United States Patent [19]

Nichols

[11] **3,822,978**

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[54] **PORTABLE VACUUM FORMING APPARATUS**

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[52] **U.S. Cl.** **425/388,** 425/450

[51] **Int. Cl.** **B29c 17/04**

[58] **Field of Search** 425/388, 450

[56] **References Cited**

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Attorney, Agent, or Firm—Leo Gregory

[57] **ABSTRACT**

A portable vacuum forming apparatus consisting of a housing parallelepiped in form including hinged portions comprising a heating member, a vacuum member and a material holding member hinged to said housing swingable between said heating member and said vacuum member, said material holding member comprising an outer frame and an inner frame seating therein, and hinge means connecting said frames, said means resiliently yielding to accommodate various thicknesses of sheet material disposed between said frames and means locking said frames in operating position.

1 Claim, 9 Drawing Figures

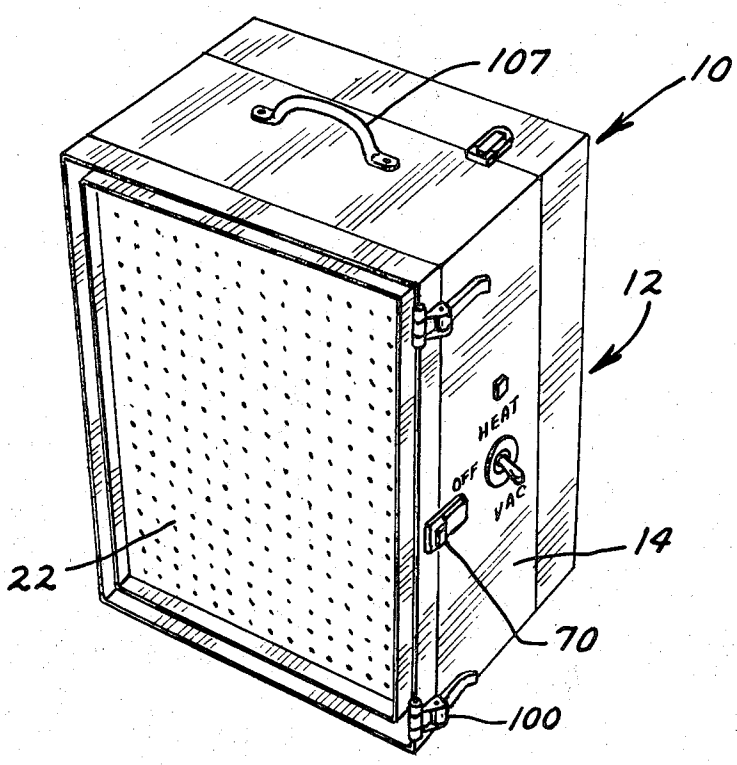
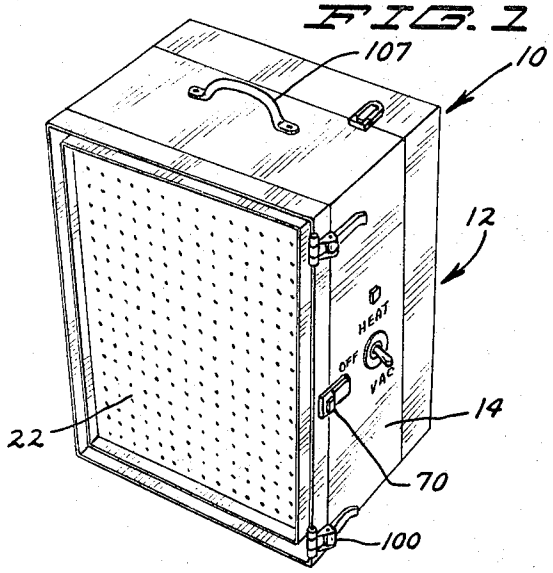


FIG. 1



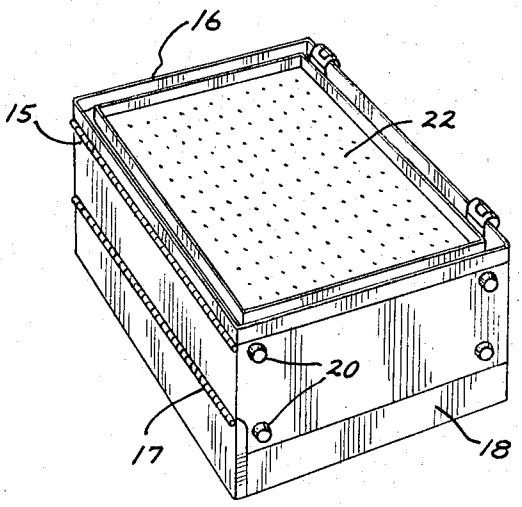
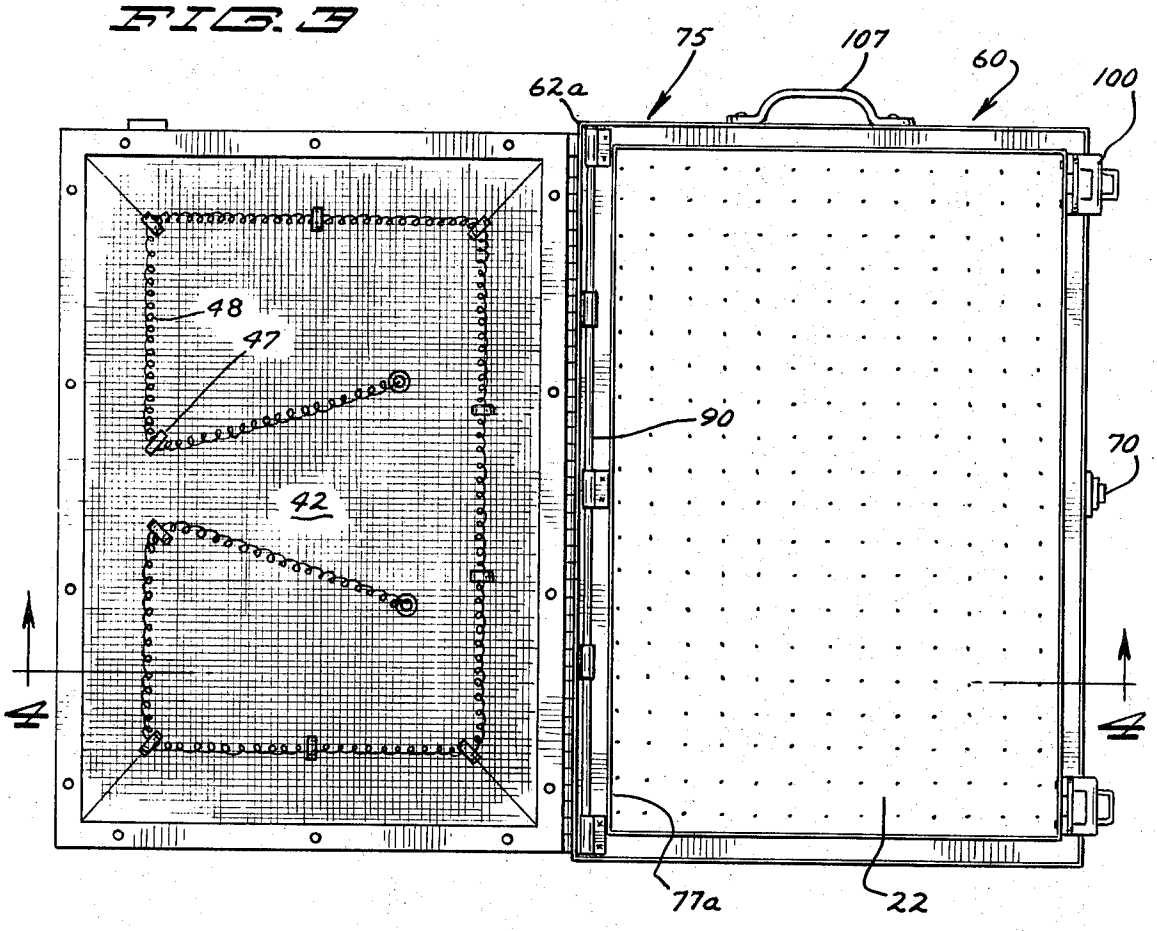


FIG. 2

FIG. 3



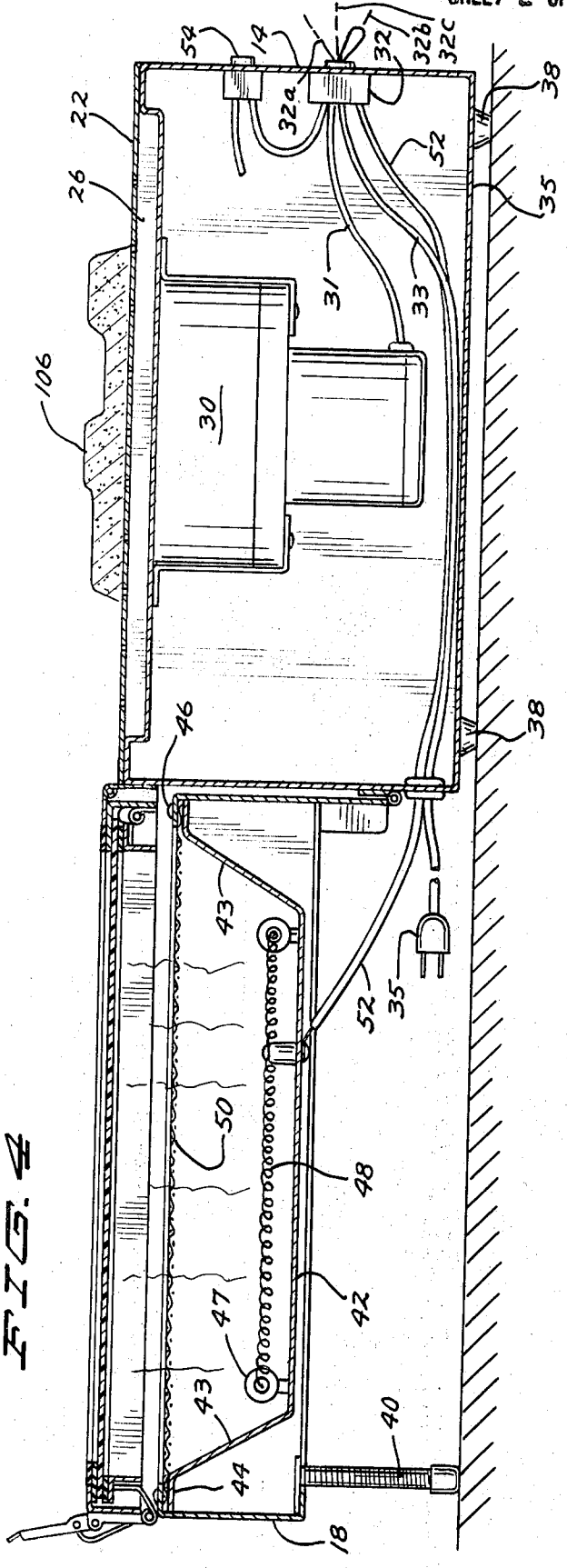

54
14
32
32b
32c
32a
38
22
26
52
35
31
33
106
30
46
38
43
52
35
50
48
42
47
43
40
44
18

FIG. 4

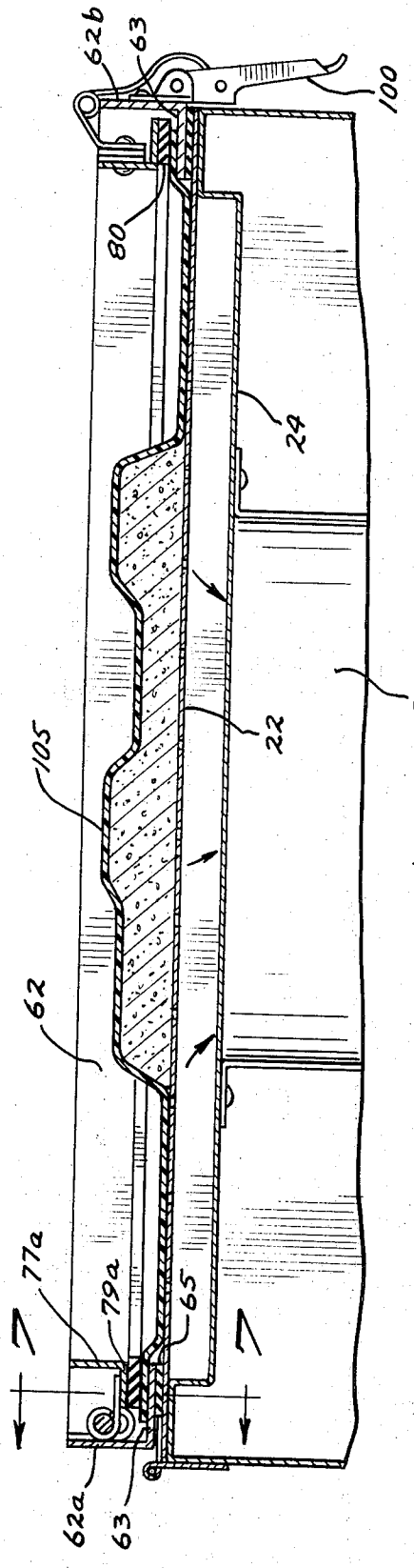

62b
63
100
80
24
30
22
105
62
77a
79a
65
62a
63

FIG. 5

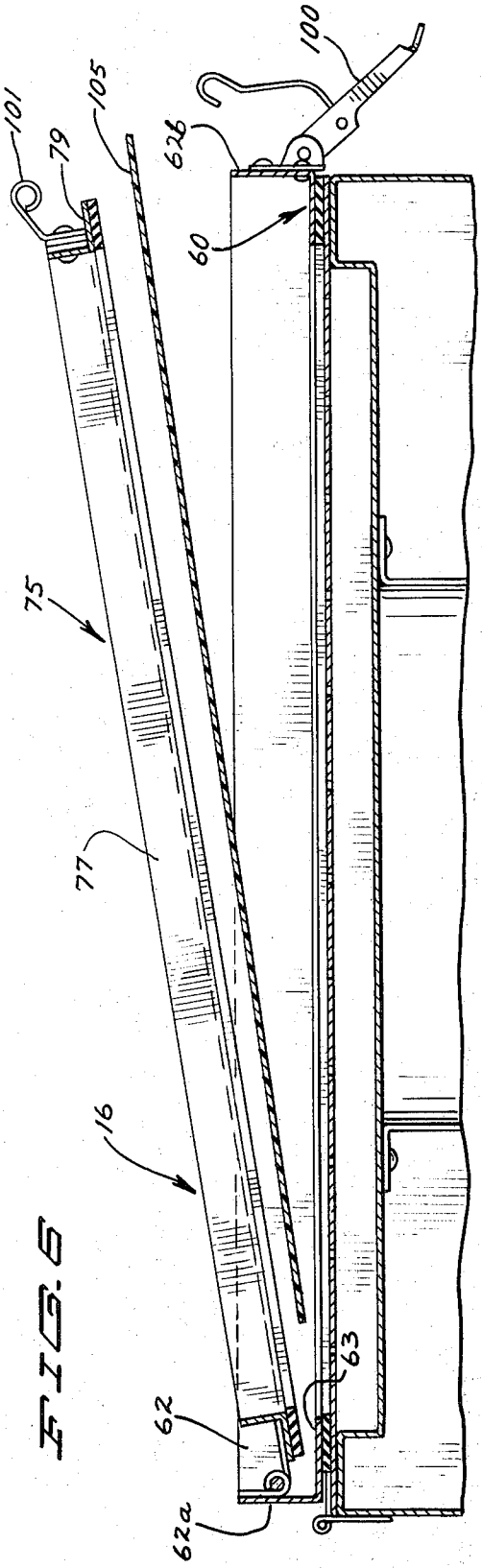


FIG. 6

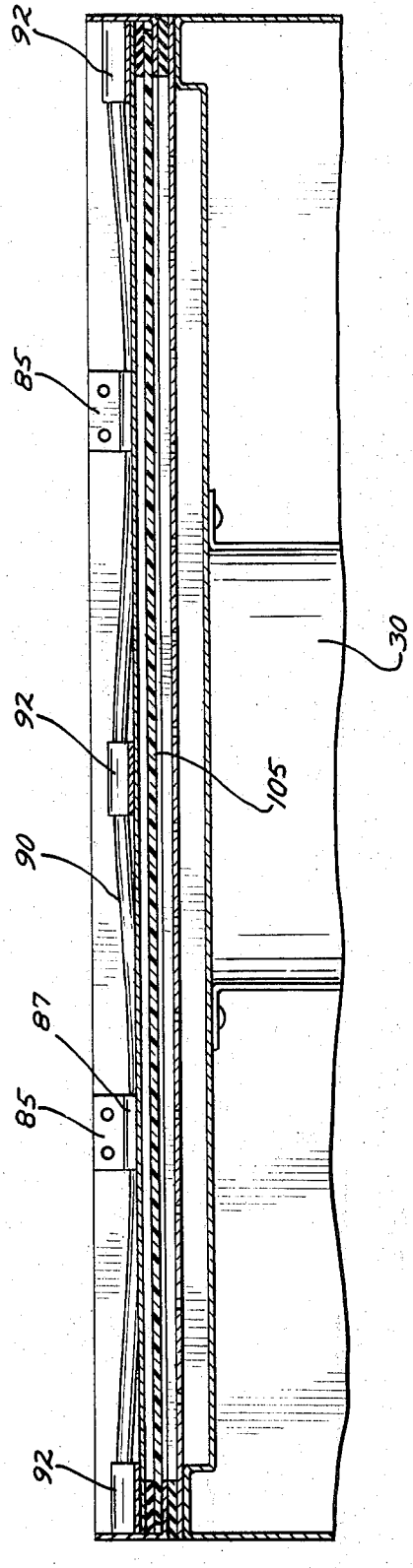


FIG. 7

FIG. 8

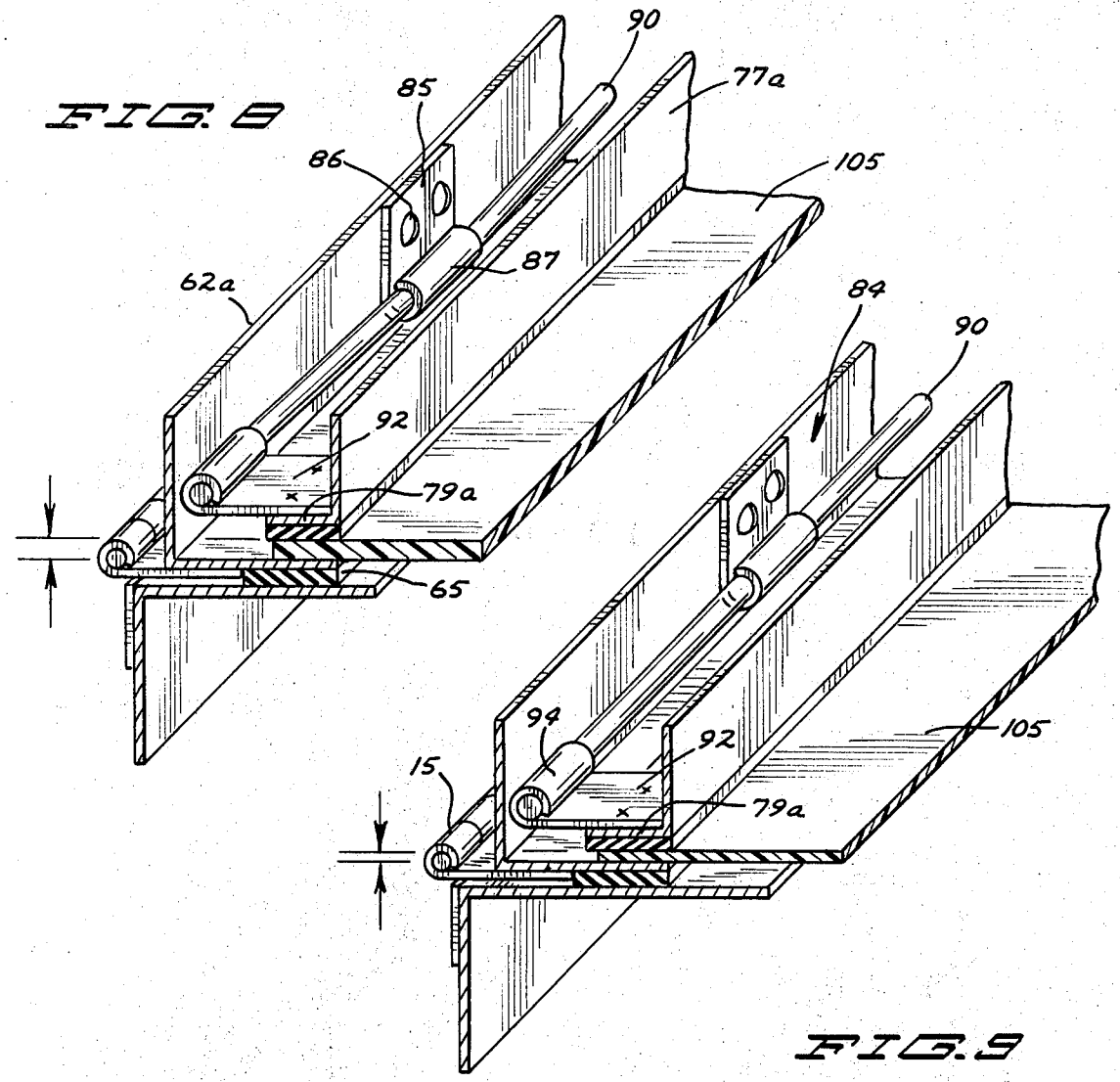


FIG. 9

PORTABLE VACUUM FORMING APPARATUS

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a portable vacuum forming apparatus.

Vacuum forming apparatus generally is regarded as representing a substantial piece of machinery and generally comprises a permanent fixture.

It is desirable to have a vacuum forming apparatus for use in many areas wherein a large or permanent piece of apparatus would not be practical. It is desirable to have such an apparatus for use as in creative or art classes in learning or training institutions and as for hobby use for home.

It is an object of this invention therefore to provide a relatively inexpensive portable vacuum forming apparatus.

It is another object of this invention to provide a compact arrangement of the essential elements for vacuum forming such that they may be assembled for carrying and for ready arrangement into operating position.

It is a more general object of this invention to provide a portable vacuum forming apparatus comprising a casing arrangement to be carried, said casing including a portion consisting of a vacuum pump having an apertured overlying plate, a hinged second portion of said casing including a heating element and a frame member swingable from a position overlying said heating element to a position overlying said apertured plate, said frame member being arranged to hold therein sheets of material to be formed.

It is a further object of this invention to have said above described frame member include means to accommodate various thicknesses of said sheets of material to be held therein.

These and other objects and advantages of the invention will be set forth in the following description made in connection with the accompanying drawings in which like reference characters refer to similar parts throughout the several views and in which:

FIGS. **1** and **2** are views in perspective on a reduced scale of the apparatus herein;

FIG. **3** is a top plan view of the apparatus in operating position;

FIG. **4** is a view in vertical cross section on an enlarged scale taken on line **4**—**4** of FIG. **3** as indicated;

FIG. **5** is a broken view in vertical cross section on an enlarged scale showing the structure herein in an operating position;

FIG. **6** is a view similar to FIG. **5** showing another step in the operation of the apparatus;

FIG. **7** is a broken view in vertical cross section taken on line **7**—**7** of FIG. **5**; and

FIGS. **8** and **9** are fragmentary views in perspective on an enlarged scale showing details of structure.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawings, the structure comprising the subject matter of the invention herein and representing a portable vacuum forming apparatus and particularly a drape forming apparatus is indicated generally by the reference numeral **10.** Generally stated said

apparatus **10** is shown consisting of a housing **12** substantially parallelepiped in form having a central body portion **14** which includes a vacuum plate and vacuum pump having hinged at one side thereto as by a piano hinge **15** a body portion **16** which comprises a material holding member, and hinged to the other side thereof as by a piano hinge **17** is a body portion **18** which comprises the heating element and forms a heat table.

Said apparatus **10** is shown in its compact upright inoperative or carrying position in FIG. **1** supported on leg members **20.** In FIG. **3** said apparatus is shown opened and disposed in operating position as hereinafter described.

Said central body portion **14** has an upper wall **22** comprising an apertured plate member forming a vacuum plate. Underlying said vacuum plate member **22** is a downwardly offset plate member **24** having a substantial central portion thereof spaced below said vacuum plate **22** forming a chamber or manifold **26.** Underlying said plate member **24** and carried thereby and having communication with said chamber **26** is a vacuum pump **30.** Said vacuum pump is a conventional structure and has a line **31** running to the "On Vacuum" position contact **32***a* of a two position toggle switch **32.** A line **33** having a terminal **35** runs from the "Off" position contact **32***c* of said switch **32** to a power source.

Supporting said housing **14** when in operative position as indicated in FIG. **4** are leg members **38.** Said body portion **18** in operative position is shown supported at its free end by a leg member **40.**

Disposed within said body portion **18** is a downwardly offset or recessed plate member **42** having inclined side walls **43** having a peripheral flange **44** thereabout secured as by screws to an upper flange portion **46** of said body portion **18.** Carried on said plate member **42** and supported thereon by insulators **47** is a heating coil **48.** Forming the upper wall of said body portion **18** is a fairly coarse mesh screen **50.** A line **52** runs from the heating coil **48** to the "On Heat" position contact **32***b* of said toggle switch **32.** A light signal **54** is provided wired to be energized when the switch is in one of the "On" positions. Said switch is preferably adapted to automatically shut off the vacuum pump and hence the toggle must be held in "On Vacuum" position.

It will be noted in FIG. **4** that the body portion **18** swings outwardly sideways from said housing portion **14** as indicated in FIG. **1** and said portions **14** and **18** are then placed in a horizontal operating position as indicated in FIG. **4.**

Said body portion **16** comprising a material holding member consists of an outer frame member **60,** said frame member being right angled in cross section having an upstanding annular wall portion **62** having a right angled flange base portion **63.**

Said base flange portion **63** has attached thereto an underlying layer of resilient material **65.** Said frame member **60** is adapted to overlie the periphery of said vacuum plate **22** and is latched thereto for carrying purposes by a toggle locking member **70** centrally of the free side thereof as indicated in FIGS. **1** and **3.**

Disposed to be seated or nested in said frame member **60** is an inner frame member **75** comprising a right angled upstanding annular wall **77** and an outwardly disposed flange **79,** said flange **79** being adapted to seat on the adjacent underlying side of said flange **63.** Un-

derlying said flange **79** is a strip **80** of resilient material. The rear flange portion **79***a* of said flange **79** extends adjacent the rear wall **62***a* of said outer frame **60.**

One of the essential elements of novelty in the structure herein is the arrangement by which said inner frame member **75** by a hinge structure **84** is hinged to said outer frame member **60** as indicated in FIGS. **5–9.** A pair of hinge plate members **85** are secured to said rear wall **62***a* of said frame member **60** in spaced relation as indicated in FIG. **7** with said hinge members being suitably secured as by screws **86** and having their lower end portions curved to form tubular hinge portions or knuckles **87** through which is disposed a flexible cylindrical hinge rod **90** extending the full length of the rear wall portion **77***a* of said wall **77.** Said flange portion **79***a* which corresponds to said wall portion **62***a* carries thereon a plurality of hinge plate members **92** consisting of plate portions secured as by welding to said flange **79***a* and having reversely curved free end or knuckle portions **94** which are aligned with said hinge portions **87** to receive therethrough said rod **90.** Hence it is seen that said rod **90** is secured to the flange **62***a* by the hinge members **85** and is secured to and carries the flange portion **79***a* and the inner frame member **75** by means of said hinge members **92.**

The forward wall portion **62***b* of said wall **62** carries a pair of spaced toggle latch members **100** adapted to engage corresponding keepers **101** carried by said frame **60** to secure said frames together in operating position.

Adapted to be disposed into said frame **60** to overlie the flange **63** and to underlie the flange **79** for illustration of the operation thereof is a sheet of vacuum forming material **105** such as polystyrene to be used to be formed as will hereinafter be described by being draped over a removable mold **106** disposed to overlie the vacuum plate **22.**

In FIG. **1,** a handle **107** is secured to the body portion **14** for carrying the apparatus.

OPERATION

FIG. **1** shows the apparatus in its compact carrying condition. It is readily carried about by hand.

For use, the apparatus is opened up as shown in FIGS. **3–5** and the power line **33** will be plugged into a convenient electric current source.

The outer frame **60** is unlatched from the body portion **14** and the inner frame **75** is unlatched from said outer frame **60** as indicated in FIG. **6.** A sheet of suitable material **105** for forming is layed into said frame **60** and is overlayed with said frame **75.** The respective annular flange portions of said frames **60** and **75** secure said sheet therebetween and said inner frame is latched to said outer frame.

Said mold **106** is then placed to overlie the vacuum plate **22.** The operator will then swing the frames **60** and **75** to overlie the screen **50** and the heating element **48** therebelow. The toggle switch is then moved to the "On Heat" position. Said sheet **105** is then suitably heated.

Upon said sheet being suitably heated, the operator with one hand moves the toggle of said switch **32** from the "On Heat" to the "On Vacuum" position and holds said toggle in said position. At the same time the operator swings the sheet of material to overlie the mold **106.** Upon said sheet becoming draped over the mold and drawn thereunto by the operation of the vacuum pump **30,** said toggle is then released to "Off" position. With respect to said toggle switch, it must be held in the "On Vacuum" position or else it will automatically move to "Off" position. The frame **75** is unlatched and swung away from the frame **60** and the formed sheet **105** therebetween is removed.

A particular element of novel structure is present in the adaptability of said frames **75** and **60** to accommodate a range of thicknesses of sheets of said material to hold said sheets in a tight secured position. The novelty is present in the structure of the hinge **74.**

It is noted that the flexible hinge rod **90** is secured to the flange portion **62***a* by the hinge members **85** and is secured to the flange portion **77***a* by the hinge members **92.** The respective hinge members **92** and **85** are spaced apart laterally sufficiently that when stress is placed upon the flange **79***a* by an underlying sheet of material, that said flange portion and the overlying hinges **92** carried therebetween urge said hinge rod **90** upwardly to provide necessary clearance to accommodate various thicknesses of sheet material. Said hinge rod yields upwardly between said hinge members **85** as illustrated in FIGS. **7** and **8.** Thus there is maintained a secure gripping upon the sheet of material inserted into said frame **60.** The initial clearance provided between said frames **60** and **75** as indicated in FIG. **9** is a clearance to accommodate a minimum sheet thickness of the material to be used for molding purposes.

The apparatus has proved to be very successful in use due to its portability and due to its operation in very nicely receiving various thicknesses of sheet material for molding purposes and securely holding the same in the operation of the apparatus.

It will of course be understood that various changes may be made in form, details, arrangement and proportions of the parts without departing from the scope of the invention herein which, generally stated, consists in an apparatus capable of carrying out the objects above set forth, in the parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:

1. A portable vacuum forming apparatus including a vacuum member and a heating member, having in combination

a material holding member comprising

an outer frame member,

an inner frame member seated within said outer frame member in operating position,

said members having superposed flange portions holding a sheet of material therebetween,

a hinge swingably connecting a pair of adjacent sides of said frame members, said hinge comprising

a plurality of hinge plate members secured to said pair of adjacent sides of said frames, alternate of said hinged plate members being secured to said outer frame and the remaining of said hinged frame members being secured to said inner frame, said hinged plate members being in laterally spaced relation,

said hinged plate members having axially aligned tubular portions,

a flexible rod disposed through said tubular portions of said hinged plate members, and

said rod flexing providing adjustable vertical spacing between said inner and outer frame members in operating position accommodating various thicknesses of sheet material therebetween.

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