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(54) **Title:** ULTRASONIC METHOD AND DEVICE FOR REMOVING STAINS ON CLOTHES

(57) **Abstract:** The method comprises wetting the stained area of the clothes with water, applying detergent at the stained area of the clothes and applying ultrasonic vibrations at the stained area of the clothes at a frequency range of 48 to 52 kHz with simultaneous application of water. The device (1) comprises a housing (2) bifurcated into a top portion (3) and a base portion (4) by a stained cloth access slot (5) extending horizontally in the housing. A cloth rest (12) is located on the base portion exposed in the access slot. An ultrasonic horn (17) is located in the top portion with the lower end thereof extending into the access slot and disposed above the cloth rest. The top portion has a water flow passage (19) connected to a water supply at the inlet end thereof through an electrically operated valve (22) and opening to the cloth rest at the outlet end thereof. A cloth sensor (24, 25) is disposed for sensing presence of cloth in the access slot. A status indicator (28) is provided for indicating the operational status of the device. An ultrasonic generator (31) capable of generating ultrasonic vibrations in the frequency range of 48 - 52 kHz is connected to the ultrasonic horn through an ultrasonic drive (32). A controller (23) is connected to the ultrasonic generator, cloth sensor, electrically operated valve and status indicator. The ultrasonic drive is connected to the controller. An AC to DC converter (35) is connected to the controller, electrically operated valve, ultrasonic generator and ultrasonic drive (Figs 2 and 6).



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TITLE OF THE INVENTION

Ultrasonic method and device for removing stains on clothes

FIELD OF THE INVENTION

5 This invention relates to an ultrasonic method and device for removing stains on clothes.

BACKGROUND OF THE INVENTION

Stains formed on clothes by drinks like tea, coffee or wine or food items like curry or by articles like paint, grease or chemicals or by sweat over a period of use, especially at the collar, cuffs or armpit area of sleeves of shirts, spoil the look and appearance of the clothes. Washing of stained clothes in a cloth washing machine may not remove the stains from the clothes effectively. Stains are generally removed from clothes by applying water and detergent (including soap) at the affected area and rubbing or scrubbing the affected area with hand or with a cloth washing brush manually. This procedure is not only messy but also inconvenient and cumbersome to carry out. Besides, rubbing or scrubbing of stained areas of clothes may not effectively remove fast stains and rubbing and scrubbing with brush may damage the clothes at least over a period of time and reduce the life of the clothes.

Stain remover chemicals are available, but they may bleach and discolour the affected area and spoil the clothes. They may not be also effective on all stains. Another alternative for stain removal from clothes is dry cleaning which is not only expensive but may not be also very effective in removing certain stains. Unless the stains are effectively removed, stained clothes may become unfit and unsuitable for wearing and may be a monetary loss. There is thus need for devices and methods for removal of stains on clothes effectively, easily, conveniently and quickly in an effortless and user friendly manner without any damage to the clothes, especially as an accessory or add-on to a cloth washing machine.

DETAILED DESCRIPTION OF THE INVENTION

According to the invention there is provided an ultrasonic method for removing stains on clothes, comprising wetting the stained area of the clothes with water, applying detergent at the stained

area of the clothes and applying ultrasonic vibrations at the stained area of the clothes at a frequency range of 48 to 52 kHz with simultaneous application of water.

According to the invention there is also provided an ultrasonic device for removing stains on clothes, comprising a housing bifurcated into a top portion and a base portion by a stained cloth access slot extending horizontally in the housing, a cloth rest located on the base portion exposed in the access slot, an ultrasonic horn located in the top portion with the lower end thereof extending into the access slot and disposed above the cloth rest, the top portion having a water flow passage connected to a water supply at the inlet end thereof through an electrically operated valve and opening to the cloth rest at the outlet end thereof, a cloth sensor disposed for sensing presence of cloth in the access slot, a status indicator for indicating the operational status of the ultrasonic device, an ultrasonic generator capable of generating ultrasonic vibrations in the frequency range of 48 – 52 kHz connected to the ultrasonic horn through an ultrasonic drive, a controller connected to the ultrasonic generator, cloth sensor, electrically operated valve and status indicator, the ultrasonic drive being connected to the controller and a AC to DC converter connected to the controller, electrically operated valve, ultrasonic generator and ultrasonic drive.

DESCRIPTION OF ACCOMPANYING DRAWINGS

Fig 1 of the accompanying drawings is an isometric view of an ultrasonic device for removing stains on clothes according to an embodiment of the invention;

Fig 2 is a sectional view of the device of Fig 1;

Fig 3 is an exploded view of the housing of the device of Fig 1;

Fig 4 is an isometric view of the cloth rest of the device of Fig 1;

Fig 5 is a bottom view of the cloth rest of Fig 4;

Fig 6 is a block diagram of the electrical and electronic and ultrasonic components or features of the device of Fig 1;

Fig 7 is an isometric view of a top loading cloth washing machine;

Fig 8 is a scrap view at X of the inner wall of the washing machine of Fig 7; and

Fig 9 is an isometric view of the washing machine of Fig 7 having the ultrasonic device of Fig 1 fitted therein.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION IN THE DRAWINGS

The ultrasonic device 1 for removing stains on clothes as illustrated in Figs 1 to 6 of the accompanying drawings comprises a housing 2 bifurcated into a top portion 3 and a base portion 4 by a stained cloth access slot 5 extending horizontally in the housing (Figs 1, 2 and 3). The housing is, preferably, moulded plastics such as ABS (acrylonitrile butadiene styrene), HIPE (high impact polyethylene) or PE (polyethylene). The top portion is U-shaped having a bottom portion 6 and upright side walls 7,7 (Fig 3). 8 is a detachable L-shaped top closure extending over the top and front of the housing. 9 is a detachable back closure at the back of the top portion. 10 is a viewing window in the top closure consisting of a transparent portion. 11 is a stopper projection projecting laterally from the back closure. Both the top closure and back closure can be detachably fitted to the top portion using any known fitment arrangement, for instance, snap fit or push fit arrangement such as tongue or groove joints which are not illustrated in the drawings as they are not necessary for understanding the invention. However, the top closure and back closure also can be non-detachable.

12 is a cloth rest consisting of an elastomeric material pad 13 having bristle like projections 14 at the top thereof (Figs 1, 2, 4 and 5). The pad may be made of elastomeric material such as silicone. Cloth rest 12 has a recess 15 at the bottom thereof and the bottom portion of the housing has a protrusion 16 matching with the recess 15 underneath the cloth rest. Cloth rest 12 is disposed in the access slot 5 and located on the base portion with the recess underneath it engaged on the protrusion on the base portion. 17 is an ultrasonic horn located in the top portion

of the housing against lugs 18 in the top portion. The lower end of the ultrasonic horn extends into the access slot and is disposed above the cloth rest.

The top portion of the housing has a water flow passage 19 having inlet end 20 and an outlet end 21. The inlet end of the water flow passage is connected to a water supply (not shown) through an electrically operated valve 22. 20a is a hole in back closure 9 matching with inlet end 20 of water flow passage 19. The outlet end 21 of the water flow passage opens to the cloth rest. The electrically operated valve is, for instance, a solenoid operated valve. 23 is a controller connected to the electrically operated valve. 24 is an infrared transmitter located in the base portion exposed to the access slot. 25 is an infrared receiver located in the top portion and mounted to the ultrasonic horn with the help of bracket 26. The infrared receiver is exposed to and aligned with the infrared transmitter through an aperture 27. Controller 23 is connected to both the infrared transmitter 24 and infrared receiver 25 which together constitute a cloth sensor.

A LED 28 is located in the top portion of the housing and mounted to the ultrasonic horn with a bracket 29. 30 is a light guide disposed in the top portion of the housing and mounted to the inner surface of the top portion facing the LED. Window 10 in the top closure 8 of the top portion of the housing is aligned with the light guide and LED. Controller 23 is connected to the LED and to an ultrasonic generator 31 which in turn is connected to an ultrasonic drive 32. Ultrasonic drive is connected to the ultrasonic horn and also connected to the controller through feedback line 33. 34 is a groove in the top portion of the housing to accommodate the cable (not shown) connecting the ultrasonic drive to the ultrasonic horn. Inlet end 34a of the groove 34 matches with hole 34b in the back closure 9 of the housing. 35 is a AC to DC converter connected to the controller, electrically operated valve, ultrasonic generator and ultrasonic drive.

Ultrasonic device of the invention is advantageously used as an accessory or add-on to a cloth washing machine 36 as illustrated in Figs 7 to 9 of the accompanying drawings. The washing machine is a top loading machine which is generally double walled construction having an inner wall 37 and an outer wall 38 spaced part from each other defining a space 39 therebetween. The inner wall has an opening 40 therein. 41 and 42 are top lid and drum of the washing machine, respectively. The ultrasonic device is dimensioned and configured to retrofit at the back of the

washing machine in the space between the inner and outer walls through the opening in the inner wall. While locating the ultrasonic device in the space between the inner and outer walls through the opening in the inner wall, the back closure 9 of the device is disengaged from the top portion of the housing. The back closure 9 is reintroduced at the back of the ultrasonic device
5 after the back portion of the ultrasonic device is positioned in the space between the inner and outer walls of the washing machine. The stopper projection 11 projecting laterally from the back closure abuts the inner wall of the washing machine and prevents the ultrasonic device from disengaging from the space between the inner and outer walls of the washing machine.

10 43 is the control panel of the washing machine connected to the controller 23 through a switch 44 which is integrated into the control panel for ease and convenience of operation of the ultrasonic device. 45 is a AC to DC converter connected to the AC mains through switch 46. AC to DC converter 35 is connected to the AC mains through AC to DC converter 45 and switch 46. Prior to selecting the washing cycle and operating the washing machine with the
15 control panel 43, switches 44 and 46 are switched on to turn on the ultrasonic device. DC power flows to the controller 23, ultrasonic generator 31 and ultrasonic drive 32. Infrared transmitter 24 starts transmitting infrared light and the infrared receiver 25 starts receiving the infrared light. Controller 23 senses the receipt of infrared light by the infrared receiver. Stained area of the clothes (not shown) from which stains are to be removed is wetted with water and a detergent is
20 applied at the stained area of the cloth. Stained area of the clothes wetted with water and applied with detergent is then introduced in the access slot 5 and rested on the cloth rest 12. Presence of cloth on the cloth rest in the access slot obstructs infrared light transmitted by the infrared transmitter and the infrared receiver stops receiving infrared light.

25 The controller senses the non receipt of infrared light by the infrared receiver and activates the ultrasonic generator 31. The ultrasonic generator generates ultrasonic vibrations in the frequency range of 48 to 52 kHz and transmits the same to the ultrasonic drive which in turn transmits the ultrasonic vibrations to the stained area of the clothes through the ultrasonic horn. Simultaneously the controller 23 opens the electrically operated valve 22 to allow water to flow
30 from the water supply onto the stained area of the clothes via the water flow passage 19 and the

outlet 21 thereof. The controller continuously takes feed back from the ultrasonic drive via feed back line 33 and continues to operate the ultrasonic generator in the above frequency range.

Under the impact of the ultrasonic vibrations, detergent applied on the stained area of the clothes mixed with water droplets form minuscule detergent bubbles and implode and penetrate into the stained area of the clothes at minuscule level to dislodge the stain particles at the stained area of the clothes very effectively and efficiently. The device is very easy and convenient to operate and user friendly. It is very compact and ergonomically designed and can be easily accommodated and retrofitted as an accessory or add-on to a cloth washing machine. Water and detergent required for stain removal is minimal. It avoids manual scrubbing and damage to the clothes. It also avoids stain remover chemicals and dry cleaning. It does not damage the stained clothes while removing stains and therefore increases the fabric life. Clothes free from stains are put in the washing machine and washed in the washing machine by operating the washing machine with the control panel 43 in the usual manner.

During operation of the ultrasonic device, the controller 23 operates the LED 28 and the LED glows. The glow of the LED is visible through the viewing window 10 thereby indicating the operational status of the ultrasonic device. The light guide 30 associated with the LED helps to focus and magnify the intensity of the glow effect. The status indicator can be of a different construction and configuration. However, the status indicator is optional. The ultrasonic vibrations in the frequency range of 48 to 52 kHz are found to be sufficient to implode and penetrate into the stained area of the clothes and dislodge the stained particles. However, the frequency range of the ultrasonic vibrations can be different. The housing can be of a different configuration and construction. Instead of the stopper projection 11 projecting laterally from the back closure of the housing, other stopper means can be provided to prevent the ultrasonic device from getting disengaged from the inner wall of the washing machine.

The space between the inner and outer walls of the washing machine and the opening in the inner wall of the washing machine are generally available in a top loading washing machine and provide provision for retrofit of the ultrasonic device in an existing top loading washing machine without any alterations to the washing machine. Instead of infrared transmitter and infrared

receiver, the cloth sensor can be of different configuration and construction. The bristle like projections 14 at the top surface of the elastomeric material pad provide a smooth and soft surface for the stained area of the clothes and prevent damage to the clothes. Variations in the embodiment of the invention described above, as an illustrative example of the invention, which are obvious to a person skilled in the art are to be construed and understood to be within the scope of the invention.

Claims:

1. An ultrasonic method for removing stains on clothes, comprising :
wetting the stained area of the clothes with water, applying detergent at the stained area of the clothes and applying ultrasonic vibrations at the stained area of the clothes at a frequency range
5 of 48 to 52 kHz with simultaneous application of water.
2. An ultrasonic device for removing stains on clothes, comprising a housing bifurcated into a top portion and a base portion by a stained cloth access slot extending horizontally in the housing, a cloth rest located on the base portion exposed in the access slot, an ultrasonic horn
10 located in the top portion with the lower end thereof extending into the access slot and disposed above the cloth rest, the top portion having a water flow passage connected to a water supply at the inlet end thereof through an electrically operated valve and opening to the cloth rest at the outlet end thereof, a cloth sensor disposed for sensing presence of cloth in the access slot, a status indicator for indicating the operational status of the ultrasonic device, an ultrasonic
15 generator capable of generating ultrasonic vibrations in the frequency range of 48 – 52 kHz connected to the ultrasonic horn through an ultrasonic drive, a controller connected to the ultrasonic generator, cloth sensor, electrically operated valve and status indicator, the ultrasonic drive being connected to the controller and a AC to DC converter connected to the controller, electrically operated valve, ultrasonic generator and ultrasonic drive.
20
3. The ultrasonic device as claimed in claim 2, wherein the housing is molded plastics and the top portion is U-shaped having a detachable L-shaped top closure extending over the top and front end thereof and a detachable back closure at the back thereof, the top closure having a viewing window.
25
4. The ultrasonic device as claimed in claim 3, wherein the back closure consists of a stopper projection projecting laterally therefrom.
5. The ultrasonic device as claimed in claim 2, wherein the status indicator consists of a
30 LED with a light guide located in the top portion of the housing.

6. The ultrasonic device as claimed in claim 2, wherein the cloth sensor consists of an infrared transmitter located in the base portion exposed to the access slot and an infrared receiver located in the top portion exposed to and aligned with the infrared transmitter through an aperture.

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7. The ultrasonic device as claimed in claim 2, wherein the bottom portion consists of a protrusion and the cloth rest consists of an elastomeric material pad having bristle like projection at the top surface thereof and a socket at the bottom thereof dimensioned to press fit over the protrusion.

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8. The ultrasonic device as claimed in claim 2, wherein the electrically operated valve is a solenoid operated valve.

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9. A cloth washing machine comprising the ultrasonic device as claimed in anyone of claims 2 to 8 mounted thereto.

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10. The cloth washing machine as claimed in claim 9, which is a top loading washing machine of double walled construction having an inner wall and an outer wall spaced apart from each other, the inner wall at the back having an opening, wherein the ultrasonic device is dimensioned and configured to retrofit at the back of the washing machine in the space between the inner and outer walls through the opening in the inner wall.

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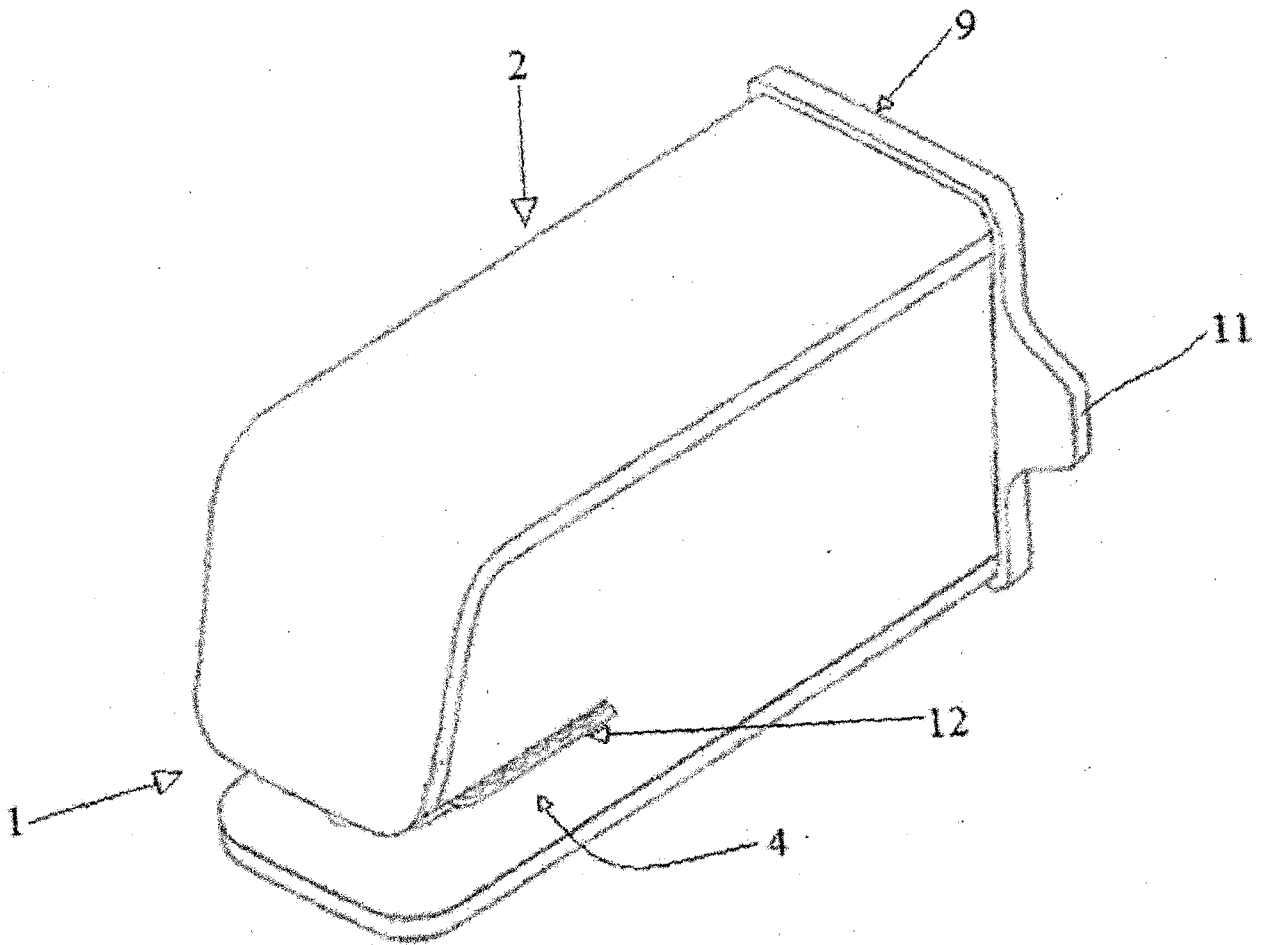


Fig 1

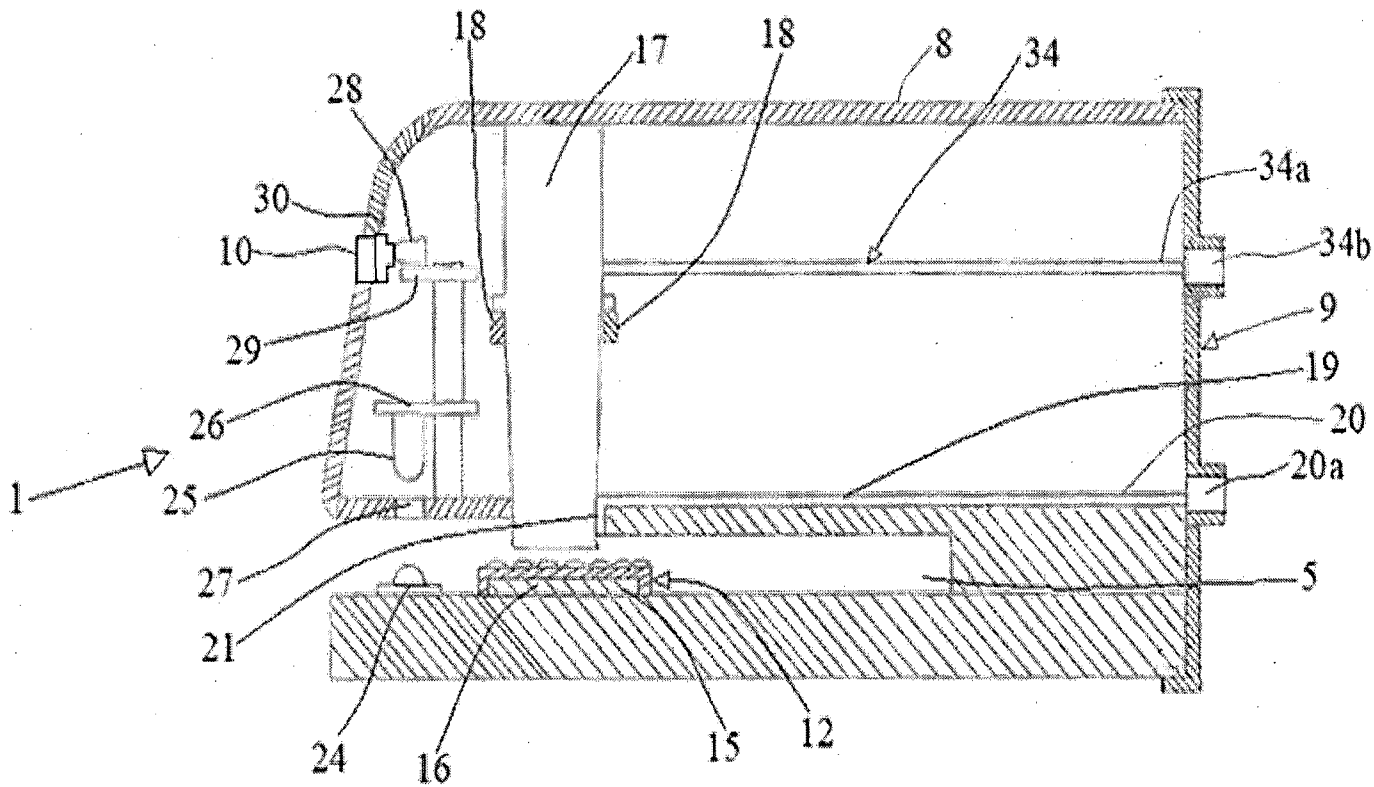


Fig 2

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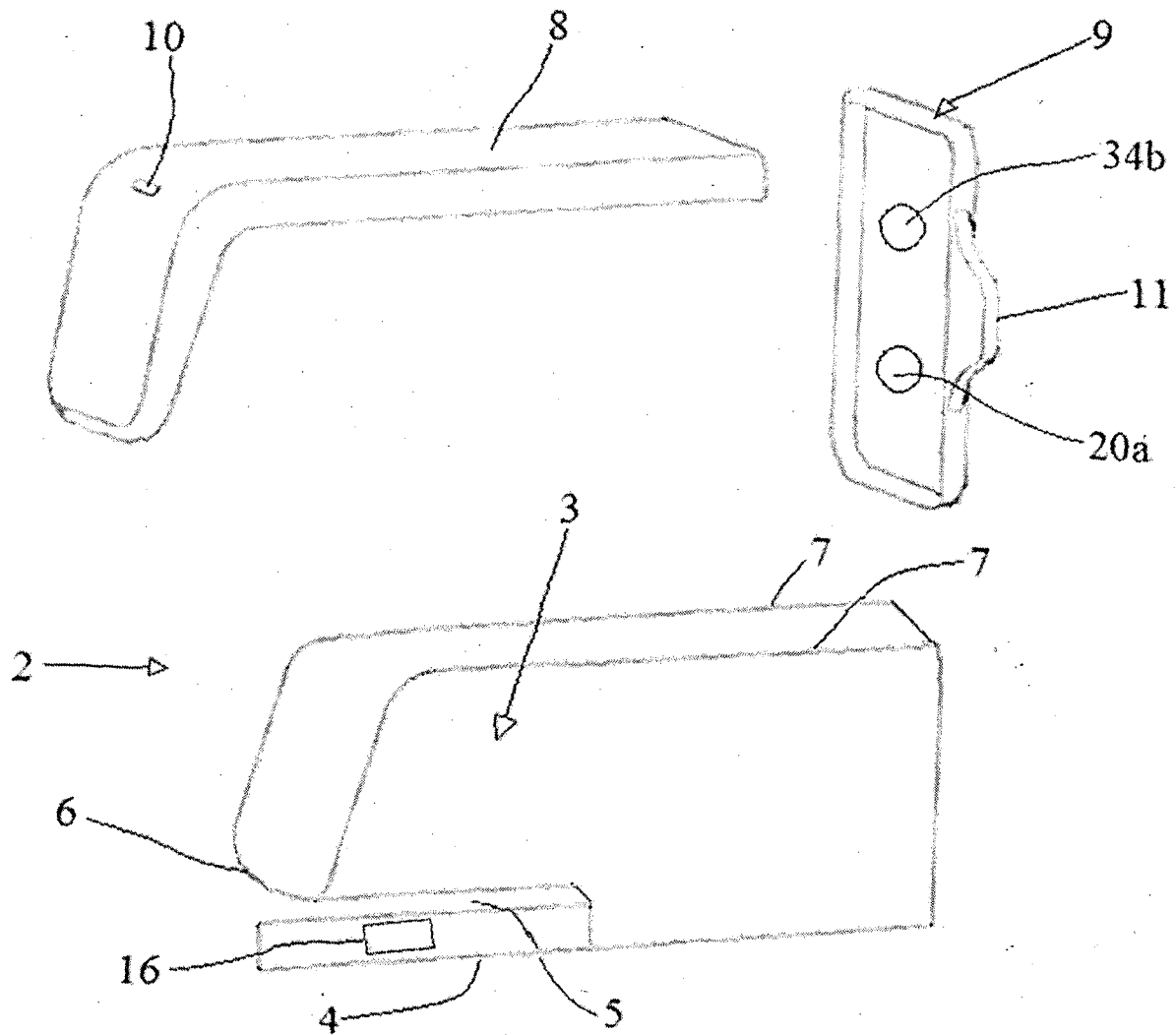


Fig 3

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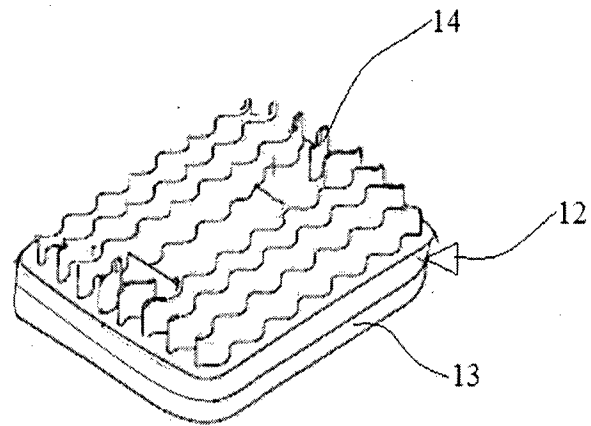


Fig 4

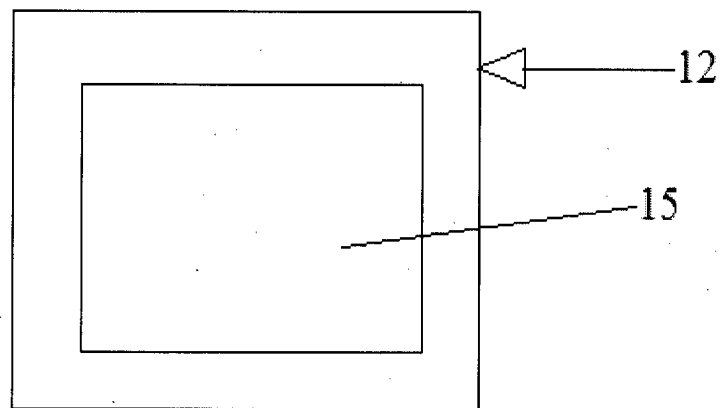


Fig 5

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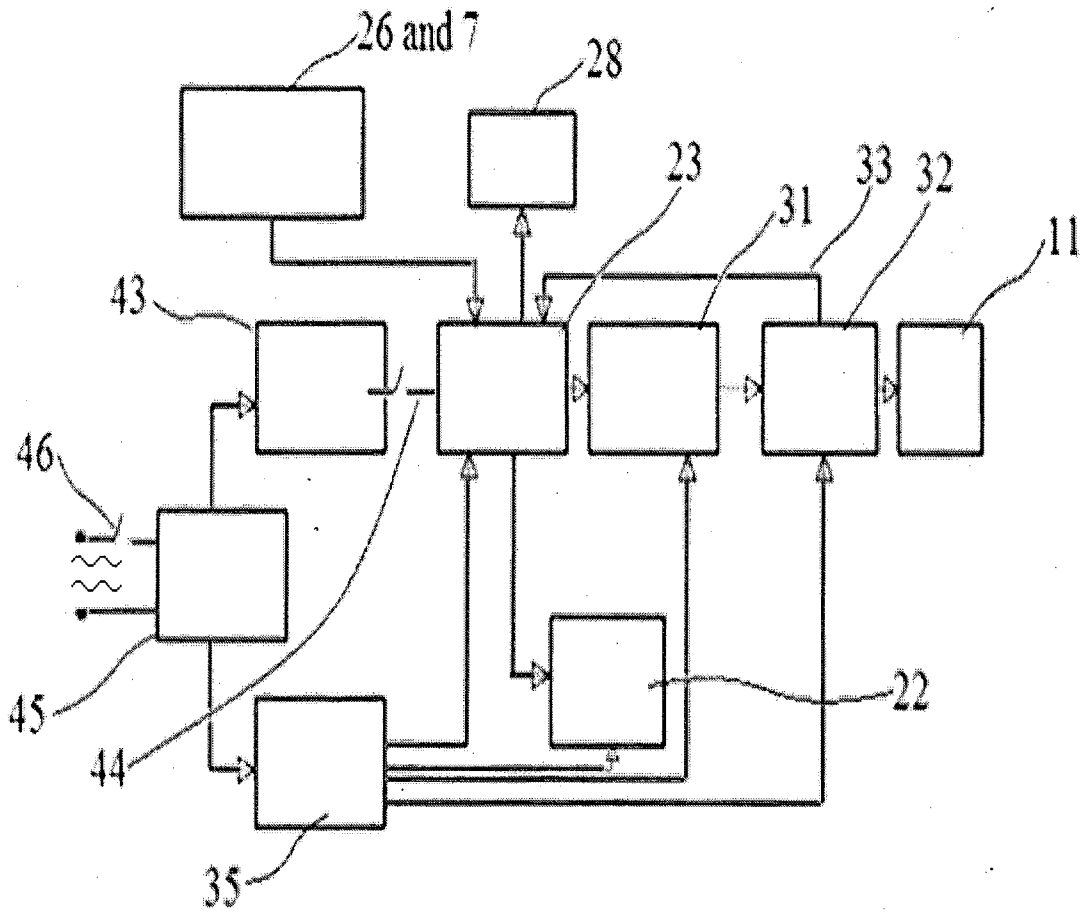


Fig 6

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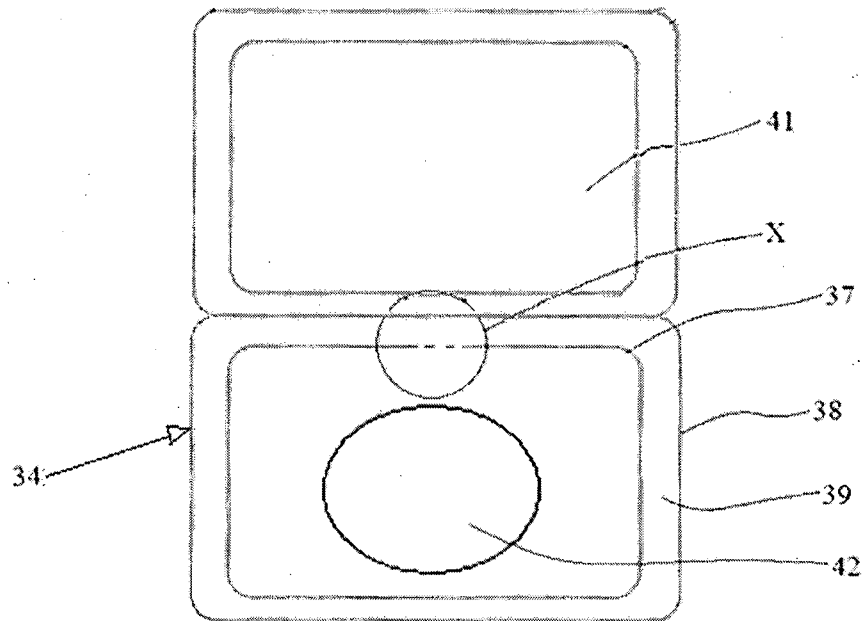


Fig 7

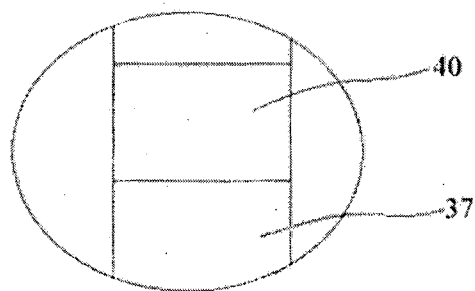


Fig 8

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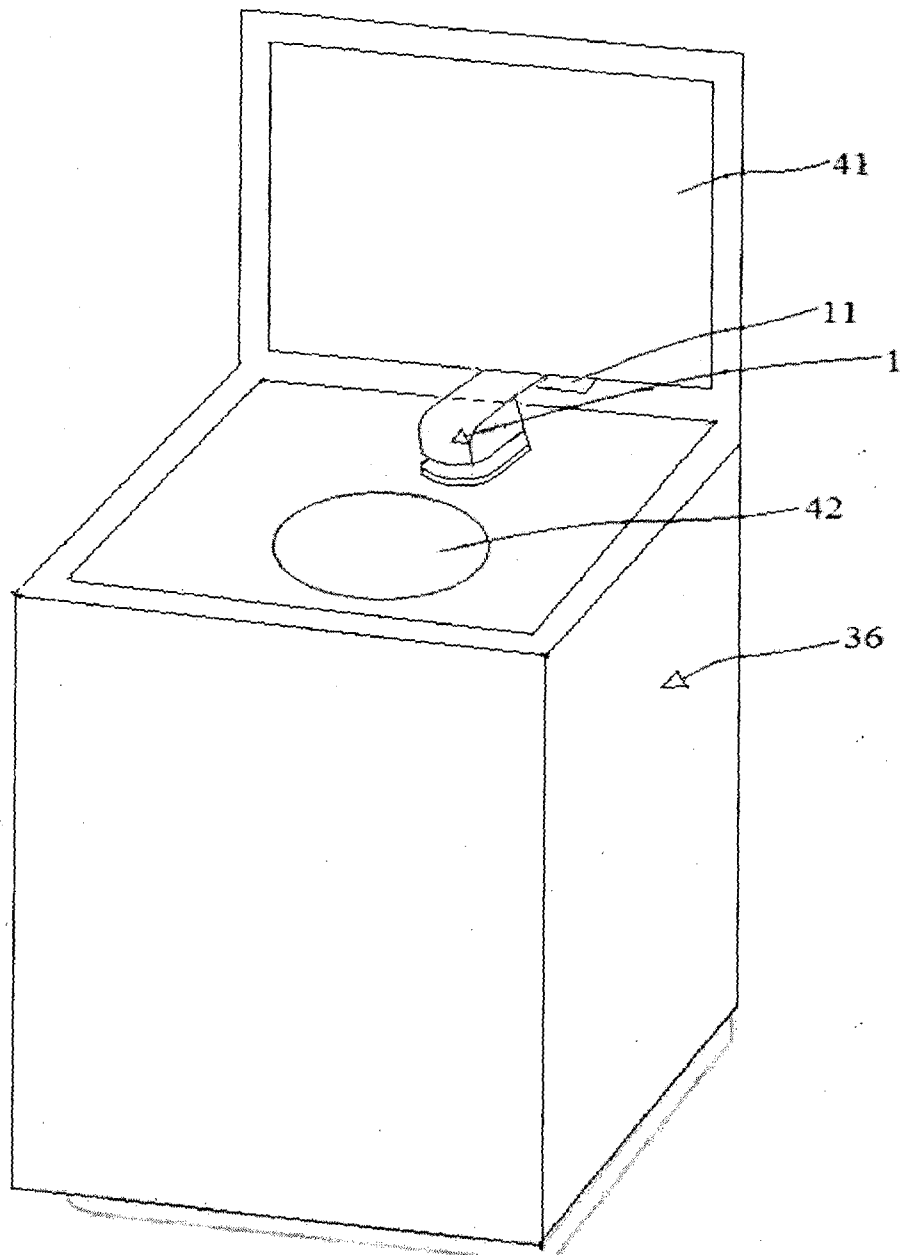


Fig 9