembly enclosed into a large cylinder (6) shown in Figure 1 of sheet 1.

The large outer cylinder carries a slot (5) on its entire length to accommodate the scale containing levels of glaucoma. At the top of the cylinder (6) it provided with protruded rod (9) to connect the free end of the spring. The outer cylinder acts as housing shown in Figure 2 of sheet 2. The displacement cylinder (4) permits to slide inside the outer cylinder (6). As the tip (1) of the plunger (2) contacts with the eyelid the plunger gets displaced into the displacement cylinder (4). This vertical movement of the plunger can be read on the scale (5). For detecting the level of glaucoma in patient's eye we need to flatten the cornea of the patient's eye through eyelid. The pressure is exerted by the plunger on the eyelid to flatten the cornea and it moves inside the displacement cylinder (13) shown in Figure 2 of sheet 2. As the plunger moves vertically the piston (3) also moves in vertical direction inside the displacement cylinder (4) compressing the spring (7). The vertical

movement of plunger is represented on the displacement scale (13) whereas the compressive movement of the spring is recorded on scale (5). If the displacement of piston (3) continues inside the cylinder (4), it reaches to its upper limit (10) Figure 2 of sheet 2. Then the displacement cylinder stops it, indicating limit of non-glaucomatous eye indentation has been achieved and the corresponding level of glaucoma will be shown on scale (5). If the piston gets its end limit of displacement (10) or the resistance offered to the displacement of piston inside the cylinder (4) is more the whole assembly shown in Figure 1 of sheet 1 displaced inside the cylinder (6) indicating the further level of glaucoma on scale (5). On the scale the pointer shows any deviation from the normal or base level then it can be treated as normal or elevated level of glaucoma.

Additional advantages and modification will readily occur to those skilled in art. Therefore, the invention in its broader aspect is not limited to specific details and representative embodiments shown and described herein. Accordingly various modifications may be made without departing from the spirit or scope of the general invention concept as defined by the appended claims and their equivalents.



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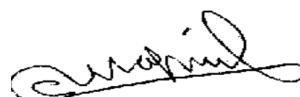
CLAIMS

We claim

1. A low cost and easy to construct and operate device for the detection of the glaucoma in patients eye by the screening based on applanation and indentation principles by placing it on closed eyelid of the patient and by applying a pressure (applanation force) on the eyelid through plunger with its tip and the calibrated scale present on the cylinder will indicate the level of glaucoma in patient's eye means the device can be used externally through eyelid and does not require anesthetic drops to be added in patient's eye wherein the device mainly comprises of plunger, piston, displacement cylinder, outer cylinder, compression spring, knob on piston and the top knob on outer cylinder.
2. The main body of the device as claimed in claim 1 comprises a main cylinder enclosing small displacement cylinder and compression spring inside and the pointer attached to the spring is moveable on the upper surface of the main cylinder inside a slot comprising a scale with levels of glaucoma.
3. The displacement cylinder of the device as claimed in claim 1 and 2 carries a piston and plunger inside which allows the movement of the plunger.
4. In the device as claimed in claim 1 and 2 the top surface of the piston attached to the plunger is connected to the compression

spring enables the compression of the spring due to the movement of the plunger and the tip of the plunger is provided with a flat circular cross section with a diameter of about 3.06 mm required to applanate the cornea.

5. The scale of the device as claimed in claim 1 and 2 provided on the plunger records the indentation of the plunger into the eye.
6. In normal working of the device as claimed in claim 1:
 - a) the tip of the plunger is placed normal to the eyelid on patient's eye with a closed eyelid;
 - b) The plunger exerts a pressure on eyelid to applanate the cornea;
 - c) The pressure exerted by the plunger on eyelid will transfer through piston on compression spring the spring will transfer this applanated force into the level of glaucoma on the scale through calibrating it simultaneously the scale on the plunger records the indentation depth;
 - d) The recorded values will be directly indicated on the scale into the levels of glaucoma.



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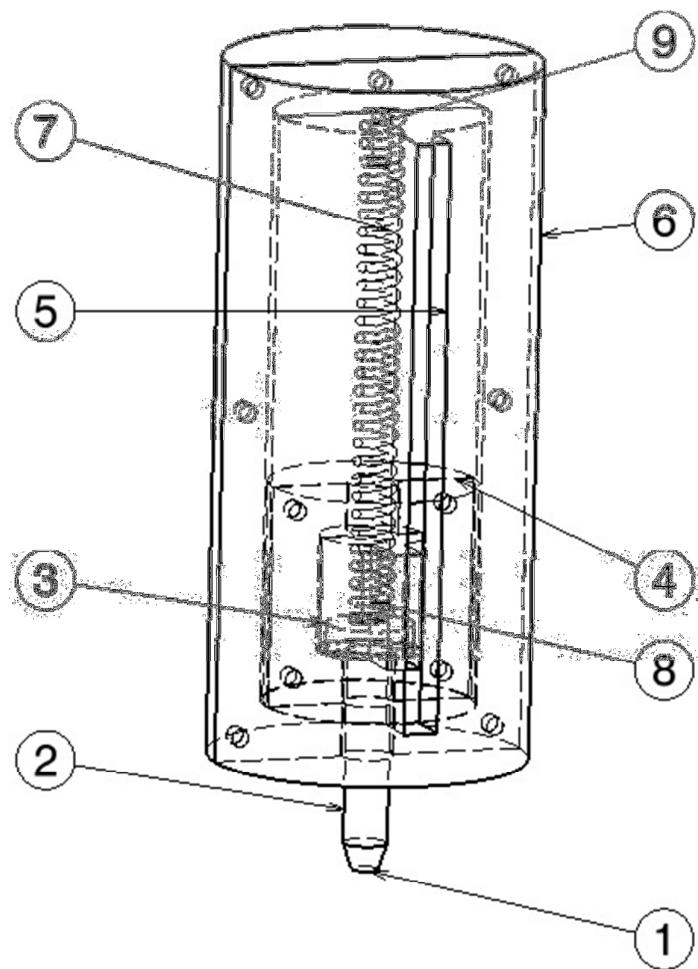


Figure 1

Swapnil

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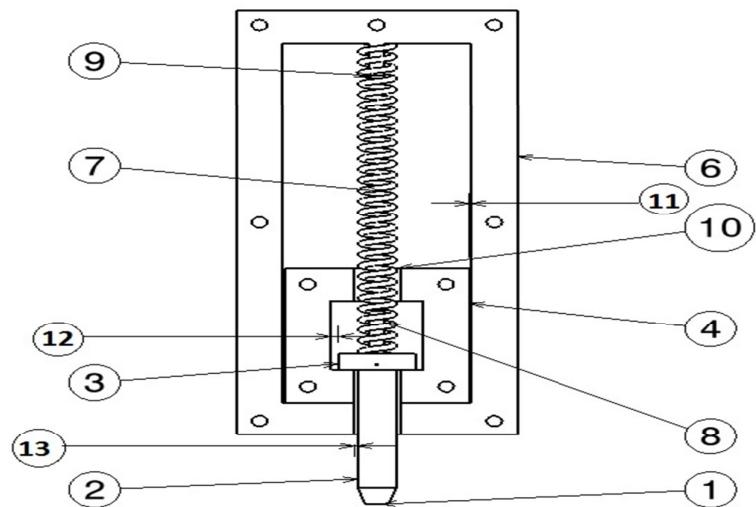


Figure 2

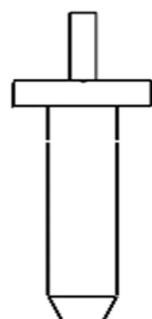


Figure 3

Swapnil

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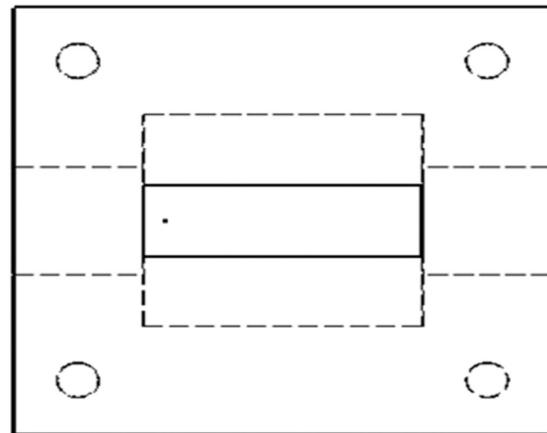


Figure 4

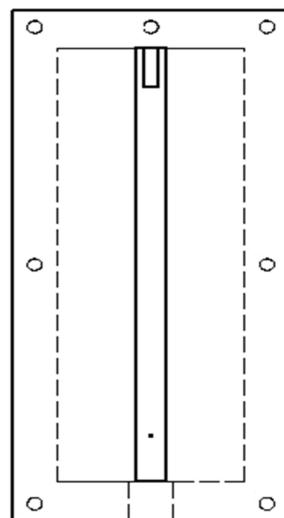


Figure 5

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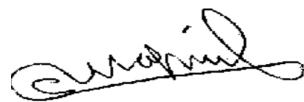
Figure 6

A handwritten signature in black ink, which appears to read "Swapnil".

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ABSTRACT

The present invention relates to a device to provide systems and methods for a device for the detection of the glaucoma by the screening based on applanation and indentation principles. Glaucoma is a disease mainly concerned with the damages of optic nerve which further results into the vision loss of a human eye. In early detection of glaucoma the increase in intraocular pressure (IOP) is the only risk factor, so accurate measurement of IOP become important in case of glaucoma. The methods and the devices those are used for the measurement of IOP are complex, needs expertise in the field and causing discomfort to the patient during measurement of IOP. The objective of developing a device is to find out directly the level of glaucoma in patient's eye instead of measuring the IOP. The device is simple and it can be used comfortably by putting its plunger on patient's eye with a closed eyelid. Following invention is described in detail with the help of Figure 1 of sheet 1 shows diagram for an isometric view of device for detecting glaucoma, Figure 2 of sheet 2 shows the sectional view of device for detecting glaucoma, Figure 3 of sheet 2 shows the complete plunger, Figure 4 of sheet 3 shows the displacement cylinder, Figure 5 of sheet 3 shows the outer cylinder and Figure 6 of sheet 4 shows the compression spring.



Adv. Swapnil Gawande (IN/PA/1587)