Feb. 24, 1953 F. T. WALLIN 2,629,372
CHEST RESPIRATOR
Filed June 23, 1950 2 SHEETS--SHEET 1

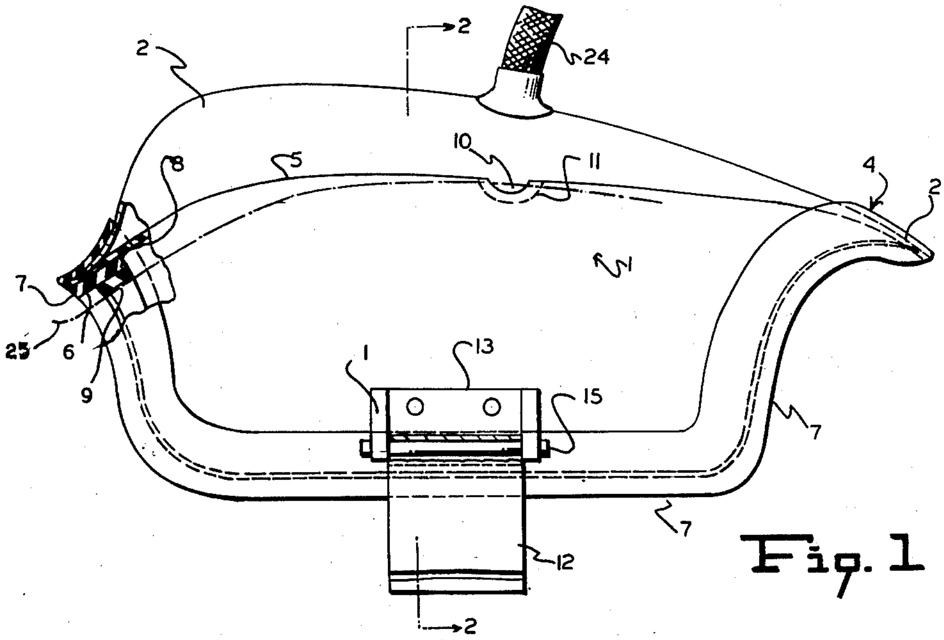

Fig. 1

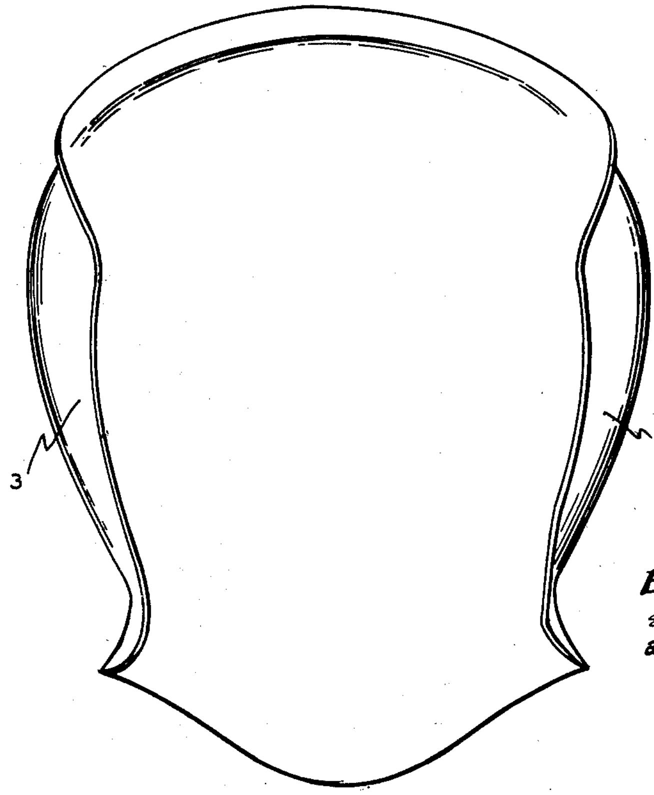

Fig. 3

inventor
Francis T Wallin
By [signature]
attorney

Feb. 24, 1953

F. T. WALLIN

2,629,372

CHEST RESPIRATOR

Filed June 23, 1950

2 SHEETS--SHEET 2

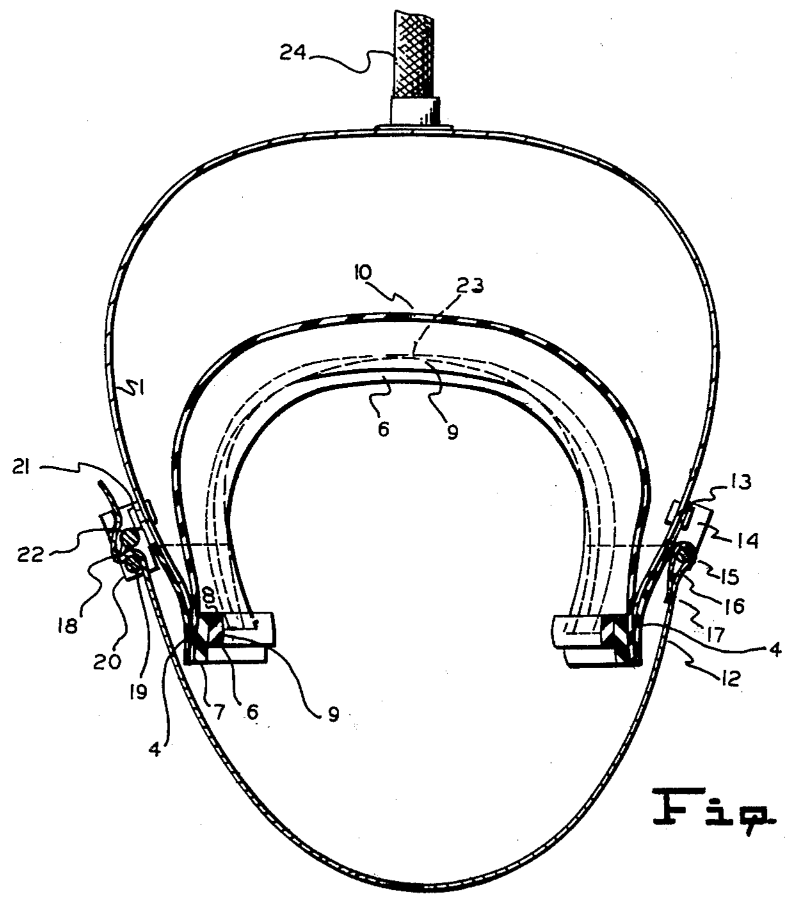

Fig. 2

Inventor
Francis T. Wallin
By Ezekiel Wolf
attorney

Patented Feb. 24, 1953

2,629,372

UNITED STATES PATENT OFFICE

2,629,372

CHEST RESPIRATOR

Francis T. Wallin, Brookline, Mass.

Application June 23, 1950, Serial No. 169,959

2 Claims. (Cl. 128—30)

1

The present invention relates to a so called chest respirator designed to extend over the chest of an individual from a region slightly below the collar-bone approximately to just below the waist on the front of the individual and at the sides from a region just below the arm-pit down along the sides of the ribs to the abdomen. Respirators of this type are made of sheet metal and non-metallic materials, such as thermo-plastics or thermo-setting resins, as for instance, cellulose acetate, acrylic resins, Vinylite, polyamines and other materials.

By the use of suitable plastics the respirators may be made strong and yet have sufficient flexibility so that they may be deformed to fit the body of the patient to whom they are applied. In general however these respirators do not hug the body sufficiently closely to permit the same action as in the full respirator where the person is wholly contained.

The artificial respirator used quite generally now for various purposes to carry through a complete breathing cycle for the individual, must not only force the air out of the lungs, but also cause the air to fill out the lungs. In the normal chest respirators, it is comparatively easy to provide the necessary negative pressure to permit the air to expand the lungs. This requires the pressure to be lowered within the respirator shell which means that there is a slight vacuum created which forces the respirator around its edges to hug the body of the individual since the pressure is greater on the outside of the respirator than on the inside. There is therefore under these conditions a tendency for a natural seal and if a type of plastic respirator is used which has an air foam rubber seal around its periphery to seal the periphery of the shell against the torso of the patient, a substantial negative pressure within the respirator, that is, a pressure lower than atmospheric pressure may be obtained. This will of course permit air at normal air pressure to expand the lungs as it flows through the nose and mouth in the desired fashion. The difficulty comes when positive pressure higher than atmospheric is to be applied within the respirator or shell over the chest to force the air out of the lungs. There is a tendency when air is pumped into the respirator for the respirator to be forced away from the body so that no pressure or very little pressure above atmospheric can be built up within the respirator. It follows therefore that in respirators which cover only the chest and abdominal parts of the body, there is great difficulty in obtaining sufficient positive pressure to compress the lungs, and this is one of the reasons why a chest respirator cannot be used under all circumstances. Where an individual has some muscle control, very little or no positive pressure may be needed, but where the individual cannot force the air out of his lungs, this must be done for him before fresh air can be drawn into the lungs.

2

The purpose of the present invention is to provide the necessary positive pressure so that the lungs may be compressed and the air forced out of them. The present invention accomplishes this purpose by providing a rubber diaphragm within the respirator which extends from the edge where the respirator is sealed to the patient and is coextensive with the respirator or shell, but is entirely contained within it. This diaphragm is provided with a hole at its center which is so positioned that when positive pressure is applied within the respirator shell, the opening seals itself or practically seals itself against the individual. This has the effect of maintaining a seal for the shell against the torso along the edge of the respirator because the positive pressure within the shell over the diaphragm exerts a sealing effect of the rubber seal around the edge of the respirator with the body. At the same time the positive pressure is allowed to build up against the diaphragm thereby forcing the diaphragm against the body simulating the Shaeffer prone method of resuscitation.

In the other half of the artificial breathing cycle, when the air is sucked out of the respirator, the diaphragm is drawn away from the body of the individual and negative pressure is established within the respirator.

Other features of the present invention will be more fully appreciated from the description in the specification below when taken in connection with the drawings illustrating an embodiment of the same, in which:

Figure 1 shows a side elevation of the respirator with a fragmentary portion in section.

Figure 2 shows a section taken on the line 2—2 of Figure 1, and

Figure 3 shows a view looking at the shell alone as viewed upward from the bottom of Figure 1.

In the arrangement indicated in the figures, 1 indicates the respirator shell which may be made of sheet metal or plastic material of the well known materials commonly used for molded plastic devices. The shell itself should be sufficiently thin to allow reasonable deformation so that standard sizes may be used to fit the body. For this purpose the shell may be $\frac{1}{16}''$ to $\frac{1}{32}''$ thick and may be made of such materials as "Plexiglass," "Lucite," "nylon," "Vinylite," "Bakelite," and other well known materials.

While the above materials are listed as trade names, it may be noted that such common plastics as cellulose acetate, methylmethacrylate, polystyrene, polyethylene, polyamines and other synthetic resins which may be reinforced with natural fibers may form the basis of the material for the respirator shell.

The respirator shell 1 should be formed to have a considerable chamber space above the chest as indicated by the region 2 of the shell. Also additional space should be provided at the sides of the chest within the shell as indicated by the regions 3. This provides a larger volume of air than if the shell hugged closely to the body and minimizes erratic changes and variations over the breathing cycle due to leakage and other causes. While no definite figure has been established, it is believed that this reserve air volume should be at least equal to the volume occupied by the patient's body.

The forward end of the respirator fits around the top of the chest extending under the arms, while the sides of the respirator extend downward to the abdomen and over the front of the abdomen. A seal is provided around the entire edge of the respirator shell. This seal on its outside consists of a rubber sheet or strip 4, which extends all around the edge of the respirator and hugs closely the outside of the shell extending beyond the edge. Around the periphery of this strip is sealed the periphery of the diaphragm 5. In a normal construction the outer strip or sheet 4 and the inner flexible diaphragm 5 may have a marginal seal in face to face relation of approximately 1'' wide, the diaphragm along its periphery contacting the inner peripheral surface of the shell. The outer strip or sheet 4 and the inner strip 5 may be made of flexible, yieldable rubber or other corresponding material, such as synthetic rubber or soft plastic. While it is desirable to use a material which will stretch and retract, this is not entirely necessary, providing the material is sufficiently flexible and yieldable and will conform to the contour over which the material is to fit. Vinylite or other suitable plastic sheeting may be used. Also sealed to the strip 4 is a wide strip 6 of foam rubber or other suitable soft sealing material, which has its outer edge 7 extending to the outer edge of the strip 4, while the inner edge or end of the strip 6 at 8 lies against and is sealed to the inner face of the diaphragm 5 around its whole periphery. A second narrow strip 9 is sealed to the face of the strip 6. This strip 9 is set on a short distance from the outer edge 7 of the outer edge of the strip 4. Both the strips 6 and 9 may be of foam rubber or some equivalent soft sealing material which may be pressed against the torso of the human body without producing harmful effects. The strips 6 and 9 are coextensive with the strip 4, but lie on the inside of the shell periphery and on the inner surface of the strip 4 which extends outward of the edge of the shell.

In the central region of the diaphragm 5 is a hole 10 which on its inside may be reinforced with a soft foam rubber or sealing ring 11. It will be noted that the diaphragm is coextensive with the edge of the shell and therefore arches over the body similarly as the shell does. When the respirator is put on the individual, it is tight-

ened by means of a strap 12 which goes around the back of the individual from one side of the respirator to the other. The method of attaching the strap may be by any suitable means. In the illustration shown, the strap is attached at one side of the respirator by means of a plate 13 which is riveted or cemented to the face of the respirator shell. This plate is provided with a pair of outwardly projecting flanges 14, in which a bar 15 is supported about which the strap 13 is looped as indicated more clearly in Figure 2. The looped end of the strap may be stitched by stitching as indicated by 16 and 17 and preferably as indicated in Figures 1 and 2, the bar hangs over the outer strip 4. The strap 12 may be drawn tightly against the lower edge of the strip 4 and the body and is fixed in place by means of a suitable securing device 18 at the other side of the respirator. This may comprise a bar 19 similarly attached to flanges 20 extending from the plate 21 held securely to the shell 1 against which a ribbed or toothed rod 22 also mounted between the flanges 20 may bear, to prevent the strap from being pulled loose but maintaining it against unintentional release.

In Figure 2 which shows a section through the respirator, it will be noted that the back end of the respirator, as viewed in Figure 1, which is the part in contact with the lower section of the body, slopes off to a comparatively slight inclination in the region 23 of the end. This end however is higher as viewed in Figure 1 than the forward end of the respirator and as indicated in Figure 2, the rubber strip 4 and the foam strips 6 and 9 on the inner side of the respirator, are beneath the shell and in substantially flat contact with the body. The seal therefore at the lower end of the respirator is particularly effective, especially because with the diaphragm 5 tending to force the strips 6 and 9 downward, a considerable contact surface is maintained with the torso of the individual.

When air is forced into the hose 24, pressure increases in the upper region 2 of the respirator and tends to force a seal of the strips 6 and 9 downward against the body since the diaphragm 5 is forced downward until the chamber is sealed off by the opening 10 coming in contact with the body. This tends to build up pressure against the body all around the respirator, both by the diaphragm action and the air pressure which will be equalized by the diaphragm pressing against the body substantially over its whole surface producing a positive pressure which has proved to be sufficient to compress the lungs. When the air in the region 2 is exhausted, the diaphragm 5 is raised and negative pressure is applied throughout the interior of the repirator in the region 2 and also below the region of the diaphragm. Under these conditions both the desired positive and negative pressure are obtained even though the respirator only partially surrounds the body. In Figure 1 the body line is suggested by 25. When the positive pressure is complete the diaphragm will tend to coincide with this.

Obviously from the description above, the respirator is comparatively light in weight and therefore permits the patient to move around without great difficulty.

Having now described my invention, I claim:

1. A chest respirator of the type described, comprising a shell adapted to extend over the chest and abdomen of a patient, having a peripheral sealing means extending around the periph-

ery of the respirator comprising a yielding thin strip member extending over the outer peripheral surface of the respirator shell and beyond the edge thereof, a heavier soft yielding strip sealed in face relation in the region beyond the edge to said first strip and extending within the shell around its periphery and a thin flexible sheet sealed between the soft yielding strip and the first mentioned strip all around the periphery, said sheet forming a diaphragm coextensive with the interior of the respirator and having a hole therein.

2. A chest respirator of the type described, comprising a shell adapted to extend over the chest and abdomen of a patient, having a peripheral sealing means extending around the periphery of the respirator comprising a yielding thin strip member extending over the outer peripheral surface of the respirator shell and beyond the edge thereof, a soft, yielding, flexible diaphragm having its periphery sealed all around its marginal surface to the under side surface of said strip member in the region extending beyond the edge of the shell, a soft wide sealing strip attached around the periphery of the marginal surface of the diaphragm and extending under the margin of said shell and communicating passages through the shell and through the diaphragm.

FRANCIS T. WALLIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,360,476	Church	Oct. 17, 1944
2,466,108	Huxley	Apr. 5, 1949

FOREIGN PATENTS

Number	Country	Date
470,611	Great Britain	Aug. 18, 1937