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(54) **Producing an animated image.**

(57) A deformable screen (1), e.g. of foam rubber, bears an image surface (3), e.g. a white plastics sheet bonded to it. A TV camera (71) views the image surface (3). A character (11) may be drawn on the image surface (3). An operator can deform the image surface and so animate the image produced by the camera.

A slit (5) in the image surface (3) is fitted with a mitten (9) extending through a hole (7) in the screen. By manipulation of the mitten (9) in the manner of a glove puppet, the slit (5) can act as a mouth for the drawn character (11).

Apparent eyeball movement can be provided by mounting elements (13) for the pupils spaced in front of the image surface (3) so that sideways movement of the image surface (3) relative to the camera (71) results in apparent movement of the pupils relative to the drawn character (11) as seen from the camera (71).

The screen (1) may be movably mounted in a surround unit (37) which provides an independent light environment for the image surface (3).

The camera (71) may be a black-and-white one, and its output combined with output from a colour camera to give a colour image signal.

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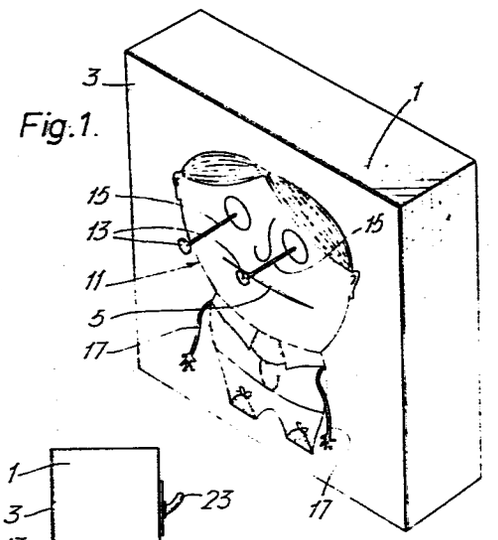


Fig.1.

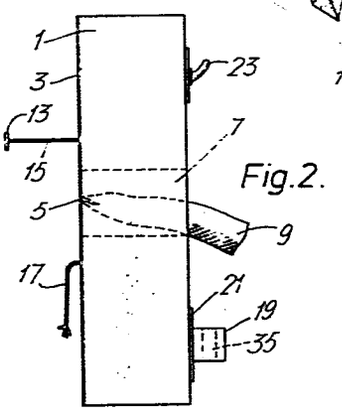


Fig.2.

"Producing An Animated Image".

The present invention relates to a method and apparatus for producing an animated image. It has particular, but not exclusive, application in the production of a television picture showing an animated image which is animated in real time, i.e. the image is animated substantially at the same speed as it is shown. One advantage of real time animation is that it can be done "live", i.e. at the same moment as the image is shown, and therefore the image can respond to a live audience.

UK Patent Specifications 1,511,875 and 946,294 describe a real time animation system in which a cartoon style line drawing is animated. The system works by providing a cut-out of deformable material mounted in front of a visually contrasting screen. The image is produced by viewing the screen with a TV camera. In order to animate the cut-out it is deformed by the movement of a number of rods connected to it. The rods do not contrast visually with the screen and so do not appear in the animated image.

This known system has a number of drawbacks. First, each character to be animated has to be created as a cut-out. This is a somewhat laborious operation. It

also means that the features of a character are not easily altered. Second, it is not easy to manipulate the cut-out via the rods, so that the system requires a trained operator.

The present invention provides a relatively simple and easy to operate system. In one aspect it provides apparatus for producing an animated image, comprising a deformable screen, an image surface, on which an image may be drawn in use, on the screen and deformable with it, a camera disposed in use to view the image surface, and means to deform the image surface and means to move the image surface relative to the camera whereby the appearance to the camera of an image drawn on the image surface may be deformed and/or moved by an operator, the apparatus further having either means to store or means to display the output of the camera, or both.

In another aspect the present invention provides a method of using the apparatus to produce an animated image in which an image is drawn on the image surface and the camera is disposed to view the image surface, and then the image surface is deformed and/or moved by operation of the said means so as to deform and/or move the appearance of the image to the camera, the output of the camera being either stored or displayed, or both.

Normally the camera will be a television camera. The camera output may be processed before it is stored or displayed, e.g. to combine it with another image or to effect colour mixing or matting.

If the material of the image surface and the means used to draw the image are selected appropriately, it can be quick and easy to remove and re-draw a part of the image. For instance, the image may be drawn using felt tip pens with water-soluble ink. The deformable screen may be a block of foam rubber or the like and the image surface may be provided by a sheet of polyurethane or the like, possibly laminated to a backing material such as cotton, mounted on the block so as to be taut when the block is not deformed.

It may be advantageous to have a slit cut in the image surface, with a hole in the screen behind the slit and a mitten fitted to the back of the image surface and extending in or through the hole in the screen. The mitten can be operated as a glove puppet, opening, closing and shaping the slit and deforming the screen. This provides a mouth for a character drawn on the image surface. It is useful to provide elastic finger and thumb grips inside the mitten to improve the operator's control of the movement of the mitten and the "mouth".

The portion of the screen around the slit will be

deformed when the slit is opened, so that as the mouth of the drawn character moves, adjacent features move slightly as well. This enables a high degree of realism and expression to be produced.

Relative movement between adjacent features, e.g. movement of the pupils of the eyes, can be created by mounting the feature to be moved (e.g. pupils) in front of the plane of the image surface, using rods or stalks. Because this feature is nearer to the camera than the drawn image, if the screen is moved sideways or is rotated this feature will appear to the camera to move more than the rest.

Features mounted in front of the plane of the image surface can also be made to disappear under some circumstances. If the illumination level of the surface is controllable, then it is possible to vary the depth of field of the camera focus while maintaining a constant exposure level. If the depth of field is reduced so that the camera views these features substantially out of focus, a black feature will be seen as grey by the camera. If the camera output is processed using a colour key system, grey areas can be made to disappear.

If desired, movable limbs may be provided by fixing movable elements to the image surface. Alternatively, the material of the deformable screen can

be hollowed out behind the portions where the limbs are to be drawn and control rods or wires attached to the back of the image surface at these positions. These parts of the image surface can then be pushed out from the surface plane or pulled back into the hollow. As the surface is pulled back into the hollow the limb drawn on it appears to the camera to get smaller, and thus to a viewer the limb appears to move away. The camera depth of field can be used to make such limbs, or other features drawn in these positions, disappear by the mechanism described above. This method only permits a small degree of movement. However, the amount of movement obtainable can be considerably increased if the image surface is cut around these limbs or features to facilitate the movements. The limbs or features can be made to disappear by pulling them right into the hollow, out of the camera's line of sight. If the image surface is cut, the hollowed out surface of the screen should match the colour of the image surface, so that it does not show on the final displayed image.

The apparent size and position of the image can be altered by changing the focal length of the camera lens and changing slightly the direction in which the camera faces, respectively.

The apparatus will normally include a surround

unit in which the screen will be movably mounted in use. The unit will have means, such as an opening, to allow access by the operator to the back of the screen. The unit can extend around the screen so as to bear lamps, so that the illumination of the screen is independent of the illumination of the surroundings of the unit.

A monitor screen may be provided so that the operator can see the animated image as viewed by the camera or as displayed or stored. Means, such as another camera or a pre-recorded tape or the like, can be used to provide a background for the viewed image or to provide captions.

If the camera output is being displayed live but remotely from the apparatus, a TV camera and monitor system may be provided so that the operator can monitor the live audience.

A sound system, using a microphone and/or a pre-recorded tape or the like may also be provided.

Embodiments of the present invention, given by way of example, will now be described with reference to the accompanying drawings, in which:

Figure 1 is a view of a deformable screen for use in an embodiment of the present invention, showing the image surface on the front of the screen;

Figure 2 is a side view of the screen of Figure

1;

Figure 3 is a view of the screen of Figure 1, showing its back;

Figure 4 shows a mounting element for mounting the screen of Figures 1 to 3 in a surround unit;

Fiugre 5 is a view of a first embodiment of a surround unit, showing the back and one side;

Figure 6 is a view of showing one side of the unit of Figure 5;

Figure 7 shows a portion of the back of the unit of Figure 5 as seen from inside the unit;

Figure 8 is a view from behind of a second embodiment of a surround unit;

Figure 9 is a view from one side of the unit of Figure 8;

Figure 10 is a view from in front of the unit of Figure 8.

Referring to Figures 1 to 3, a deformable screen 1 is made essentially of a block of foam rubber or the like. On its front, this screen bears an image surface 3, which is provided by a sheet of a white plastics material such as polyurethane, laminated to a cotton backing. In the absence of external influences the foam rubber block holds the image surface 3 taut.

A horizontal slit 5 has been cut in the image

surface 3, and behind the slit 5 there is a hole 7 through the screen 1. A mitten or sock 9 is attached to the back of the image surface 3 around the slit 5. The hole 7 provides access to the slit 5 from the back of the screen, and by means of the mitten or sock 9 the slit can be opened, shaped, and closed by manipulations similar to those used with a mitten or sock style of glove puppet.

To manufacture the screen, the slit is first cut in the laminate. Then a closed mitten end is attached to the back of the laminate around the slit. Next a mitten sleeve is attached to the back of the laminate around the mitten end. Lastly the foam block is covered with adhesive and the laminated sheet stretched over and mounted on it.

A cartoon character 11 has been drawn on the image surface 3, using the slit 5 to represent the mouth of the character. The character 11 can be drawn e.g. by the use of felt tipped pens. If pens having water soluble ink are used, the character can be erased and redrawn partially or wholly.

The pupils of the character's eyes are provided by small black discs 13 (or pieces of any other desired shape) mounted somewhat in front of the image surface 3 by means of stalks 15. This enables the simulation of eye-ball movement in the manner described above.

The arms 17 of the character have been provided by separate elements mounted on the image surface, so that they can be made movable relative to the rest of the character 11.

Opening and shaping the mouth slit 5 will distort the adjacent portion of the image surface 3, and to some extent the portion of screen 1 around the hole 7. This means that the shape of the character's face alters, simulating the way in which facial appearance changes with movement of the mouth in real life.

At the back of the screen 1, near the bottom, there is a mounting block 19 fixed to the screen via a board 21. This is used to mount the screen 1 in a surround unit. The block 19 is, e.g. a 3cm cube.

At the back of the screen 1 near the top there is a handle 23. This enables an operator to move the screen 1, and also to distort it e.g. by bending the top of the screen backwards or forwards. This distortion has the effect that the character 11 appears to look up or down, respectively, with appropriate eyeball movement.

Figure 4 shows a mounting element 25 for the screen 1. This element has two angle pieces 27, 29, fitted into opposite ends of a sleeve 31. The angle pieces 27, 29 are held in the sleeve 31, e.g. by grub screws 33 or by winged screws. In use, a first angle

piece 27 points generally upwardly while the second angle piece 29 points downwards. The second angle piece 29 is received in a bracket in the inside of a surround unit. The first angle piece 27 is received in a hole 35 extending through the mounting block 19 of the screen 1.

Figures 5 to 7 show a surround unit 37 in which the screen 1 is mounted in use. It is essentially a three-sided box, open at the front. Dashed lines 39 indicate hinges so that the sides 41 can be folded across the back 43 when the unit 37 is not in use. As shown, the unit 37 is free standing, but a table-top version could be provided, which would comprise only the portion of the unit above dashed line 45.

The mounting element 25 for the screen 1 fits into a bracket 47 on the inside of the back 43 of the unit 37 (Figure 7). Immediately above the bracket 47 there is an opening 49 in the back 43 which allows an operator sitting behind the unit access to the back of the screen 1.

The sides 41 of the unit 37 carry fittings 51 for lights to be mounted inside the unit to illuminate the image surface of the screen. Preferably the lights are independently variable in intensity, so that they can be adjusted to provide even and balanced illumination of the image surface. Illumination intensity may also be used

to allow the depth of field to be varied as described above.

A camera is disposed in front of the unit 37, and is arranged to view the image surface. It will normally be a black-and-white TV camera. A second, colour, camera can be used to provide a background scene for the image output from the first camera, or to provide a reference colour signal. It can be convenient to locate this second camera inside the unit 37 at the bottom, pointing upwards, and a top can be fitted to the unit which can include a mount for background pictures.

When the screen 1 is mounted in the unit 37 by means of the element 25, the screen can be turned horizontally about either angle-piece 27, 29. Rotation of the element 25 about both angle pieces 27, 29 simultaneously allow the screen a degree of non-rotational sideways movement. If the angle pieces 27, 29 are permitted to rotate relative to each other in the sleeve, e.g. by loosening a grub-screw 33, the screen 1 can be rotated about the axis of the sleeve.

Figures 8 to 10 show a second embodiment of the surround unit 37. This has a top portion 53 which closes the unit at the top and provides a support for the accompanying electronics. Figure 8 shows the top portion 53 bearing two vision mixers 55, 57, two television

monitors 59, 61 and a sound mixer 63, which form part of a system for displaying the animated image to a remote live audience, using three TV cameras. (In Figure 9 the electronics are not shown except for one TV monitor 61.) The bottom surface of the top portion 53, which is an inside surface of the unit, is white. The other surfaces may be, e.g., black.

The unit 37 also has a base portion 65. This provides a support for the unit 37 as a whole, in use. When the unit is disassembled and packed for transportation, the base portion 65 can be used to house some or all of the electronics disposed on the top portion 53 in use. The top portion 53 may also be housed in, or alternatively may close, the base portion 65. The base portion 65 has a handle 67 by which it can be carried. Analogously with the top portion, the top surface of the base portion 65 is white, while its remaining surfaces may be, e.g., black.

A central portion 69 of the unit 37 provides the back 43 and sides 41, and carries the screen 1 and the lights, as described above with reference to Figures 5 to 7. In use this portion is roughly a two foot cube, and can be folded up into a two foot square about four inches deep.

In use of this system, the animated image is

displayed to a remote audience by a TV screen. The audience is monitored by a television camera the output of which is displayed on a first monitor 59, for the benefit of the operator. A two-way sound system allows the operator to listen to the audience and to speak to them in the persona of the cartoon character 11 and/or to play them pre-recorded sounds. In this way the illusion can be created that the animated character seen by the audience can see and hear them, and reply to them.

A black-and-white TV camera 71 views the image surface 3 of the deformable screen 1. A third TV camera, not shown in the drawings, which is a colour camera, provides a background scene, captions for the displayed image or (as will be assumed in the following discussion) a colour reference signal. The outputs from both the black-and-white camera 71 and the third camera (colour) are fed to a first mixer 55. This mixer removes the half-tones from the black-and-white signal and combines it with the colour signal to output a two-colour signal. The output from the first mixer 55 is fed to the second mixer 57.

The second mixer 57 also receives the output signal of the black-and-white camera 71. This mixer is used to add a third colour to the output of the first mixer, in response to the half-tones in the black-and-

white signal. In this way, the displayed animated image of the cartoon character can have two colours in addition to the colour of the background. To obtain this effect the character 11 should be drawn in two colours, e.g. black and grey or black and blue, on the white image surface 3. Of course, the three colours of the output image can be selected at the choice of the operator and need bear no relation to the colours of the character 11 and the image surface 3.

The output of the second vision mixer 57 is fed to the display screen watched by the audience, and also to the second monitor 61 for the benefit of the operator.

The displayed image can be altered by the use of effects and appropriate generating equipment in manners which will be apparent to those skilled in the use of video equipment.

As an alternative to the camera system described above, the character 11 could be drawn in full colour and the image surface 3 viewed by a colour camera. In this case, captions or background scenes can be added using the Chromakey process (some details of this process are given in UK 1,511,875). The image surface would in this case normally be the blue tone used as neutral in the Chromakey process.

CLAIMS.

1. Apparatus for producing an animated image, comprising means to present an image to a camera, a camera disposed in use to view the image presented by the said means, and either means to store or means to display the output of the camera, or both, characterised in that the means to present an image to the camera comprises a deformable screen (1), an image surface (3) on the screen and deformable with it, on which image surface an image (11) may be drawn in use, the camera (71) being disposed in use to view the image surface (3), and means (23, 9) to deform the image surface and means (23, 9) to move the image surface (3) relative to the camera (71) whereby the appearance to the camera of an image (11) drawn on the image surface may be deformed and/or moved by an operator.

2. Apparatus according to claim 1 in which the camera is a TV camera.

3. Apparatus according to claim 2 in which the output of the camera is subjected to further processing before it is stored or displayed.

4. Apparatus according to claim 3 in which the said camera (71) is a black-and-white camera, and which includes a second, colour, TV camera, the said further processing comprising modifying the output of the black-

and-white camera (71) in view of the output of the colour camera to provide output corresponding to a coloured picture when displayed.

5. Apparatus according to any one of the preceding claims in which the screen (1) is substantially made of an elastomeric foam material.

6. Apparatus according to any one of the preceding claims in which the image surface (3) is provided by a sheet of plastics material bonded to the main body of the screen (1).

7. Apparatus according to claim 6 in which the sheet of plastics material is laminated with a fibrous backing material.

8. Apparatus according to any one of the preceding claims in which the means for deforming the image surface comprise a handle (23) on the screen (1) but not on the image surface (3), operable to deform the screen and thus deform the image surface.

9. Apparatus according to any one of the preceding claims in which the image surface (3) has a slit (5) in it and the screen (1) has a hole (7) through it behind the slit (5), allowing access to the slit, the means to deform the image surface comprising a manually operable means (9) to open and shape the slit.

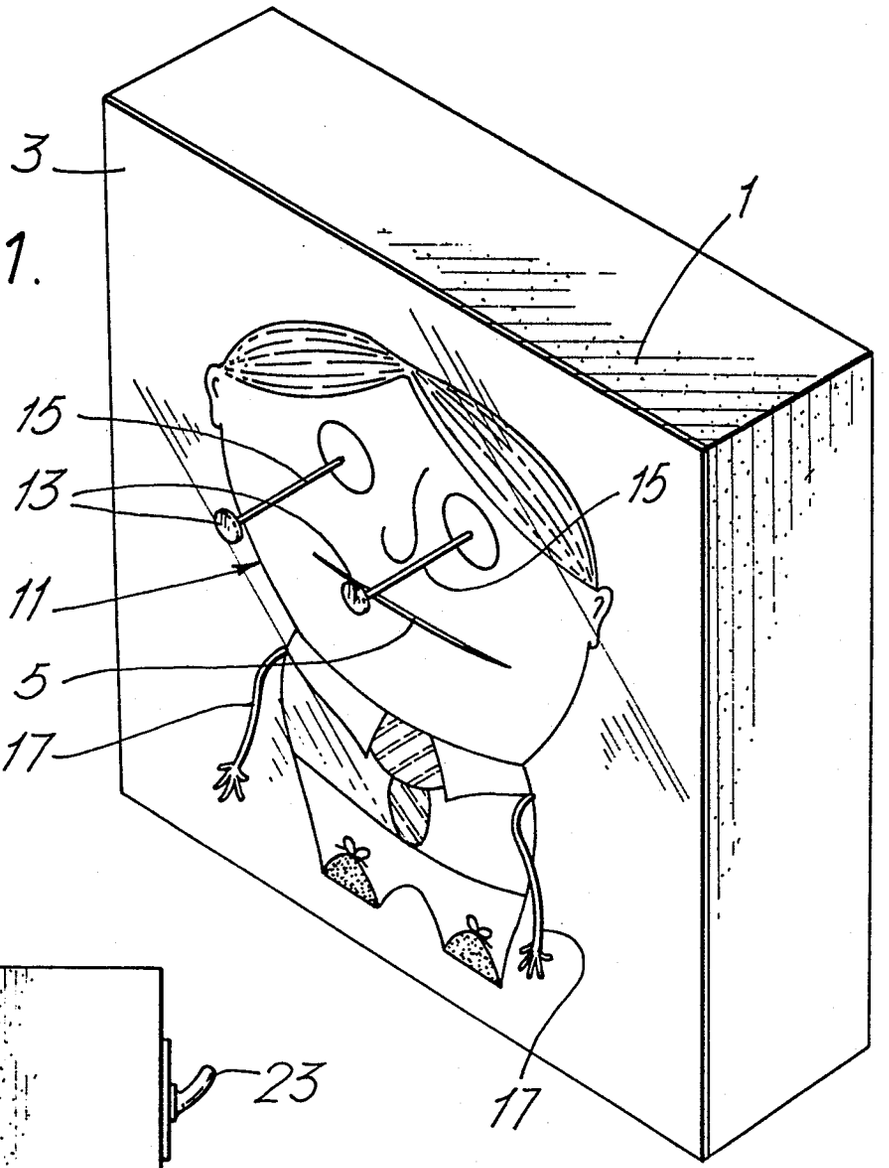
10. Apparatus according to any one of the preceding

claims in which an element (13) is mounted on the image surface (3) spaced away from the image surface towards the camera, whereby movement of the image surface in its plane creates an apparent movement of the element (13) relative to an image (11) drawn on the image surface as viewed by the camera.

11. Apparatus according to any one of the preceding claims in which the screen (1) is movably mounted in a surround unit (37), the unit having an opening (49) behind the screen (as viewed from the camera) to allow access to the screen by an operator, and the unit having means (51) to illuminate the image surface.

12. A method of using the apparatus of any one of the preceding claims to produce an animated image in which an image (11) is drawn on the image surface (3) and the camera (71) is disposed to view the image surface (3), and then the image surface is deformed and/or moved by operation of the said means (9, 23) so as to deform and/or move the appearance of the image to the camera, the output of the camera being either stored or displayed, or both.

Fig.1.



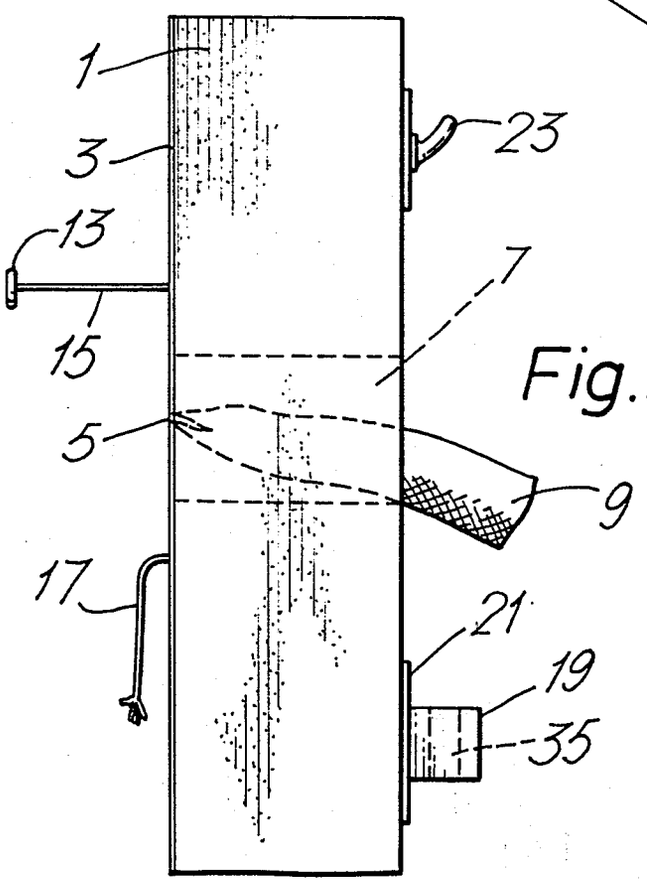


Fig.2.

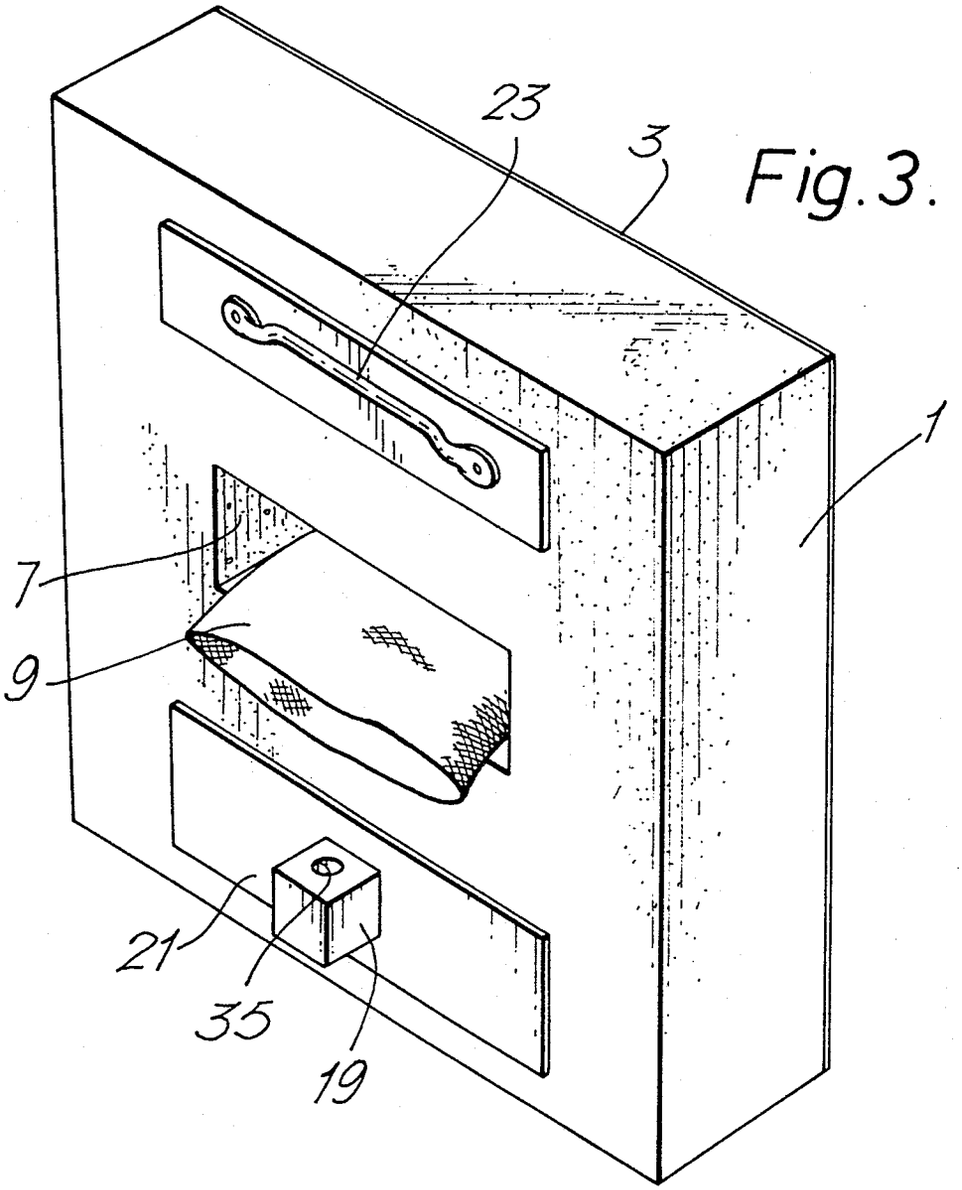


Fig.3.

Fig.4.

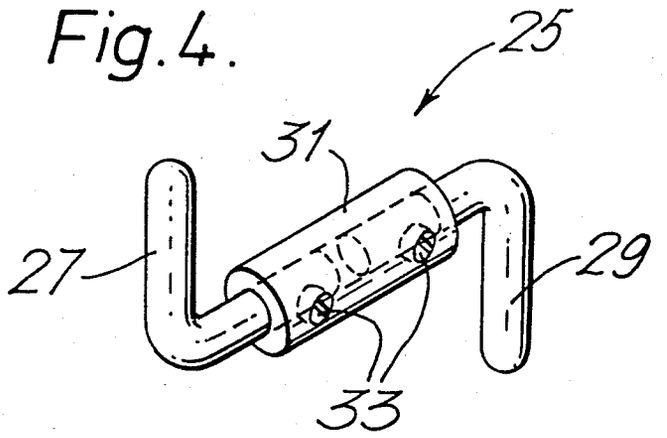
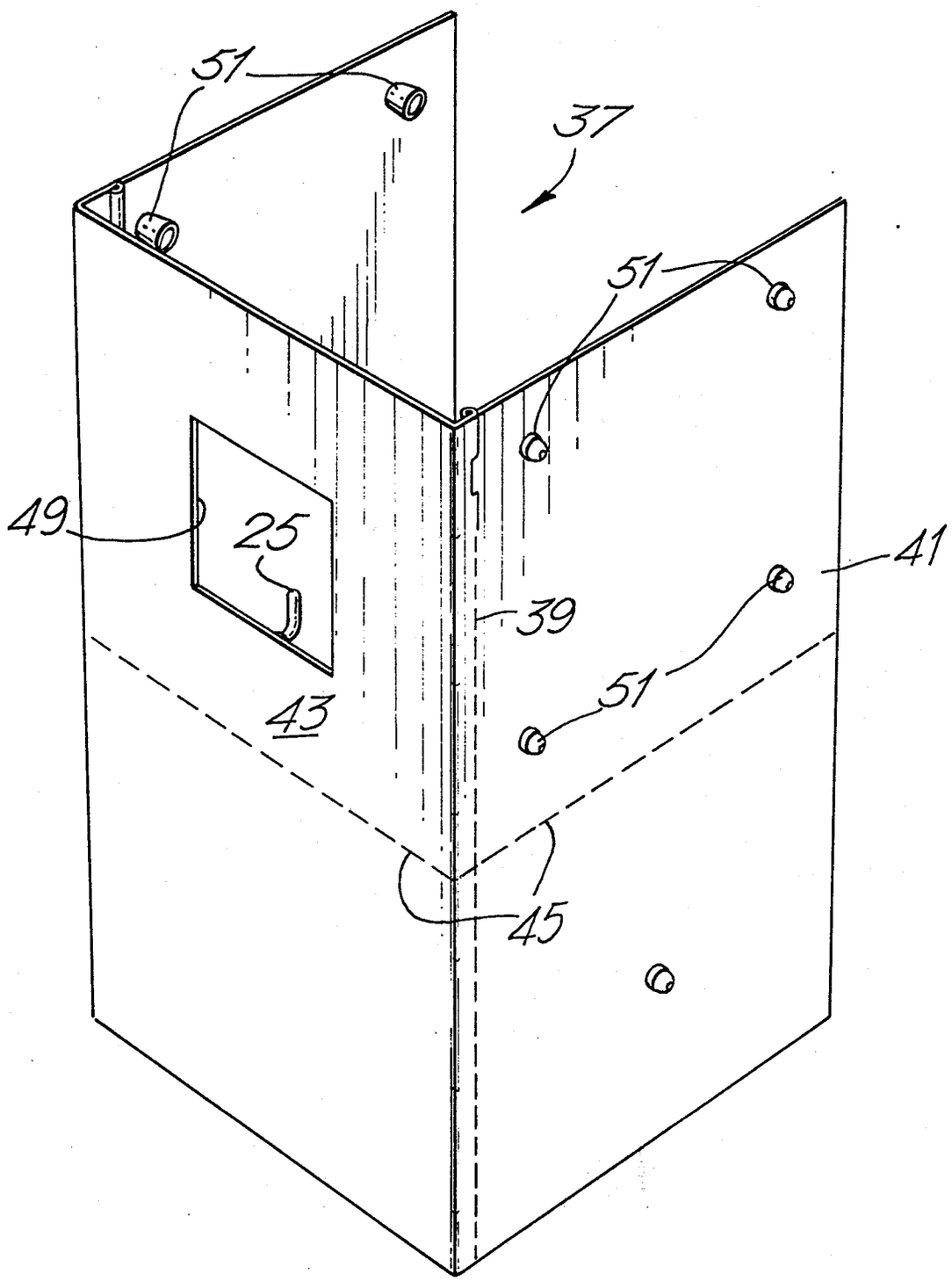


Fig.5.



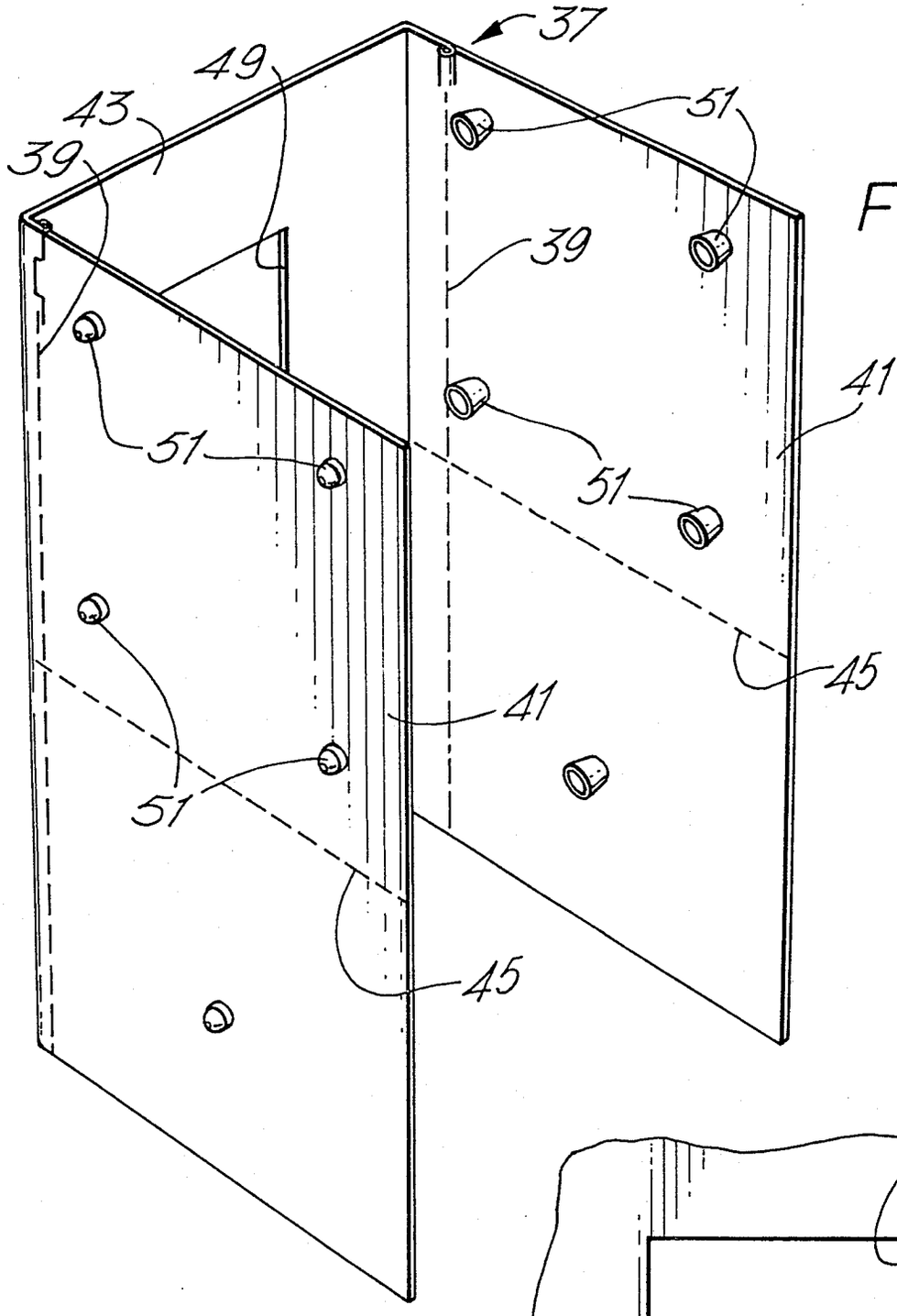


Fig.6.

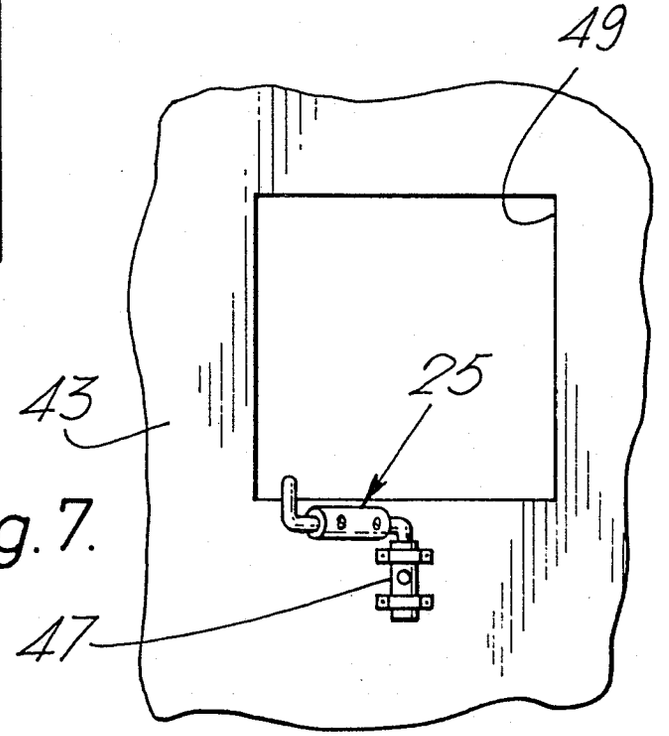


Fig.7.

Fig. 8.

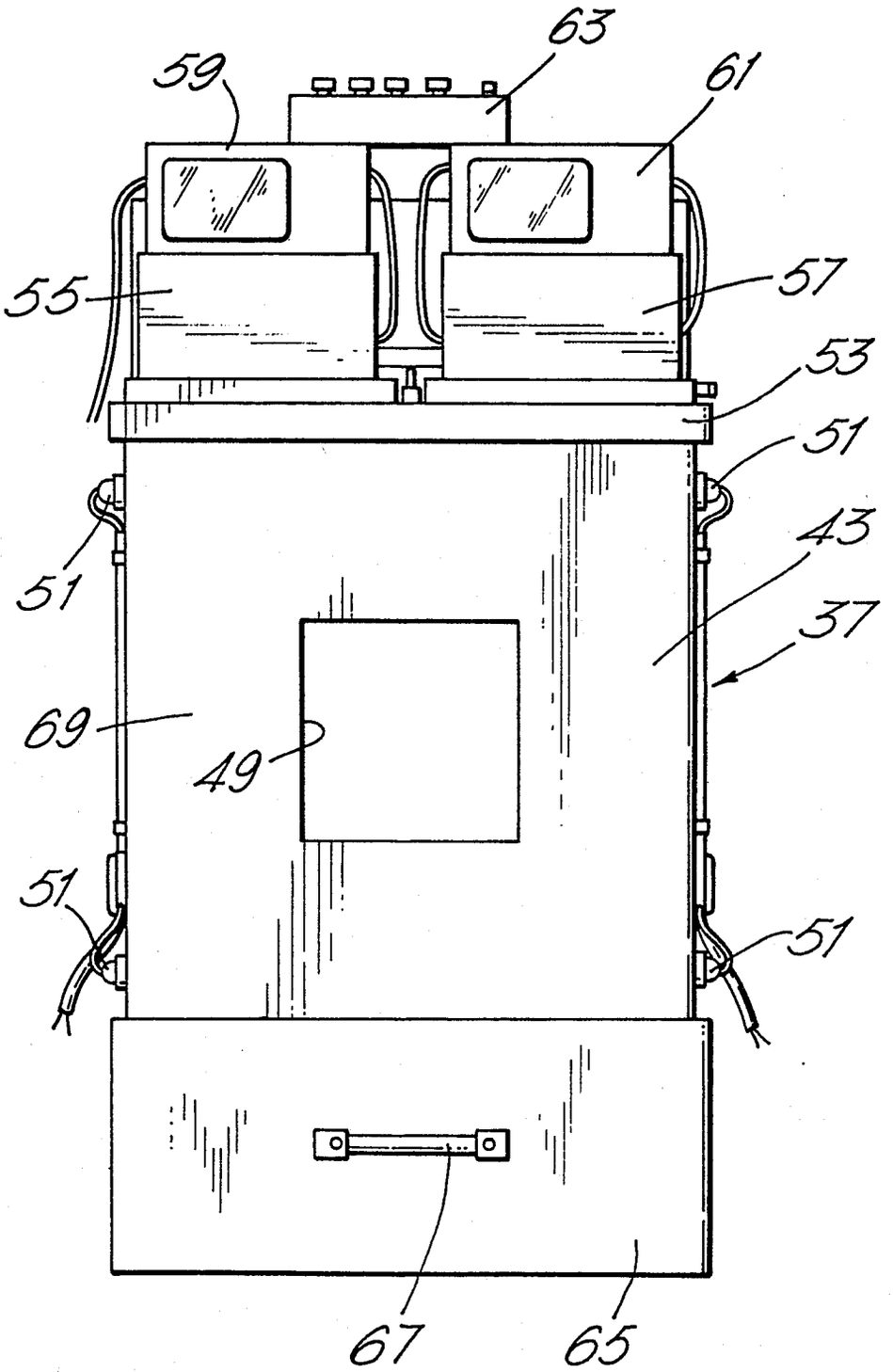


Fig.9.

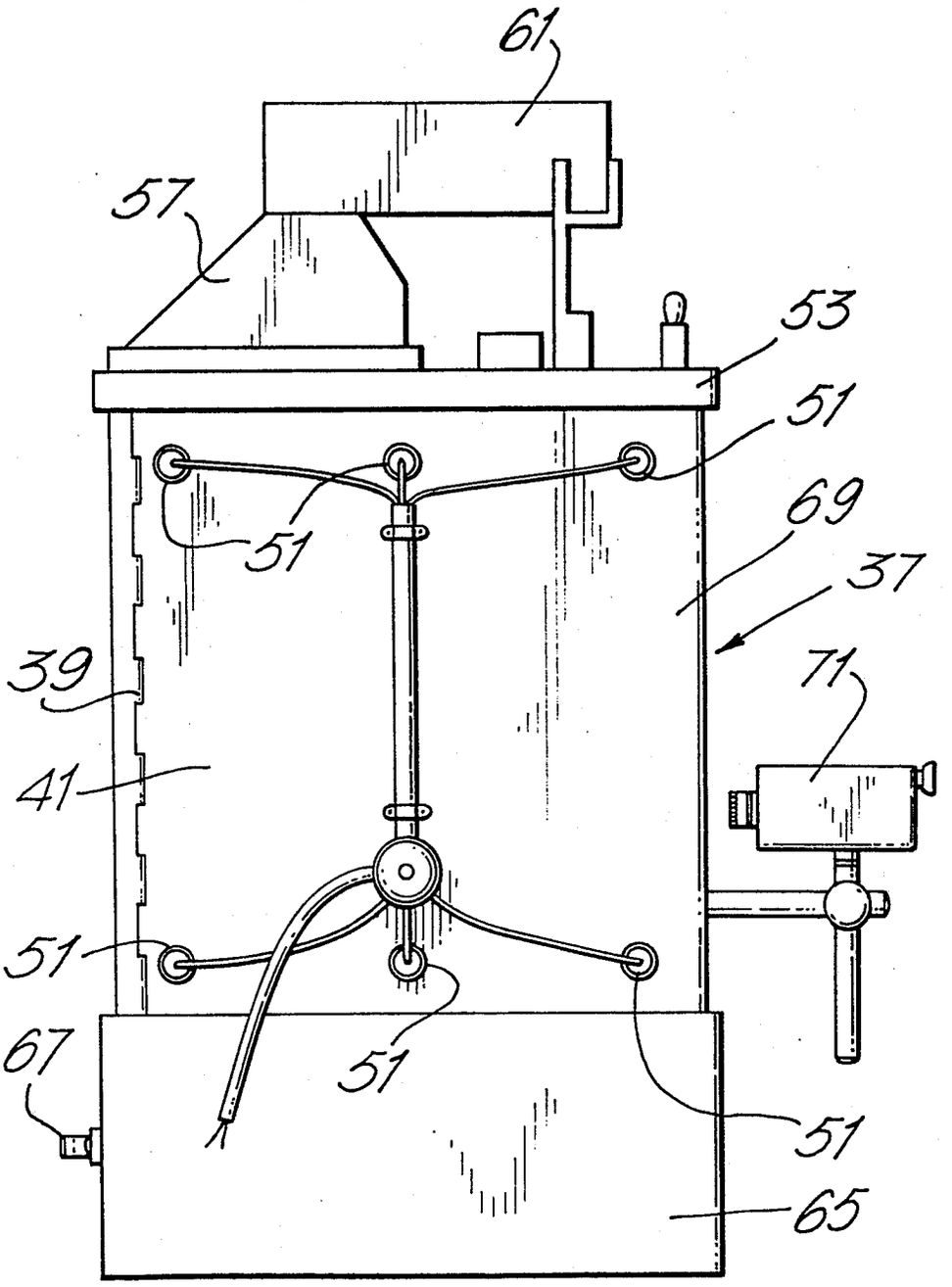


Fig. 10.