

[54] **CLOSED WOUND SUCTION APPARATUS HAVING BIASED PLATE MEMBERS**

[76] Inventor: Royce C. Lewis, Jr., 5233 W. 19th, Lubbock, Tex. 79407

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[51] Int. Cl. .... A61m 1/00

[58] Field of Search ..... 128/145.5-145.7, 226, 230, 128/276-278

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Primary Examiner—Charles F. Rosenbaum  
Attorney, Agent, or Firm—Marcus L. Bates

[57] **ABSTRACT**

Continuous suction apparatus for post operative wounds comprised of contiguous plates superimposed upon one another in aligned relationship, and having guide means associated therewith so that a distracting force biases the plates apart from one another. A disposable, collapsible bag has opposed faces thereof removably affixed to the adjacent faces of the plate members so that when the plates are pulled apart by the distracting force, a reduced pressure is effected within the interior of the bag.

A disposable plastic tubing is placed in communication with the interior of a wound and the interior of the bag so that any secretion formed within the wound is immediately withdrawn into the sterile disposable bag, thereby greatly facilitating healing of the wound.

10 Claims, 17 Drawing Figures

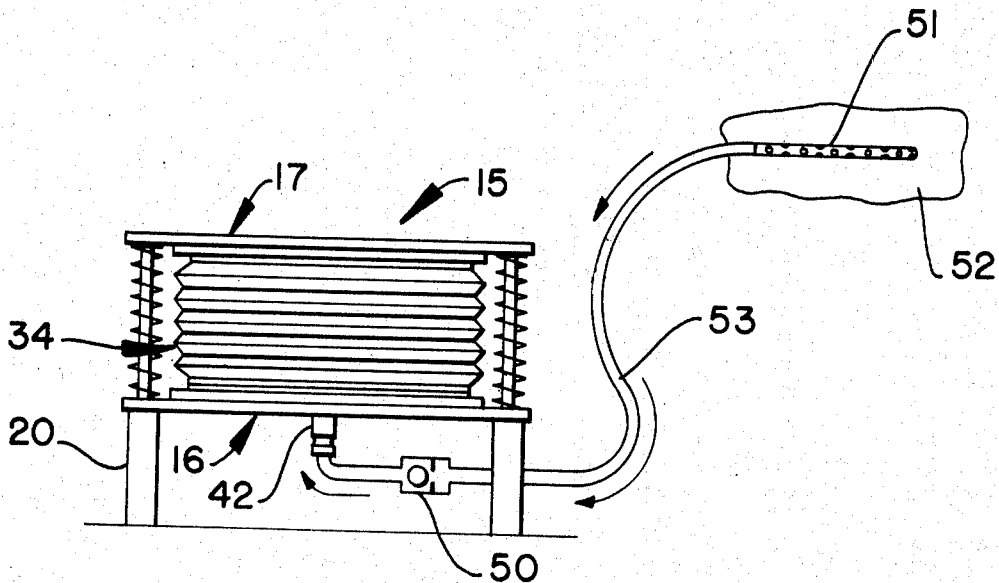


FIG. 1

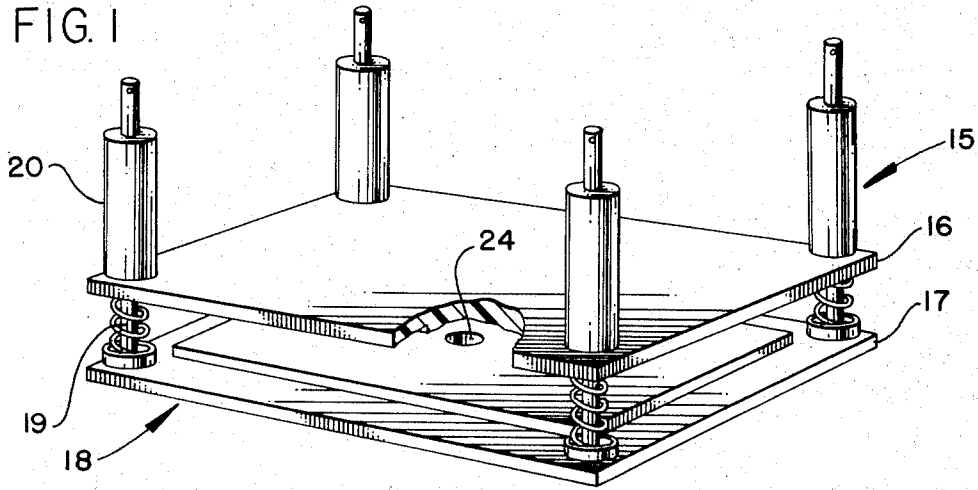


FIG. 2

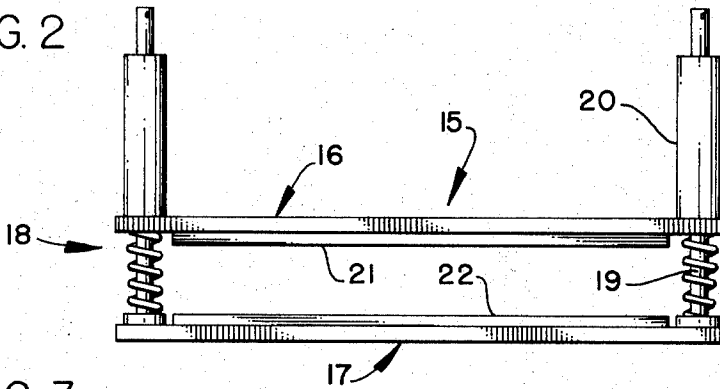


FIG. 3

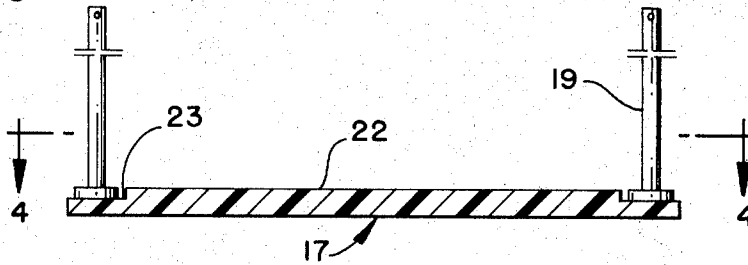
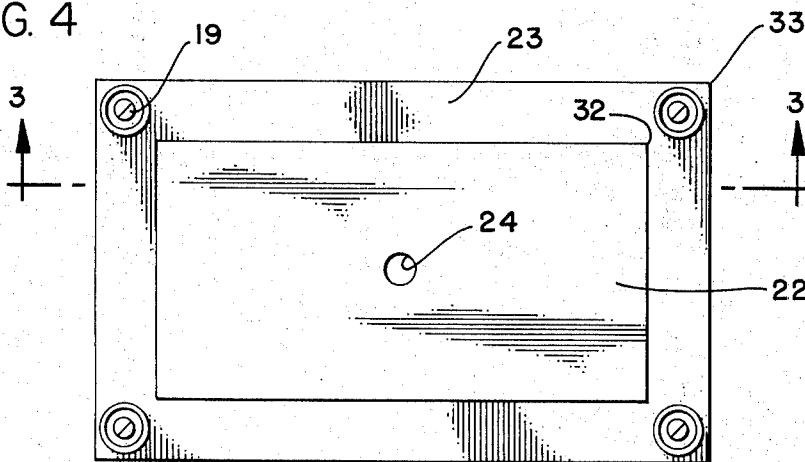
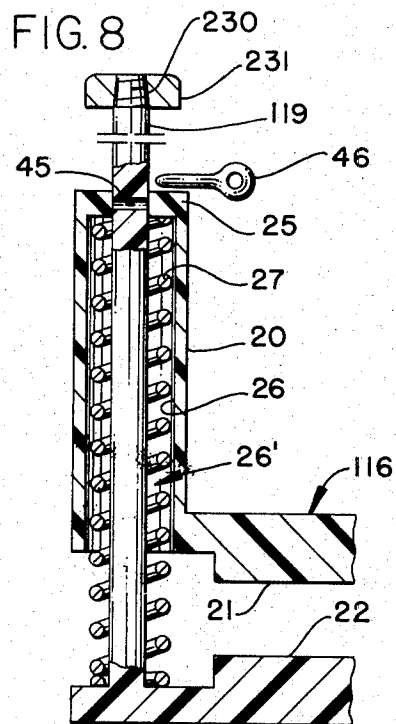
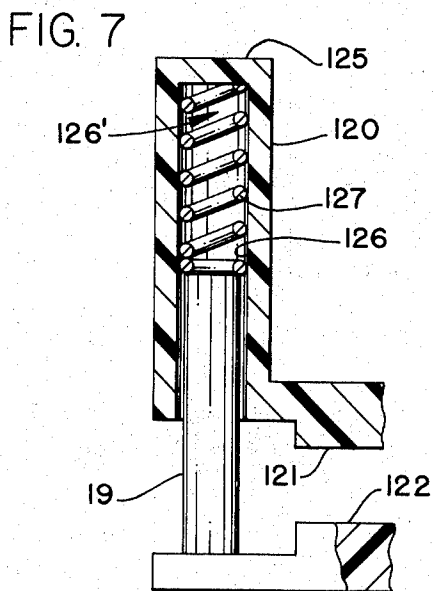
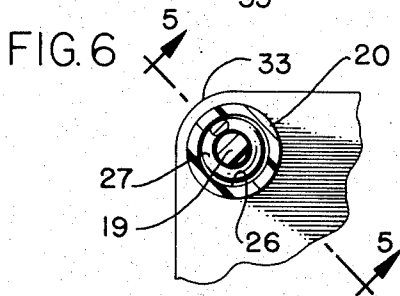
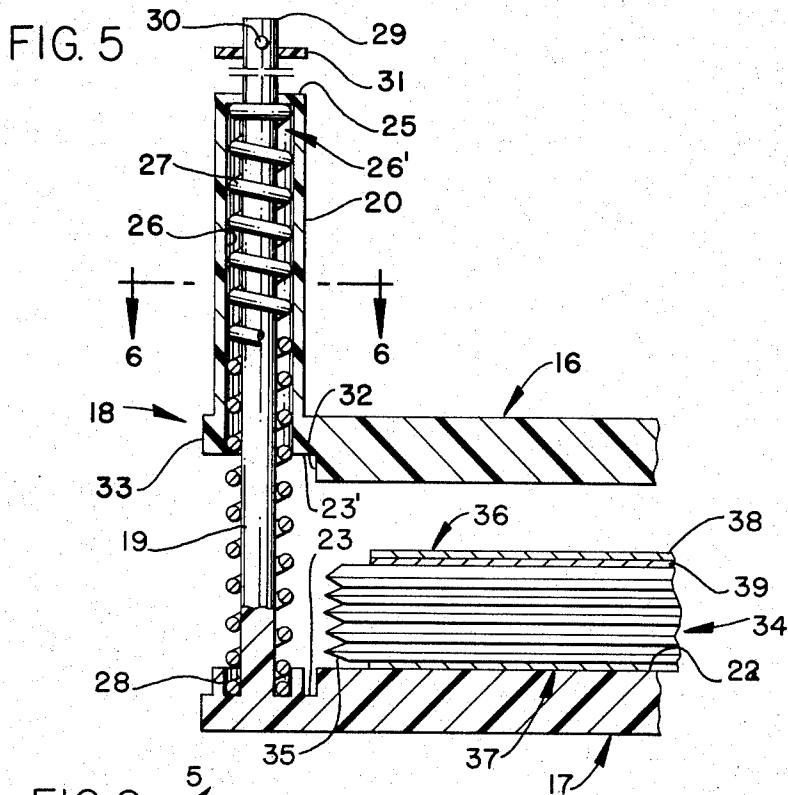


FIG. 4





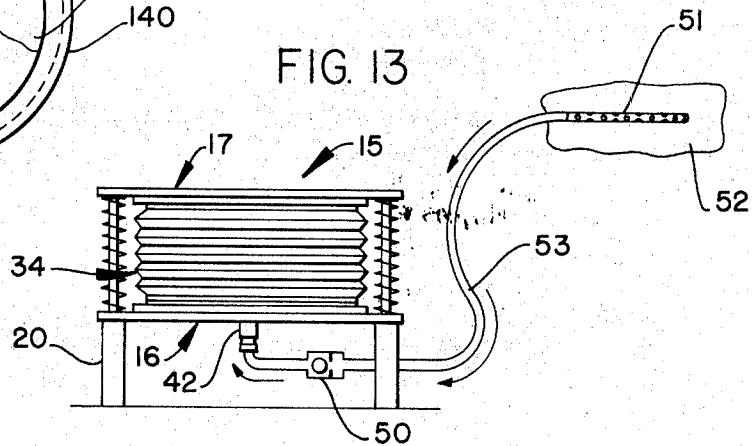
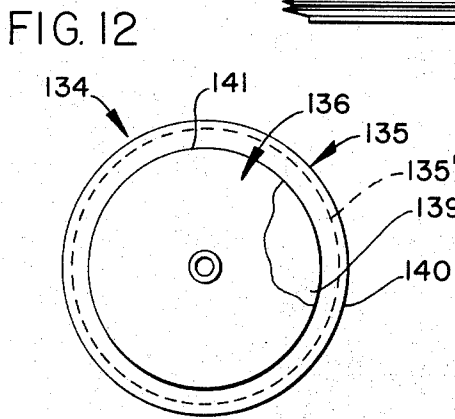
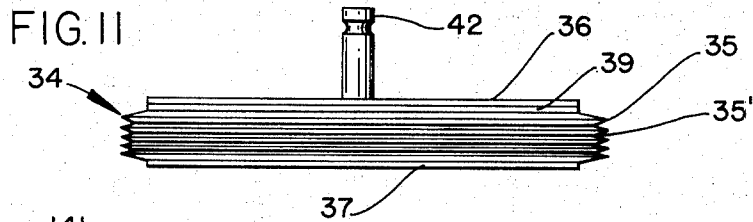
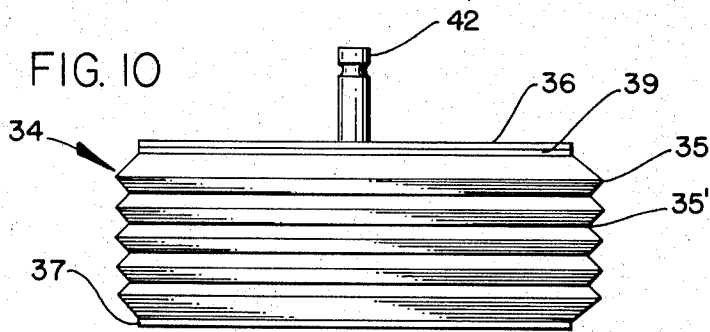
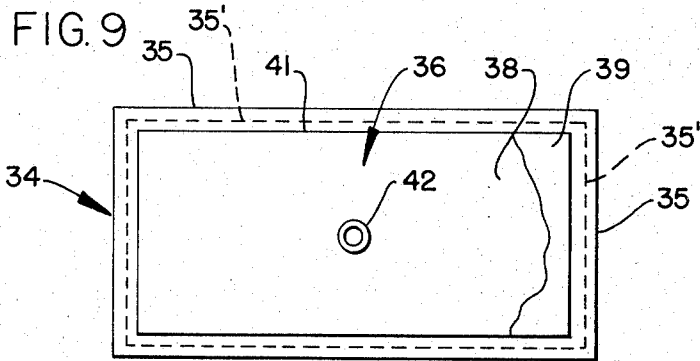


FIG. 14

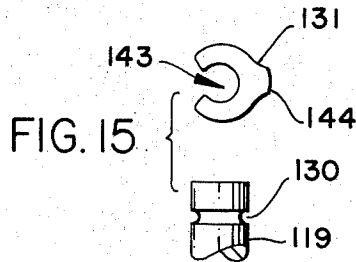
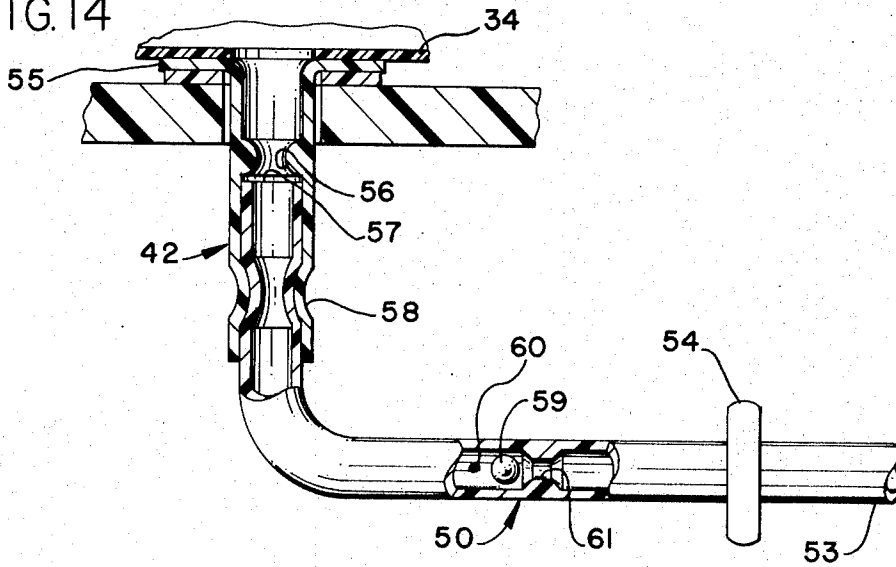


FIG. 16

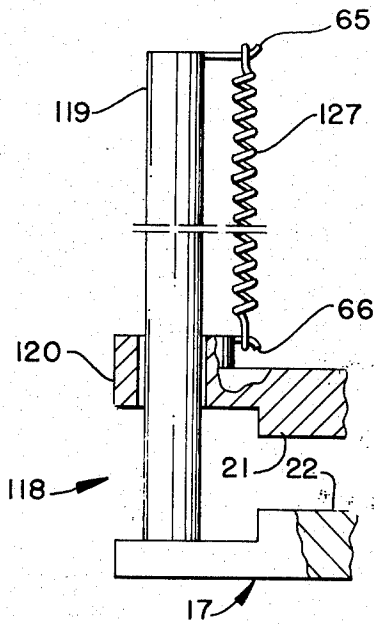
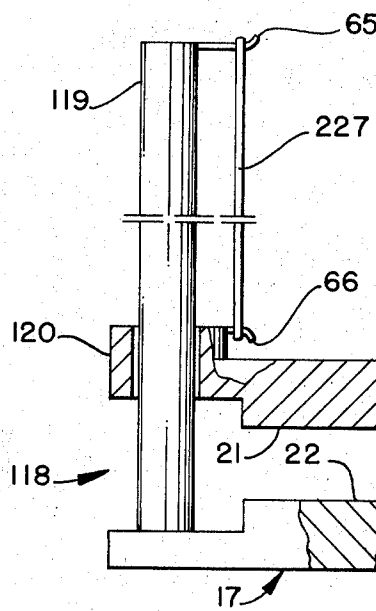


FIG. 17



## CLOSED WOUND SUCTION APPARATUS HAVING BIASED PLATE MEMBERS

### BACKGROUND OF THE INVENTION

Surgical evacuator apparatus of the prior art which establish closed wound drainage generally are dependent upon complicated mechanism for effecting a negative pressure for causing accumulated fluids within the wound to be drained externally. A primary problem of these prior art apparatus is maintenance, sterility, cost, dependability, and the requirement that a highly trained technician be available for supervising the operation thereof. In most prior art surgical evacuator devices, the accumulation of fluids must be emptied from the reservoir from time to time, thereby bringing about an extremely dangerous condition in that the fluid contained within the reservoir accidentally could be forced back into the wound itself through the same tube from which the fluids drain from the wound. Furthermore, where suction producing chambers of the prior art are employed, it is possible for the patient to roll over onto the suction chamber, thereby collapsing the container a sufficient amount to produce a hydrostatic head which in turn could cause the before mentioned backflow to occur into the wound.

Accordingly, it is desirable to have closed wound suction apparatus for providing continuous suction in post operative wounds which avoids the practice of the before mentioned dangers, which is low in cost, simple to operate, and which includes a sterile packaged assembly of the components which are to be placed in fluid communication with the wound with the packaged sterile apparatus being sufficiently low in cost to permit it to be discarded after each use.

### SUMMARY OF THE INVENTION

This invention comprehends a closed wound suction apparatus for providing continuous suction in post operative wounds so that any secretions are immediately withdrawn into a sterile bag and not allowed to accumulate in the wound. The apparatus is comprised of spaced contiguous plate members having guide means by which the members may be superimposed one upon the other and moved into abutting engagement with one another, with one face of one plate being abuttingly received by the opposed face of the remaining plate member.

Biasing means urges one plate away from the other while the guide means maintain the plates in parallel aligned relationship. A collapsible bag is sandwiched between the opposed faces of the plates and has opposed outwardly directed wall surfaces thereof removably attached to the opposed faces of the plates. As the biasing means moves the plates away from one another, the bag is urged into a partially opened configuration, thereby reducing the pressure therewithin relative to ambient.

One end of the tubing is placed in communication with the interior of the bag and the remaining end is placed in communication with a closed wound enabling reduced pressure to be effected within the interior of the closed wound itself, thereby causing any secretions formed within the wound to flow through the tube and into the disposable bag.

A primary object of the present invention is the provision of improvements in closed wound suction apparatus.

Another object of the invention is the provision of a closed wound suction system having disposable fluid carrying components.

A further object of this invention is to provide a closed system for subjecting a wound to a positive drainage, thereby preventing accumulation of fluids therewithin.

A still further object of this invention is to provide a surgical evacuator device having a disposable collapsible bag associated therewith into which fluids from a wound are caused to flow.

Another and still further object is to provide a sterile evacuator device for removing fluids from a closed wound, wherein the fluid contacting components of the device are packaged in a sterile container and may be discarded after use.

These and various other objects and advantages of the invention will become readily apparent to those skilled in the art upon reading the following detailed description and claims and by referring to the accompanying drawings.

The above objects are attained in accordance with the present invention by the provision of a combination of elements which are fabricated in a manner substantially as described in the above abstract and summary.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one embodiment of the present invention;

FIG. 2 is an enlarged, side elevational view of the apparatus disclosed in FIG. 1;

FIG. 3 is a cross-sectional view taken along line 3—3 of FIG. 4; while FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an enlarged, fragmentary, part cross-sectional view of part of the apparatus disclosed in the foregoing figures;

FIG. 6 is a broken, part cross-sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a fragmentary, part cross-sectional view similar to FIG. 5, which sets forth another embodiment of the present invention;

FIG. 8 is a fragmentary, part cross-sectional view, similar to FIG. 5, which sets forth still another embodiment of the present invention;

FIG. 9 is a reduced top plan view of a collapsible bag used in conjunction with the apparatus disclosed in the foregoing figures with some parts thereof being broken away so as to disclose some of the parts therebelow;

FIG. 10 is a side elevational view of the bag apparatus disclosed in FIG. 9, with the bag being in expanded configuration;

FIG. 11 is a side elevational view of the bag disclosed in FIG. 9 with the bag being disclosed in the fully collapsed configuration;

FIG. 12 sets forth a top elevational view of a modification of the apparatus disclosed in the foregoing figures;

FIG. 13 is a part diagrammatical, part schematical illustration of one use of the present invention;

FIG. 14 is an enlarged, detailed, fragmentary, part cross-sectional representation of the check-valve assembly disclosed in FIG. 13;

FIG. 15 is a disassembled, fragmentary representation of a modification of part of the apparatus of FIG. 5;

FIG. 16 is similar to FIG. 5 and sets forth still another embodiment thereof; and

FIG. 17 is similar to FIG. 16 and sets forth a modification thereof.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1, together with FIGS. 2 - 6, disclose a closed wound suction apparatus 15 made in accordance with the present invention. The apparatus is comprised of spaced contiguous plate members 16, 17 movable relative to one another. Hereinafter the movable plate 16 is referred to as the "movable plate" and plate 17 is referred to as the "fixed plate."

One of a plurality of biasing means 18 provides a distracting force by which the plates are urged to move away from one another. Spaced guide means in the form of a female member or housing 20 telescopically receives a post 19 in a slidable manner therethrough.

Each plate member has an adjacent opposed bag receiving face 21 and 22, respectively, which can be moved substantially into abutting engagement with one another, or into abutting engagement with opposed faces of the bag when the bag is placed in sandwiched relationship therebetween.

A recessed peripheral marginal edge portion 23 of the plate extends about the entire perimeter thereof. One plate member is apertured at 24 for receiving the neck or inlet of a collapsible bag therethrough. Annular stop means 25 defines the upper terminal end of the housing. The internal wall surface 26 of the housing and the external wall surface of the post 19 forms the annulus 26'. Biasing means in the form of a coil spring 27 is concentrically arranged relative to the housing and to the post, with one terminal end of the spring abuttingly engaging the cup-like annular groove 28 at the base of the post while the remaining terminal end of the spring abuttingly engages the before mentioned annular stop means 25.

The terminal end 29 of the post is provided with pin 30, thereby capturing stop washer 31 therebelow. Peripheral shoulder 32 defines the outermost edge portion of each of the plate members.

The collapsible bag 34 preferably has a side wall thereof formed into pleats 35 in the nature of an accordion, with opposed outer surfaces 36, 37 of the bag being provided with an adhesive material 39 by which the face of the bag can be releasibly secured to the face of the plate. Protective overlay paper 38 isolates the adhesive until it is needed in order to releasibly secure the bag to the plate. The side wall of the bag must be sufficiently resilient to be easily made into the accordion-like configuration, yet the bag must have a structural integrity sufficient to avoid rupture while in use.

As seen in the embodiment of FIG. 7, the post 19 extends into and terminates within the interior of the housing 120. The housing is closed at 125 and open at the opposite end to form a post receiving chamber 126'. Spring 127 is disposed within the chamber with the free terminal end of the post and the innermost portion of the chamber receiving the compressed spring therebetween. The spring preferably is affixed to the closure member 125 so that it will not become dislocated during disassembly.

In the embodiment of FIG. 8, the post 119 is provided with a removable cap 231, and is apertured at 45. Pin 46 is received through aperture 45 when plate face 21 is placed in close proximity of plate face 22, thereby holding the plates adjacent to one another.

In FIG. 9, numeral 34 indicates a square bag, while in FIG. 12, numeral 134 indicates a round bag.

In FIGS. 10 and 11, inlet 42 provides a means by which a tubing connection can be made to effect a flow passageway into the interior of the disposable bag.

FIG. 12 illustrates a closed wound suction apparatus made in a manner similar to FIG. 4, but with the plate members being circular in configuration, and with the round plastic bag 139 lying between the contiguous plate members.

FIGS. 13 and 14 illustrate a check valve 50 series connected between inlet 42 of the collapsible bag and an elongate plastic tubing 53. Tubing 53 has a marginal free end portion thereof apertured in the illustrated manner of numeral 51, with the apertured portion of the tubing being placed within the interior of a closed wound diagrammatically illustrated by the numeral 52. The check valve can be anchored by a conventional clamp 54 in close proximity to the inlet 42, if desired. Numeral 55 illustrates reinforcement provided on the bag neck so as to increase the structural integrity of the inlet portion thereof.

Annular abutment 56 prevents the depending end 57 of the check valve assembly from being excessively telescoped into the bag inlet. A circumferentially extending depression 58 enables fastening means in the form of a clamp, or a rubber band, to be placed thereabout so as to positively secure the check valve assembly to the inlet. Ball 59 is captured within the check valve assembly by transverse pin 60 so that the ball is retained closely adjacent to a valve seat 61. The ball will sealingly engage the seat should backflow inadvertently occur through the tubing.

Looking now to the details of FIGS. 16 and 17, there is disclosed a guide means 118 in the form of the before mentioned post 119 which is slidably received in a reciprocating manner by the housing 120. Spaced hooks 65, 66, respectively, are attached to the terminal end of the post and of the housing, respectively, to provide purchase for the free ends of a spring 127.

In FIG. 17, a rubber band 227 has been substituted for the tension spring 127 of FIG. 16. The number of and the elasticity of the rubber bands determine the biasing force of the biasing means.

In operation, the apparatus is placed in a standby configuration by allowing the plates to be displaced from one another a maximum amount, thereby enabling the movable plate to be removed from the apparatus. The collapsible bag is unpackaged from its sterile container, and the protective overlay is removed from the adhesive located on one face of the bag. The bag is then placed upon the fixed plate so that the exposed adhesive securely holds the bag to the plate face. The protective paper is next removed from the remaining side of the bag, thereby exposing the adhesive bearing area thereof. The movable plate member is properly assembled to the fixed member and face 21 brought to bear against the remaining exposed adhesive. Bag neck inlet 42 at this time will be telescoped through aperture 24, thereby enabling the check valve assembly 50 to be assembled thereto in the illustrated manner of FIGS. 13 and 14.

The apertured free marginal end of the plastic tubing is surgically placed in the operative wound and brought percutaneously to emerge from the skin some distance from the wound itself, whereupon the wound is then closed by suturing. The remaining end of the tubing is connected to the check valve assembly in the illustrated manner of FIG. 14. Before effecting the connection at 50, the collapsible bag is fully collapsed by moving the movable plate member towards the fixed plate member, thereby completely collapsing the bag, and expelling air therefrom. With the bag held in a collapsed configuration, the tubing connection at the check valve assembly is effected, whereupon the plate members are then permitted to be detracted from one another by the biasing means. This action produces a reduced pressure within the entire system, including the closed wound itself.

Any secretions, including blood, are immediately withdrawn as they are formed within the wound. The suction established within the sterile bag causes a continuous flow of the fluids from the wound with the fluids accumulating within the sterile bag.

As the fluids accumulate within the sterile bag, should bacteria inadvertently be introduced into the system, the contaminated fluid cannot be reintroduced into the wound because of the presence of the check valve assembly 50 should the direction of flow inadvertently be reversed. Should it become necessary to change a bag, it is preferred that a tube clamp be placed upstream of the check valve, and the check valve inserted into the inlet of another closed wound suction apparatus of the present invention. Should a second unit be unavailable for use, it is merely necessary to assemble the unit with a new bag being sandwiched between the opposed plate members, whereupon the check valve assembly can then be plugged into the neck or inlet of the new sterile bag.

The used bag is easily removed from the plate members by grasping an edge portion of one of the opposed faces of the bag and pulling the bag at an acute angle from the plate member, similar to the manner in which a piece of masking tape is removed from a polished surface. The used bag can be sealed and destroyed in the usual manner. The adhesive is selected from any commercially available non-hardening material. The protective paper may be provided with a coating of silicon material to facilitate its release from the adhesive.

In order to remove the plate member 16 from the assembly of FIG. 5, pin 30 and washer 31 are removed from the post, whereupon the housing can then be telescoped off the post as the plate is lifted free of its guide means. Where keeper 131 is used in lieu of the pin and washer arrangement, the handle 144 is pulled with sufficient force to cause the spaced legs forming the split washer 143 to be released from the annular groove 130 of post 119.

In removing the plate member from the assembly of FIG. 7, the plate is merely lifted upward, carrying spring 127 therewith. Reversal of this procedure is necessary for reassembly of the apparatus.

In order to disassemble the apparatus disclosed in the embodiment of FIG. 8, cap 231 is unscrewed from the threaded upper marginal end portion 230 of the post 119 in order to remove the movable plate member from the fixed plate member. After the bag has been assembled to the opposed plate members, the air is expelled from the bag in the before described manner,

and the plates are left contiguous to one another until the system is placed in use by anchoring the post to the housing by means of the pin 46 which is placed within the aperture 45, so that the pin bears against the housing closure 25, thereby preventing further movement of the post relative to the movable plate. As seen in the illustration of FIGS. 1 and 13, the apparatus can be placed upright on a plate member or inverted so that it is supported by the guide means.

The major components of the present invention preferably are made of molded plastic, although it could equally well be fabricated from aluminum, steel, or alloys.

I claim:

1. Closed wound suction apparatus for providing continuous suction in post operative wounds comprising spaced contiguous plate members, each plate member having a face, said plate members being arranged to provide opposed faces, spaced guide means by which said members are superimposed one upon another and movable in aligned relationship with respect to one another;

biasing means by which one said plate member is urged to move away from the other said plate member;

a collapsible bag, said bag having opposed surfaces thereon, means by which said opposed surfaces are removably affixed to said opposed faces of said plate members;

means forming an inlet to said bag, a tubing said tubing having one end thereof affixed to said inlet and a free end thereof for placement within a wound;

whereby, when said bag is partially collapsed and said free end of the tubing is surgically placed within a wound, any secretions formed within the wound are forced to flow through the tubing and into the bag.

2. The apparatus of claim 1 and further including means forming an adhesive, said opposed surfaces of said bag being coated with said adhesive to provide for said means by which said opposed surfaces of said bag are removably affixed to said opposed faces of said plate members.

3. The apparatus of claim 1 wherein said bag is provided with a plurality of accordian like folds formed between said opposed surfaces thereof so that said opposed surfaces may be distracted relative to one another when said faces of said plate members are distracted relative to one another.

4. The apparatus of claim 1 wherein said guide means includes spaced posts affixed about a marginal edge of one said plate member, and spaced housings affixed about a marginal edge of the remaining plate member with each housing and post being aligned respective to one another so that the post is reciprocatingly received within the housing.

5. The apparatus of claim 4, wherein said biasing means is a spring located within said housing, and arranged in compression with one end biasing one plate in a first direction and another end biasing the remaining plate in a direction opposed to said first direction, thereby biasing the plates apart.

6. The apparatus of claim 4 wherein said biasing means is a resilient elongate member located with one end affixed to a post and the other end affixed to a housing with said resilient member being placed in ten-



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sion so as to force one plate member away from the other plate member.

7. The apparatus of claim 1, wherein said collapsible bag is made of plastic, and is provided with accordian like folds about the periphery thereof which joins together the opposed surfaces thereof.

8. The apparatus of claim 1, wherein a one-way check valve means is flow connected in series relationship between said bag and the free end of said tubing so that flow from the wound can flow through the check valve and into said bag, while flow from said bag cannot occur toward the wound.

9. The apparatus of claim 1 wherein said bag and said tubing are packaged in sterile condition in a container so that a plurality of bags and tubes may be supplied for a single plate apparatus, thereby enabling a used bag and tubing to be disposed of after use.

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10. The apparatus of claim 1 wherein said opposed surfaces of said bag are provided with a coating of an adhesive material to provide for said means by which said opposed surfaces are removably affixed to said opposed faces of said plate members;

said opposed surfaces of said bag having a protective coating removably attached to the adhesive coating so that the protective coating may be removed, thereby enabling the bag to be secured to the plate by the exposed adhesive material;

said bag is provided with a plurality of accordian like folds between said opposed surfaces so that said opposed surfaces may be distracted relative to one another when said faces of said plates are distracted relative to one another.

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