

Nov. 6, 1945.

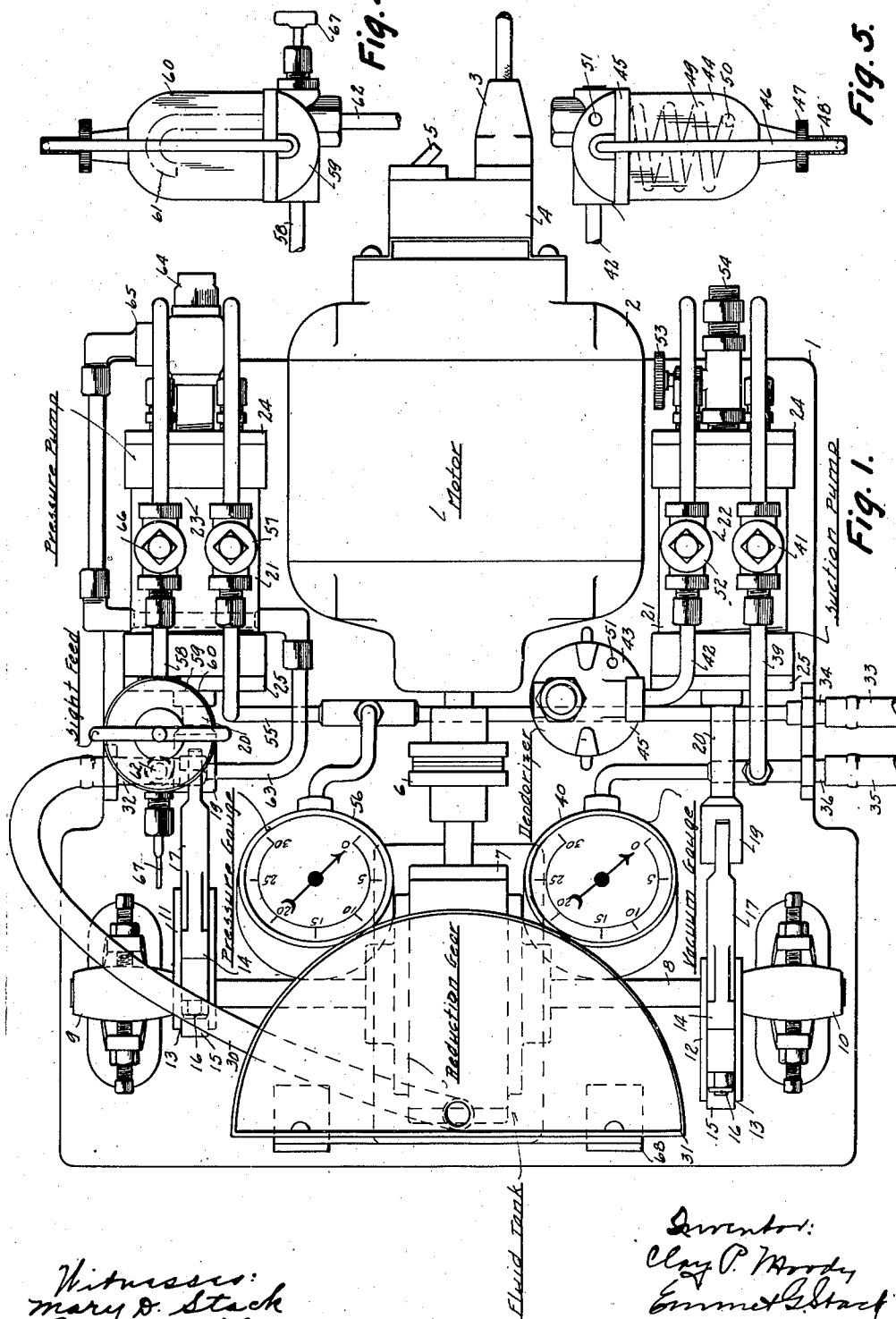
C. P. MOODY

2,388,337

METHOD FOR PREPARING CADAVERS FOR BURIAL

Filed Dec. 11, 1939

2 Sheets-Sheet 1



Nov. 6, 1945.

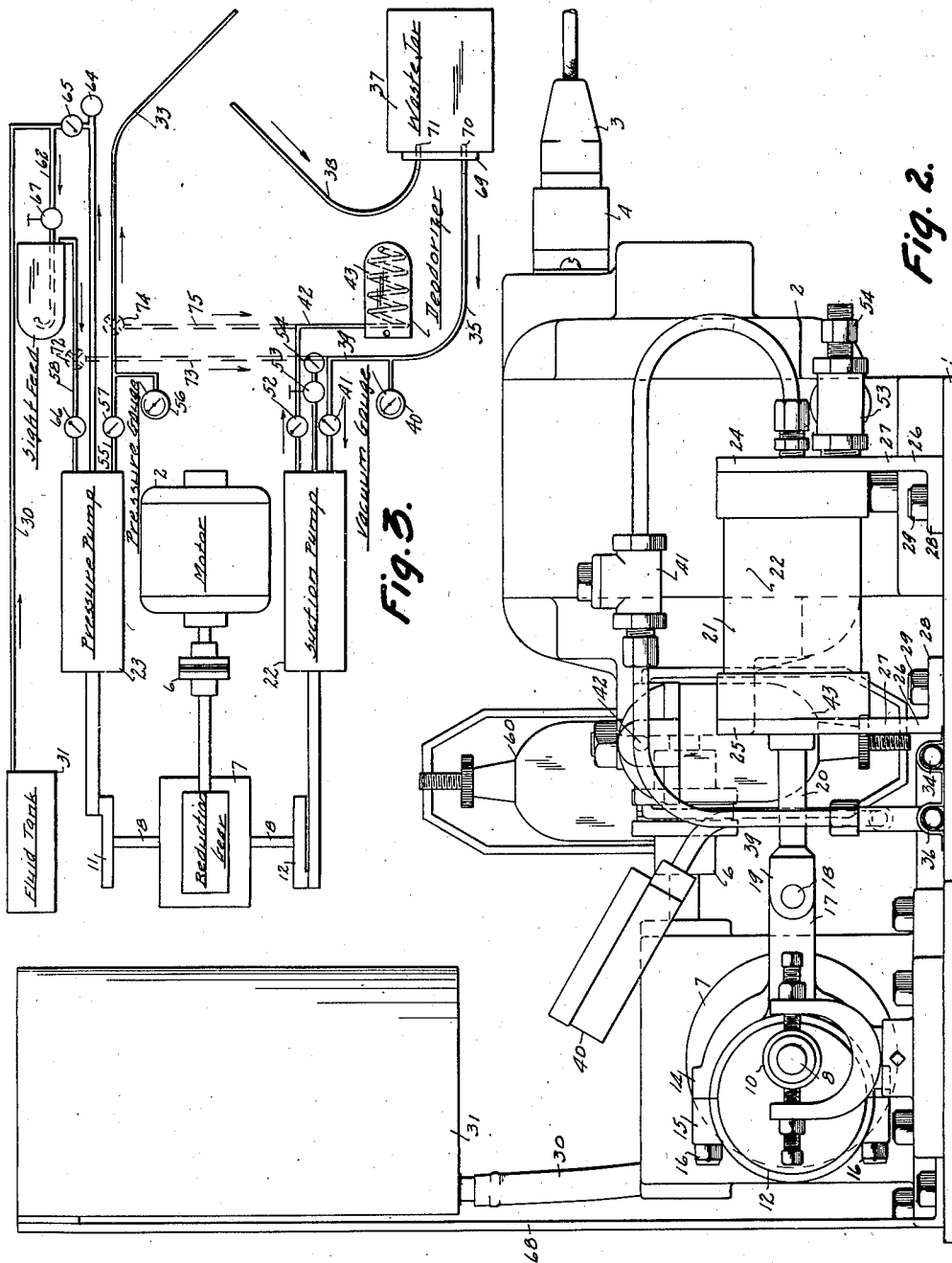
C. P. MOODY

2,388,337

METHOD FOR PREPARING CADAVERS FOR BURIAL

Filed Dec. 11, 1939

2 Sheets-Sheet 2



Witnesses:
Mary A. Stack
Richard F. Stack

Inventor:
Clay P. Moody
Emmett C. Stack
Att'y.

UNITED STATES PATENT OFFICE

2,388,337

METHOD FOR PREPARING CADAVERS FOR BURIAL

Clay P. Moody, North Bend, Oreg.

Application December 11, 1939, Serial No. 308,681

9 Claims. (Cl. 27-22)

My invention relates to a method and apparatus for injecting embalming fluid under pressure into the arterial system of the dead human body and for withdrawing blood from the venous system thereof by suction, which pressure and suction are characterized by pronounced surges of pressure followed by intervals of non-pressure and surges of suction followed by intervals of non-suction, and is a continuation in part of my application filed August 23, 1938, Ser. No. 226,389.

My invention is an improvement over the much discussed and publicized "constant pressure" methods and apparatus exemplified in the patents to Dwyer, 1,806,845, Grontkowski, 2,118,704, and many other "constant pressure" devices which have appeared on the market commercially during the past several years, all of which employ pressure tanks and/or other means of delivering embalming fluid to the body under constant pressure which must be manually controlled in some manner by the operator to meet the changes in resistance in the body.

The principal object of my invention is to produce a better embalmed body.

Another object is to save time and money in doing it.

Another object is to eliminate a very definite hazard to the embalmer's health.

Another object is to eliminate in large measure the necessity of coming into bodily contact with residue from the cadaver and to eliminate offensive and dangerous odors and gas resulting from the embalming operation.

Another object is to provide apparatus which will inject embalming fluid into the arterial system of a cadaver in accordance with the resistance in said system.

Another object is to provide apparatus whose fluid delivery pressure varies automatically with the resistance encountered in the body.

Still another object is to provide apparatus by which the venous system may be aspirated without vein collapse.

The method and apparatus by which the above and other objectives are effected is later described and the apparatus is shown in the accompanying drawings.

Fig. 1 of the drawings is a plan view; Fig. 2 is a side view; Fig. 3 is a diagram showing the interconnections between pumps; Fig. 4 is a side view of the fluid sight feed; and Fig. 5 is a side view of the deodorizer.

Thruout the drawings and the specification similar numerals refer to similar parts.

Since I utilize both suction and pressure, I may

use a single pump. However, because of the small capacity required in the pressure pump, I believe it best to separate and distribute the work between two pumps. In so doing, I get a better balanced, smaller, and more compact apparatus, yet one that is easier to get at, build, or assemble. In the arrangement shown in Fig. 3, two pumps are necessary as will be explained later on. The scale of the drawings is one-half which shows how small and compact the apparatus may be, yet, how easily one may observe its functions and make adjustments thereto. Except for the arrangement shown in Fig. 3, the two pumps are to be considered the equivalent of a single pump.

The apparatus of my invention includes a motor, reduction gear, and pumps, which are mounted on the steel plate base 1. The motor 2 is connected to any suitable source of power thru the agency of the plug 3. The duplex receptacle 4 is mounted on the motor 2 and has one side formed to receive the plug 3 and the other side provided with the motor switch 5. The motor 2 is direct connected thru the flexible coupling 6 to the reduction gear 7 whose gear shaft 8 extends on both sides to receive, outside and adjacent its outboard bearings 9 and 10, the eccentrics 11 and 12, respectively. These eccentrics 11 and 12 are shown oppositely mounted but may be shifted around on their shaft to be parallel to one another or to have any other desired relation to one another. Each eccentric is formed with an annular peripheral groove 13 for the reception and retention of its strap and cap 14 and 15, respectively, which are secured together by the studs 16. The eccentric rod 17 is hingedly connected by the pin 18 to the crosshead 19 formed on one end of the piston rod 20 connected to its piston head (not shown) which is adapted to be reciprocated in the cylinders 21 of the pumps 22 and 23. These cylinders 21 have rear heads 24 integral therewith and front heads 25 threadedly secured thereto. Since the forward stroke is not utilized when two pumps are used, no packing glands are required, in fact, back pressure is released thru a vent (not shown) provided in the front head 25. The absence of gland packing is one of the advantages accruing in the use of two pumps. Another advantage is that there is no possibility of fluid leakage into the suction which might be possible with a one pump arrangement if the piston thereof was not tight. Since the pistons are not shown, it is believed sufficient to say that any tight commercial type may be employed. I use one constructed with two oppositely disposed cup leathers and find it satisfac-

tory. Support for the pumps 22 and 23 is provided by the L-shaped standards 26 having their leg 27 welded or otherwise secured to the heads 24 and 25 and their leg 28 secured to the base plate 1 by the bolts 29.

As disclosed in Fig. 1, the piston in the venous or suction pump 22 will be at the end of its suction stroke, while the piston of the pressure or arterial pump 23 will be at the end of its pressure stroke. Pipe or copper tubing, tubing being shown, may be used for the pump suction and pressure lines adjacent the machine. A rubber tube 30 connects the fluid tank 31 with the suction line terminal fitting 32 of the pressure pump 23. This tank 31 is open for the reception of fluid at all times, and may be provided with a valve (not shown) to close automatically and immediately the tank becomes empty to prevent air being pumped into the arterial system of the cadaver. A rubber tube 33 connects with the pressure line terminal fitting 34 of the pressure pump 23 and receives at its opposite end the artery tube (not shown). A rubber tube 35 connects the suction line terminal fitting 36 with the blood or waste jar 37 adapted to be exhausted to provide a vacuum therein. This jar is connected with the vein tube (not shown) by another length of rubber tubing 38. These lengths of rubber tubing provide the required flexibility between the machine, which is usually stationary, and the vein and artery tubes which are moved about by the operator. They also permit quick and easy connections to be made to the terminal fittings. The suction line 39 of the suction pump 22 is connected to the rear head 24 of said pump and to the terminal fitting 36. This line 39 is provided with a vacuum gauge 40 and a check valve 41. The pressure line 42 of the suction pump 22 is connected to the rear head 24 of said pump and to the deodorizer 43 clearly shown in Fig. 5. This deodorizer comprises a glass cup 44 having a removable cap 45 held by the wire loop clamping means 46 tightened and loosened by the nut 47 on the loop holding bar 48. The line 42 is connected to a worm 49 whose bottom end 50 is open to discharge into the glass cup 44. This glass cup 44 is kept partially filled with a germicidal fluid having or provided with a pleasant odor. Between the fluid and the cap 45 is positioned a layer of cotton or some similar article (none being shown in place) which serves to prevent the fluid from being blown out thru the vent hole 51 in the cap 45 but which at the same time permits air from the blood or waste jar to be discharged up thru the fluid and out thru the vent in said cap. It is quite evident that the air coming from the deodorizer may be piped to the outside, but I find it not inconvenient or unpleasant to discharge it directly into the room since it has been sterilized and deodorized. The pressure line 42 is also provided with a check valve 52. In the rear head 24 of the suction pump 22 is positioned a valve 53 which may be finely adjusted, such as one of the needle type, for letting air into the pump cylinder whereby the degree of vacuum may be regulated to meet the conditions arising in the particular case. Outside of this valve 53 is placed a check valve 54 which is adapted to permit air to enter but not leave therethru.

The pressure line 55 of the pressure pump 23 is connected to the rear head 24 of said pump and to the terminal fitting 34. This line 55 is provided with a pressure gauge 56 and a check valve 57. The suction line 58 of the pressure pump 23 is also connected to the rear head of said pump

and to the bottom 59 of the fluid sight feed glass 60 from which it receives fluid discharged into it thru the goose-neck 61 which is the terminal of the line 62 branching from the terminal fitting 32. Another branch 63 of this fitting 32 forms a by-pass connecting with a pressure-relief valve 64 positioned in the head 24 of the pressure pump 23. This by-pass 63 and the suction line 58 are each provided with a check valve 65 and 66, respectively, while the flow of the fluid thru the line 62 into the fluid sight feed glass 60 is regulated by the throttle valve 67 positioned in the bottom 59 of said glass.

Believing that the Creator provided the nearest perfect and foolproof system of circulating the flow of life blood thruout the vascular system, it is my contention that simulating this same heart action by producing the nearest possible counterpart in the flow of fluid after death is productive of certain results impossible to obtain by any other method. Upon this theory my machine and method are based endeavoring to take up after death where the heart left off in life. That this theory and belief have led to the solution of the embalming problem I have repeatedly demonstrated.

During life, the heart drives the blood from the arteries thru the capillaries into the veins which return it to the heart. The arteries being already filled with blood under pressure, the additional quantity of blood forced into them by each ventricular contraction causes a distention of the arterial walls. These, contracting again thru their own elasticity, force the blood along, distending in turn the part of the artery next beyond. A series of such distentions thus travels along the artery moving from the heart. In the normal adult this pulsation rate varies from 70 to 75 per minute. In my apparatus I hold my pumps to approximately 60 strokes per minute—that is 60 impulses or surges of pressure and 60 surges of suction. My machine is powered to drive the pumps at his speed regardless of the body conditions encountered, hence the action of the pumps is smooth under all conditions of body or arterial system resistance. Since I use a pump with a reciprocable piston which acts directly upon a column of embalming fluid to inject it into the arterial system of the cadaver against the resistance encountered therein, and since the pump will only build up sufficient pressure to inject said fluid into the arterial system at the resistance encountered, it follows that the pump will build up the pressure exactly and automatically in accordance with the resistance it encounters, and that no skill or attention on the part of the operator is required to regulate the pressure of fluid injection in accordance with the body resistance. The control of pressure for the injection of fluid into the arterial system of a cadaver is the most discussed subject among the trade today and it is recognized that the success of the "constant pressure" machine depends upon the skill and judgment of the operator. On this point I quote from an article by Ralph W. Henson in the October issue of the Professional Embalmer—Mr. Henson being a staff member of the research department of the Undertaker's Supply Company. "It must be understood that the success of any embalming instrument depends upon the operator's ability to vary the degree of pressure to meet the various body conditions. In order for any embalmer to do this intelligently, he must know the vascular pressure within the body, or the approximate amount of resistance to the fluid flow. If he does not know

this, it will be impossible for him to vary the pressure in certain types of cases. The result is that in one case we may have an overembalmed body while in the other, the body may not have received an even distribution of fluid."

The discharge of the reciprocating piston pump in its primary form is intermittent—comes in a pronounced surge—which in most instances is considered a disadvantage. Many things have been devised to merge the surges in order to smooth out the flow of the discharge. I make use of the primary pump with its pronounced surges and intervals of rest therebetween. These surge or pressure periods correspond to the systole period of the heart during which the heart contracts to force the blood forward in the arteries, while the rest periods between the surges correspond to the diastole period of the heart during which it is being filled up and during which the blood in the arteries is spread-out and hence forward and the blood in the veins is being forced toward the heart.

In its primary or elemental form as I use the piston pump, the piston of the pressure pump 23 moves forward to force fluid into the arteries and capillaries during one-half of its stroke or for the duration of one-half second. During the other half of its stroke, or for the duration of another one-half second, it draws in another charge of fluid. During this charging period, or period of rest from its ultimate or intended function, the arteries and capillaries have an opportunity to adjust themselves to the pressure of fluid within them and to permit said fluid to seep forward.

In the machine which I am now describing, the fluid tank 31 is supported on the standard 68 so that the fluid may flow by gravity into the sight feed glass 60 where the rate of flow may be under observation at all times and adjusted if desired or necessary, the flow being regulated by the throttle valve 67. The fluid travels from the sight feed glass to the pressure pump 23 which delivers the amount of fluid the case is taking per stroke of said pump to the artery tube in spaced pronounced surges or pulsations. The fluid is delivered and injected at just sufficient pressure to overcome the body resistance whether it be one pound or ten, again meeting the heart's ability to step up pressure, hence no swollen tissues result. I set the throttle valve 67 to deliver about one tablespoon of fluid per pulsation or stroke of a pump having a 2" diameter cylinder and a 1 1/4" stroke when the gauge pressure is around 4#. However, the pump will deliver that amount of fluid at 1# if the body resistance is but 1#, but will build up a pressure in accordance with the body resistance or, until the pressure is reached at which the pressure relief valve 64 is set, at which time the relief valve will open and the fluid will follow the line of least resistance which is thru said relief valve and the check valve 65 into the by-pass branch 63 and hence back to the pump again. By providing the relief valve there is no danger of injecting fluid into the body at excessive or dangerous pressures if an obstruction is met and the attention of the operator is elsewhere. It has another advantage. I set my relief valve at 10#, which is well within a safe margin, although I find that 4# is usually sufficient to force fluid thru the average body. I did have one that took a minimum of 8#. This body was that of a woman who weighed over three hundred pounds and had extremely small veins and arteries. While fluid is by-passing thru the relief valve the pump remains in action directing surges

of pressure against the column of fluid in the pressure line 55 at the rate of sixty impulses a minute. This hammering action forces a little fluid past the check valve 57 in the line 55 and thus crowds the fluid ahead of said check valve further into the body. I find that this hammering soon breaks down the resistance and when this is accomplished the pressure falls back to normal again—resulting in a perfect and complete distribution of fluid thruout the body.

While the pressure pump 23 is injecting the fluid into the arterial system in spaced pronounced surges or pulsations, the suction pump 22 is causing spaced pronounced surges or pulsations of suction to be maintained on the venous system, the suction surges occurring between the pressure surges. In order to avoid taking blood into the suction pump 22 I use an intervening blood or waste jar 37, which constitutes a vacuum jar, in the suction line between said pump and the body. I use a deep jar of about one gallon capacity which I can exhaust to maintain any desired degree of vacuum within the capacity of the equipment, the degree being fixed by the needle valve 53. I find a vacuum with a gauge reading of four pounds proves satisfactory in aspirating the venous system, and a good flow of blood is obtained without collapsing the veins. With my machine I have had no trouble in keeping the veins open until their drainage was complete. I am not aware that this feat has ever before been accomplished—I find it is impossible of accomplishment on any of the present "constant pressure" machines. This blood or waste jar 37 is provided with a tight fitting cap 69 thru which project two fittings 70 and 71. The inner end of these fittings extend just beneath the cap to which they are fitted tightly while their outer ends are formed to receive and hold tightly in any efficient manner without air leakage the ends of the rubber tubes 35 and 38. With this arrangement the air exhausted from this jar, which contains the odorous blood and waste from cavities, is discharged into the deodorizer where it is sterilized and deodorized and thus rendered harmless and non-offensive to the room occupants.

The matter in the thoracic and abdominal cavities I remove with a trocar (not shown) which I attach to the suction tube 38 in lieu of the vein tube previously noted. The contents of the cavities are thus discharged into the jar 37. In withdrawing blood from the veins it is imperative that the spaced suction surges be maintained rather than to make them continuous which tends to collapse the thin walled veins. Since the suction stroke of the pressure pump 23 occurs during the interval between the suction strokes of the suction pump 22, the pressure pump 23 may be hooked up with the suction pump system to provide a continuous suction on the trocar. There are a number of combinations for making this hook-up one of which is illustrated in Fig. 3. In this instance, a 3-way valve 72 is incorporated in the suction line 58 of the pressure pump 23 and connected with the suction line 39 of the suction pump 22 by the crossover line 73. Another 3-way valve 74 is incorporated in the discharge line 55 of the pressure pump 23 and connected to the discharge line 42 of the suction pump 22 by the crossover line 75. The 3-way valves and the crossover lines are shown dotted in Fig. 3.

This continuous suction works all right on the trocar either when aspirating the cavities or in

injecting them. However, if necessary, the vacuum may be increased upon the trocar by positioning the eccentrics 11 and 12 so that they are in parallel alignment to cause the pistons of both pumps to move together when moving in the same direction.

The results obtained by employing my machine and method on the thirty bodies to date whose ages ranged from teen age boys to 86 year old men and 300# women was as follows:

I estimate that I obtain a 95% drainage of blood.

I estimate that I obtained a 100% distribution of fluid.

I find it possible and practical to save as much as 50% on fluid concentrate.

I did not get a single over-embalmed body.

Not the slightest evidence of swollen necks or other tissues was noted, nor any evidence of swollen eyes.

There was no evidence of skin slip present, indicating a perfect distribution of fluid to every body area.

Each case resulted in an unprecedented natural facial color—not a single putty or chalky white case produced—which is a new result.

In each case all discoloration was cleared, even the backs turned out as clear as any other body area.

Two cases which were discolored before death cleared to a remarkable degree, in fact one of them cleared entirely while the other had a slight red tinge over the former black area.

One body was kept twelve days without further treatment or without noting any change in condition.

I find that the total time required to completely aspirate and inject the body is one hour and forty-five minutes—never more than two hours. It is to be remarked that this time and the lack of any mess is due to the use of other instruments in part which are not made a part of this specification.

I believe that I have described my method and apparatus so that anyone skilled in the art may build the apparatus and apply the method. However, it is readily seen that many changes in form and arrangement of parts may be made without departing from the basic idea, therefore I do not limit my invention to exactly what has been shown and described but extend it to all that comes fairly within the scope of the appended claims.

I claim:

1. In the art of embalming, the method of injecting liquid which comprises forcing liquid into a body at pressures below a limited maximum pressure in opposition to resistance to flow of the liquid in the embalming operation, and imposing a continuing succession of force impulses simulating normal heart beat upon the injected fluid, whereby said resistance may be gradually overcome.

2. In the art of embalming, the method of injecting liquid that comprises the following steps: establishing a column of liquid connected to the arterial system of a body, and imposing upon said column a continuing succession of rhythmic impulses at pressures below a limited maximum pressure said pressures simulating normal heart pressure, whereby to dislodge impediments to the injection of said liquid by the constant gentle action of said impulses.

3. In the art of embalming, the method of injecting liquid which comprises forcing liquid into

a body at pressures below a limited maximum pressure in opposition to resistance to flow of the liquid in the embalming operation, varying said pressures in accordance with said resistance, and controlling the force on the liquid to impose a continuing succession of impulses simulating a normal heart beat upon the injected fluid, whereby said resistance may be gradually overcome.

4. In the art of embalming, the method of injecting embalming fluid into the body of a cadaver which comprises: establishing a column of fluid in connection with the arterial system of the cadaver, maintaining a source of supply to the column, and imposing thereon a continuing succession of force impulses in accordance with the resistance encountered as and when it occurs to add fluid from the supply to the column to cause fluid therefrom to expand the entered artery during a force impulse, said impulses being spaced to allow expanded arteries to contract, because of their elastic properties, between impulses to cause fluid therein to be moved forward thru the vascular system of the cadaver as the arteries move the blood in life.

5. In the art of embalming, the method of injecting embalming fluid into the body of a cadaver which comprises: establishing a column of fluid in connection with the arterial system of the cadaver, maintaining a source of supply to the column, imposing thereon a continuing succession of force impulses in accordance with the resistance encountered as and when it occurs up to a pre-determined maximum to add fluid from the supply to the column to cause fluid therefrom to expand the entered artery during a force impulse, said impulses being spaced to allow expanded arteries to contract, because of their elastic properties, between impulses to cause fluid therein to be moved forward thru the vascular system of the cadaver as the arteries move the blood in life, returning fluid, not added to the column at the pre-determined maximum pressure, back to the supply, and directing said force impulses of maximum pressure against said column until fluid is again added thereto.

6. In the art of embalming, the method of aspirating the vascular system of a cadaver which comprises: withdrawing fluid from said vascular system by exerting at a source of entry into the venous side of said system a continuing succession of surges of suction, said surges being spaced to allow veins in a state of collapse due to said suction to recover between the surges because of their elastic properties.

7. In the art of embalming, the method of aspirating the vascular system of a cadaver which comprises: withdrawing fluid from said vascular system by exerting at a source of entry into the venous side of said system a continuing succession of surges of suction, said surges being spaced to allow veins in a state of collapse due to said suction to recover between surges because of their elastic properties, separating the venous fluid withdrawn from the air exhausted during the withdrawal, and discharging said air thru a deodorizer to the atmosphere.

8. A method of preparing a cadaver for burial which comprises: creating a negative pressure upon the venous side of the cadaver's vascular system to withdraw fluid therefrom by a continuing succession of surges of suction, and simultaneously creating a positive pressure upon the arterial side of said system by injecting embalming fluid at a source of entry into the arterial

side by imposing on said embalming fluid a continuing succession of force impulses, both surges of suction and force impulses being spaced to allow the veins, contracted by the suction surge, to expand, and the arteries, expanded by the injected embalming fluid, to contract whereby said arteries act to force the embalming fluid forward and thru the vascular system as they do the blood in life, such contraction and expansion of the veins and arteries being due to their elastic properties. 10

9. A method of preparing a cadaver for burial which comprises: creating a negative pressure upon the venous side of a cadaver's vascular system to withdraw fluid therefrom by a continuing succession of surges of suction, providing a source of embalming fluid supply, creating simultaneously a positive pressure upon the arterial side of said system by injecting embalming fluid at a source of entry into the arterial side by im- 20

posing on said embalming fluid a continuing succession of force impulses in accordance with the resistance encountered as and when it occurs up to a pre-determined maximum, both surges of suction and force impulses being spaced to allow the veins, contracted by the suction surge, to expand, and the arteries, expanded by the injected embalming fluid, to contract whereby said arteries act to force the embalming fluid forward and thru the vascular system as they do the blood in life, such contraction and expansion of the veins and arteries being due to their elastic properties, returning embalming fluid, not injected at the pre-determined maximum pressure, back to the source of supply, and directing said force impulses of maximum pressure against said injected fluid until more is added thereto from the supply.

CLAY P. MOODY.