

Aug. 6, 1963

P. C. WILSON ET AL

3,099,985

RESUSCITATOR

Filed Dec. 21, 1960

3 Sheets-Sheet 1

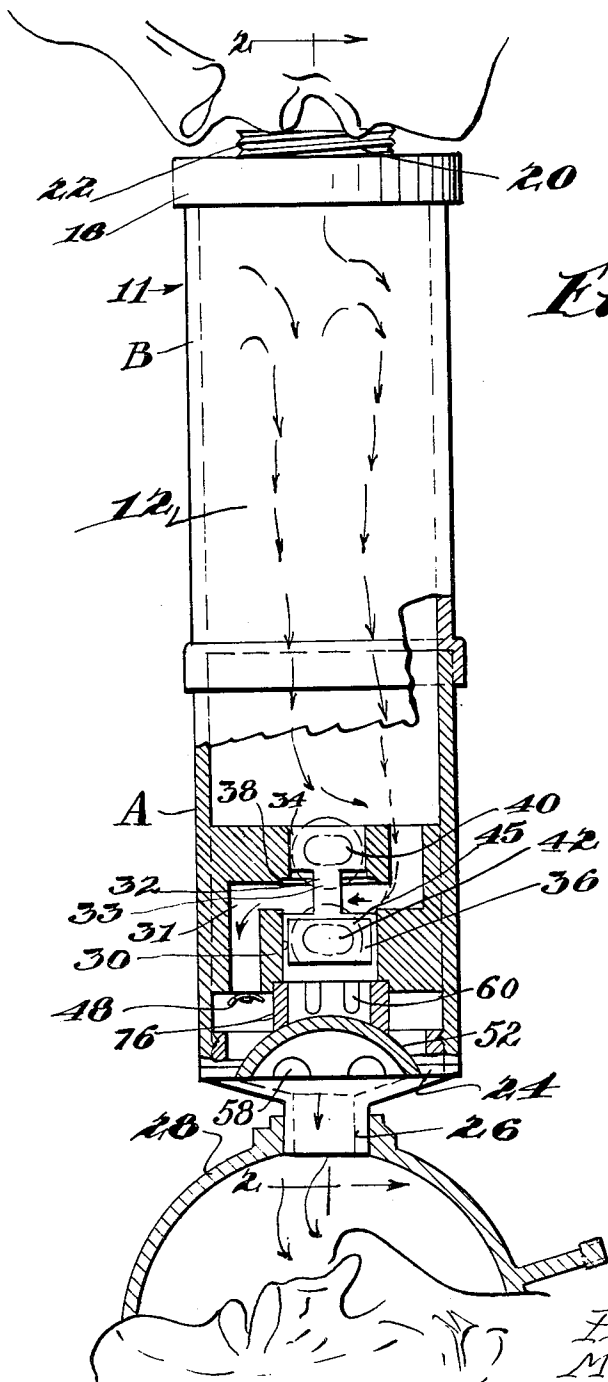


Fig. 1.

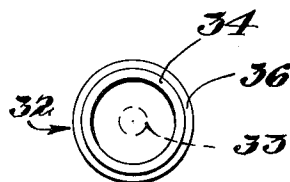


Fig. 5.

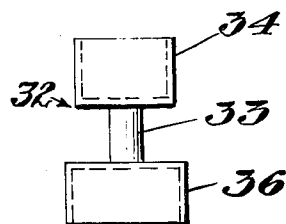


Fig. 6.

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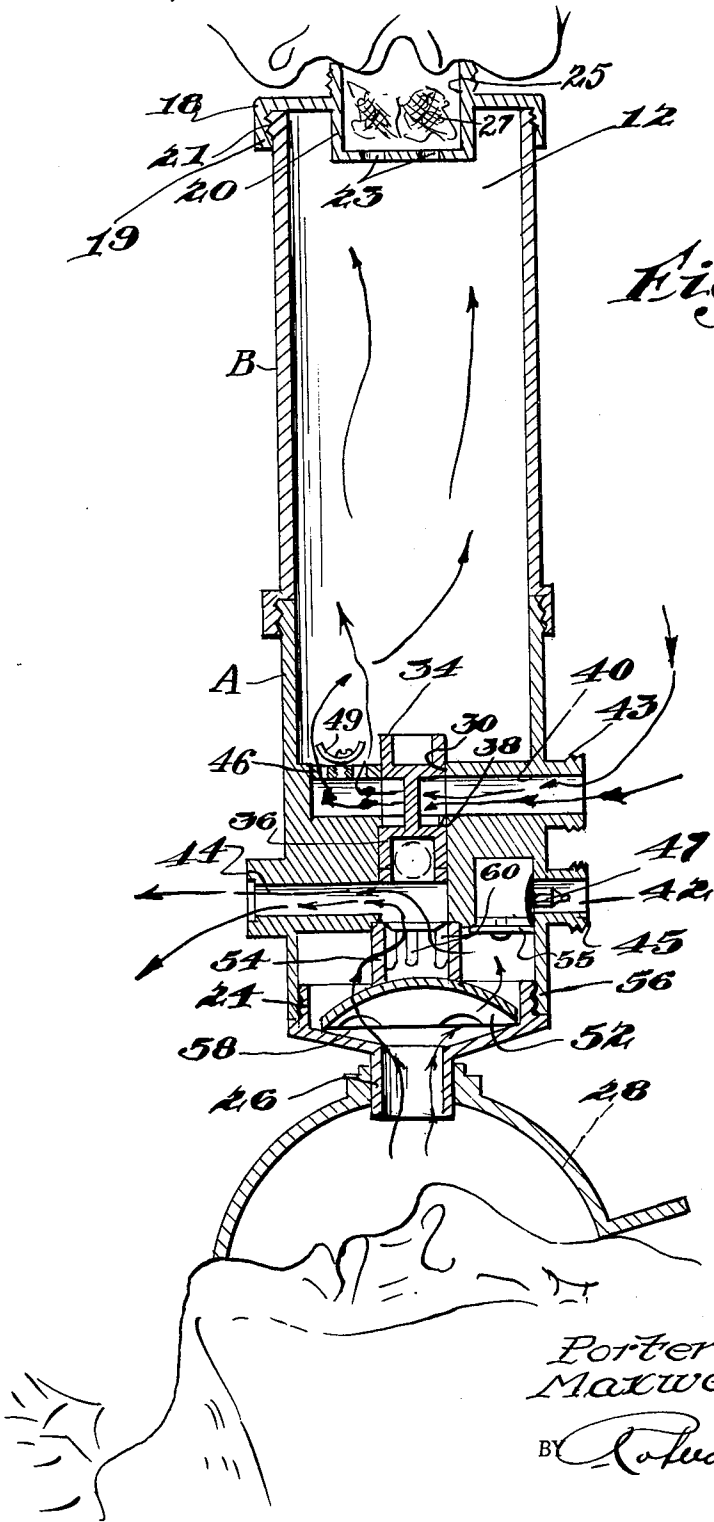
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Filed Dec. 21, 1960

3 Sheets-Sheet 3

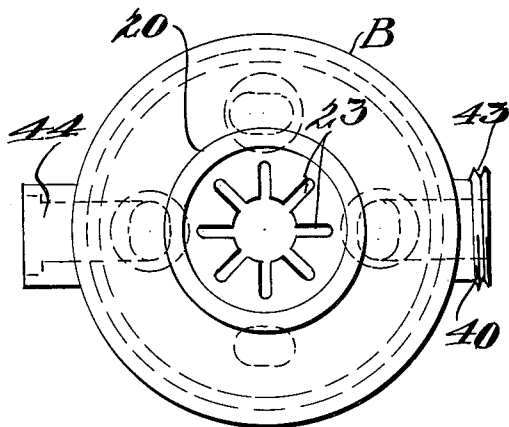


Fig. 3.

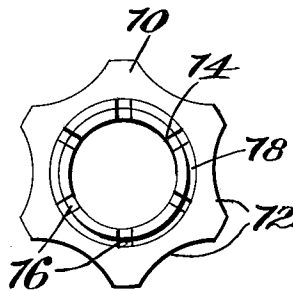


Fig. 8.

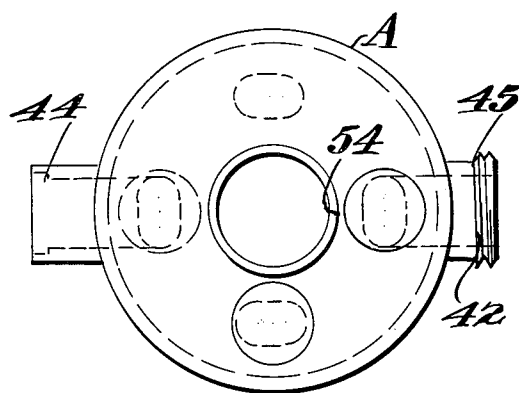


Fig. 4.

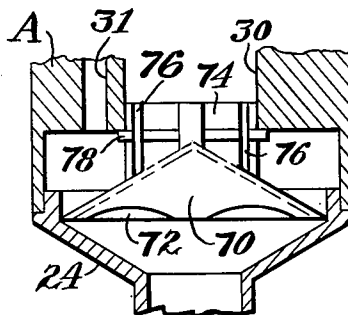


Fig. 7.

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Filed Dec. 21, 1960, Ser. No. 72,549
6 Claims. (Cl. 128—29)

This invention, a continuation-in-part of our previous application, Serial No. 839,135, now U.S. Patent No. 3,018,775 dated January 30, 1962, relates to resuscitators but more particularly to a single chamber resuscitator for mouth to mouth resuscitation, which insures tidal inflation of fresh unbreathed air to non-breathing victims in a physiological manner, at the normal breathing rate and volume of air of the operator.

Therefore, it is an object of this invention to provide a simplified but effective single chamber type of resuscitator apparatus adapted to restore breathing by artificial respiration.

Another object of this invention is to provide a mouth to mouth resuscitator for forcing tidal breaths of air into the lungs of a victim and including a pressure powered slide valve controlled by the breathing of an operator.

A further objective is the provision of a durable apparatus with the design and arrangement of the component parts being such that each part is instantly accessible for emergency cleaning or replacement of parts within the minimum of time.

Still another object is the provision of a simplified apparatus that enables the easy and safe, but convenient storage of the subject equipment as well as its rapid transportation to the desired locations.

A further and most important objective is the provision of an apparatus which will enable the use of the operator's respiratory action for its motivation with complete assurance and safety.

A still additional objective is to provide an apparatus so designed that oxygen in high concentrations may be administered by the mouth to mouth method to a non-breathing victim and also in concentrations approaching 100 percent to a victim requiring it but also breathing on his own.

Another and still very important object is the provision of a shield which, although permitting air to pass through in either direction, will also reduce the possibility of vomitus from entering the resuscitator to a minimum.

Still another object is the provision of a resuscitator wherein the operator may rebreathe some CO₂ which would tend to preclude possible symptoms of hyperventilation and thus allowing resuscitation to be given over longer periods of time.

A further objective is to provide a basic unit which will, in the absence of the application of tools, convert to use with a hose so that resuscitation may be administered while the operator may be walking beside a stretcher bearing a victim or while chest surgery is being performed or even in emergency heart massaging as well as in similar situations where the operator may be able to move about the vicinity of the victim, still having the use of both of his hands. It can be appreciated that this function is apropos in connection with toxic air rescue wherein the use of a face mask or cannister would be unnecessary.

A further objective is to provide a basic unitary device which, in the absence of special tools, may be converted to a resuscitator for use in mask to mask operation involving poison gas, allowing the operator to plug into the gas mask of a victim, providing resuscitation with the victim breathing through his own mask so that the operator may unplug and proceed on to another possible victim for repetition of the above procedure.

In the drawings:

FIGURE 1 is a vertical front view of our invention illus-

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trating an operator during exhalation and a victim during inhalation, the lower portion of the resuscitator being in section.

FIGURE 2 is a vertical sectional view taken on the line 2—2 of FIGURE 1, showing the operator in the inhalation phase and the victim in the exhalation phase.

FIGURE 3 is a top plan view of the apparatus.

FIGURE 4 is a bottom plan view of the apparatus with the shield removed.

FIGURE 5 is a bottom plan view of the vacuum valve.

FIGURE 6 is an elevation of the vacuum valve.

FIGURE 7 is a front elevational view of a modified vomit shield illustrating a portion of the cap 24 and cylindrical base portion A in section and the manner in which the shield is supported therein.

FIGURE 8 is a plan view of the modified vomit shield shown in FIGURE 7.

Referring now to FIGURES 1 and 2 a preferred embodiment of our invention is shown as comprising a bottom cylindrical portion A threaded onto an upper cylindrical portion B forming a resuscitator cylinder 11. When threaded together, the lower and upper cylindrical portions A and B provide a main air exchange chamber 12 having a volume of approximately 550 cc. or the volume of 1 adult tidal breath. A cap 18 having a cylindrical mouthpiece 20 formed integrally therewith and extending above the cap 18 is adapted to be threaded onto the top of the upper cylindrical portion B.

The mouthpiece 20 is adapted to contain gauze 22 for antiseptic purposes and also has openings 23 at its bottom to permit air to pass therethrough into the main air exchange chamber 12. It is to be noticed that the lower cylindrical portion A may be unthreaded and replaced by a hose connection which will be later explained.

A lower cylindrical cap 24 is attached or threaded onto the lower portion A and is provided with a neck member 26 to which a conventional face mask 28 is attached. The lower portion B and the cap 24 form a victim air discharge chamber 25. A valve opening 30 extends along the longitudinal axis of the resuscitator cylinder 11 between the main air exchange chamber 12 and the discharge chamber 25.

Referring to FIGURE 1, a victim air supply or inhalation passage 31, intersecting the valve opening 30, extends between the main air exchange chamber 12 and the discharge chamber 25. A flutter or nylon flap valve 48 positioned at the lower end of the victim inhalation passage 31 is arranged to be opened upon exhalation of the operator to pass fresh air into the chamber 25 or cap 24 and closed upon inhalation by the operator and/or exhalation by the victim. A slide valve 32, of general dumbbell formation, as shown in detail in FIGURES 5 and 6, is freely mounted for vertical reciprocating movement in the valve passage 30. The slide valve 32 comprises two opposing cylindrical cup members 34 and 36 interconnected at their bases by means of a cylindrical neck 33.

The cylindrical cup 34 is of smaller diameter than the cup 36. The diameter of that portion of the valve opening 30 above the intersecting passage 31 is slightly larger than that of the cup 34 while that portion of the valve opening 30 below the intersecting passage 31 is slightly larger than the cup 36. With this arrangement the freely-mounted slide valve 32 reciprocates within the valve opening 30 between a lower position in which the air passage 31 is open as shown in FIGURE 1 and an upper portion in which the cup 36 closes the air passage 31 as shown in FIGURE 2.

An inverted dome-shaped vomit shield 52 having spaced arcuate openings 58 about its downturned peripheral edge is centrally positioned within the discharge chamber 25 and rests on the cap 24, a hollow open end cylindrical stem 54 formed on the shield 52 and having a plurality of

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spaced vertical slots 51 extends partially into the valve opening 30 which is counterbored to receive the end of the stem 54.

Referring to FIGURE 2, the lower cylindrical base portion A is provided with two oval radially-extending fresh air inlet passages 40 and 42 respectively. The passages 40 and 42 extend parallel from the longitudinal axis of the resuscitator cylinder 11 at an angle of 90° to the victim inhalation passage 31, the passage 40 being above and the passage 42 being below the victim inhalation passage 31. Both passages 40 and 42 open through externally threaded projections 43 and 45 for connection to conventional cannisters.

The passage 52 passes directly into the chamber 25 via a flapper valve 55 which opens upon inhalation of the victim and closes during exhalation. This permits a conscious victim to breathe directly by-passing the resuscitator when desired. A safety shut-off valve 47 is provided to close the fresh air passage 42 when mouth-to-mouth resuscitation is to be performed.

The oval passage 40 intersects the valve opening 30 and opens into the main air exchange chamber 12 by way of spaced openings 46. An inlet flapper valve 49 restricts the passage 40 and is arranged to open during inhalation by the operator and closed during exhalation.

A projecting shoulder or stop 38 restricting the valve opening 30 is provided at the intersection of the passage 40 and the valve opening 30. The stop permits the slide valve 32 to reciprocate vertically between the raised portion, the cup 36 engaging the stop 38, as shown in FIGURE 2, and the lowered position, the cup 34 engaging the stop 38, as shown in FIGURE 1.

Opposite the victim fresh air by-pass passage or air intake 42 is another extended victim exhalation conduit or passage 44 providing for outlet during exhalation by a victim and also permitting the insertion of an outlet valve when required. It is to be noted that the cup 36 closes the victim exhalation passage 44 when the slide valve 32 is in the lower position.

It is to be observed that in FIGURES 9 and 10 a modification of the vomit shield 52 shown in FIGURES 2 and 4 has been specifically disclosed. This modification discloses a conical formation 70 having a plurality of spaced arcuate or curved cut-outs 72 around the bottom periphery. Attached to or integrally formed therefrom, is a stem 74 of smaller diameter than the valve opening 30 permitting the stem 74 to extend therein. A circular flange 78 is located centrally of said stem 74 and precludes further upward movement of the vomit shield as particularly disclosed in FIGURE 7. With this construction the circular flange 78 provides a stop permitting the shield to be readily positioned in the cap 24, while the slotted vertical rising stem 74 extends into the valve opening 30 to minimize the amount of vomit entering therein.

In the operation of the apparatus, inhalation by the operator, as shown in FIGURE 2, opens the flapper valve 49 and causes a lowering of pressure above the slide valve 32, thus creating an atmospheric lift upon the slide valve 32. Increased pressure directly below the slide valve 32 created by the prior inflation cycle and exhalation by the victim caused by the elasticity of the victim's lungs assists in giving the valve 32 an immediate smooth and effortless start in its upward movement. The slide valve 32 continues to move upward until the cup 36 engages the stop 38 where it remains positioned during the operator inhalation period. The slide valve 32 remains in this upper position due to the lowered pressure in the main air exchange chamber 12 and the rush of incoming air through the passage 40 tending to support the cup 34. The slide valve 32 in this position opens the victim exhalation passage 44 and closes the victim inhalation passage 31, preventing any exhaled air from the victim from mixing with the fresh air rushing into the main air exchange chamber 12.

When the operator exhales, as shown in FIGURE 1, 75

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the increase in pressure in the main air exchange chamber 12 closes the valve 49 and forces the slide valve 32 downwardly to the lower position where the cup 34 engages the stop 38, opening the victim inhalation passage 31. The fresh air in the main air exchange chamber 12 is forced through the inhalation passage 31 to open the downlet flapper valve 48 and enters the cup 24 and face mask 28. During this time the flow of fresh air through the passage 31 forces the cup 36 downwardly holding the cup 34 in engagement with the stop 38. In the lower position the slide valve 32 simultaneously closes the fresh air passage 40 and the victim exhalation passage 44, allowing no alternative but for the exhalation of the operator to force inflation of the victim.

Thus it can be seen that the slide valve 32 is smoothly and automatically reciprocated by the atmospheric pressure changes in the resuscitator cylinder 11 created by the natural breathing of the operator. This action duplicates the physiological act of breathing and results in great advantages.

The mouthpiece extension 20 has an inner diameter 25 of a size to permit the lips of the operator to be inserted therein so as to allow approximately 100 percent inhalation and exhalation. A changeable gauze filter 27, germicidally treated, is contained within this mouth piece 20. It is to be further observed that the resuscitator cylinder is in two sections 12 and 14, the upper one serving as the main fresh air chamber, with the parts to be replaced by threading the collar 50 around the neck of the lower section 14.

While we have described one embodiment of our invention in detail, it will be obvious that various changes could be possible. We therefore desire that our invention be solely limited by the scope of the appended claims.

We claim:

1. A resuscitator for rendering artificial respiration to a victim at the normal breathing rate of an operator comprising: a resuscitator cylinder having a main air exchange chamber of a volume of one tidal breath or approximately 550 cc.; an operator mouthpiece opening into said main air exchange chamber attached to one end of said resuscitator cylinder; a face mask attached to the other end of said resuscitator cylinder and adapted to fit a victim; a victim inhalation passage in said resuscitator cylinder interconnecting said main air exchange chamber and said face mask; a fresh air inlet passage in said resuscitator cylinder opening into said main air exchange chamber and externally of said resuscitator cylinder; a victim exhalation passage extending through said resuscitator cylinder and opening into said face mask and externally of said resuscitator cylinder; a valve chamber formed in said resuscitator cylinder, said valve chamber communicating with said fresh air passage and said victim inhalation and exhalation passages; and a freely mounted, reciprocable slide valve positioned in said valve chamber adapted to be moved by pressure changes in said resuscitator cylinder operating on said slide valve induced by and at the normal rate of said operator breathing into said mouthpiece, whereby upon inhalation of said operator the air pressure in said main air exchange chamber is lowered, causing said slide valve to move and open said fresh air and victim exhalation passages while closing said victim inhalation passage to fill said main air exchange chamber with fresh air, said movement of said slide valve upon inhalation of said operator being assisted by the elasticity of the victim's lungs; and upon exhalation of said operator said air pressure in said main air exchange chamber is increased to move said slide valve and close said fresh air passage and said victim exhalation passage and open said victim inhalation passage, forcing tidal breaths of air from said main air exchange chamber through said victim inhalation passage into said mask at the normal breathing rate of said operator, and stop means for limiting the movement of said slide valve.

2. A resuscitator as defined in claim 1 including a

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vomit shield for preventing vomitus from entering the main air exchange chamber.

3. In a mouth-to-mouth resuscitator for rendering artificial respiration to a victim, a resuscitator cylinder having a main air exchange chamber of a volume of one tidal breath or approximately 550 cc. and having a fresh air passage and victim inhalation and exhalation passages therein; a valve chamber in said resuscitator cylinder communicating with said fresh air and victim inhalation and exhalation passages and a freely mounted slide valve positioned in said valve chamber and reciprocated by pressure changes induced by an operator breathing into said main air exchange chamber to open said fresh air passage and victim exhalation passage and to close said victim inhalation passage filling said main air exchange chamber with fresh air upon inhalation by an operator and to close said fresh air and victim exhalation passages to open said victim inhalation passage upon exhalation by said operator whereby tidal breaths of fresh air are forced from said main air exchange chamber through said victim inhalation passage at the normal breathing rate of said operator.

4. Apparatus as defined in claim 3 including a second fresh air by-pass passage in said resuscitator cylinder permitting a victim to breathe directly when desired.

5. A resuscitator as defined in claim 3 wherein said valve chamber comprises upper and lower cylindrical chambers; said upper chamber being of smaller diameter than said lower chamber, and said slide valve is of general dumbbell formation provided with opposed cup-like end members of different diameters and which are respectively received in said upper and lower chambers; and means for limiting the movement of said slide valve in said valve chamber.

6. In a mouth-to-mouth resuscitator for rendering arti-

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ficial respiration by forcing tidal breaths of air into a victim at the normal breathing rate of an operator and including a resuscitator cylinder having a main air exchange chamber of a volume of one adult tidal breath or approximately 550 cubic centimeters filled and emptied by the normal inhalation and exhalation of an operator, the improvement comprising fresh air and victim inhalation and exhalation passages formed in said resuscitator cylinder, flap valves normally closing said fresh air and victim inhalation passages, a valve chamber in said resuscitator cylinder communicating with said fresh air and victim inhalation and exhalation passages; and a reciprocable, freely mounted, pressure powered slide valve positioned in said valve chamber adapted to be moved by pressure changes induced in said resuscitator cylinder by and at the normal rate of said operator breathing into said resuscitator cylinder, whereupon inhalation by said operator opens said fresh air passage flap valve and moves said slide valve to open said fresh air and victim exhalation passages and close said victim inhalation passage filling said main air exchange chamber with fresh air and exhalation by said operator opens said inhalation passage flap valve and moves said slide valve to close said fresh air passage and said victim exhalation passage and open said victim inhalation passage forcing tidal breaths of fresh air from said main air exchange chamber through said victim inhalation passage at the normal breathing rate of said operator.

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