Jan. 8, 1963 B. RAND 3,071,953

DRY CLEANING MACHINE

Filed July 10, 1961 2 Sheets-Sheet 1

Fig. 1

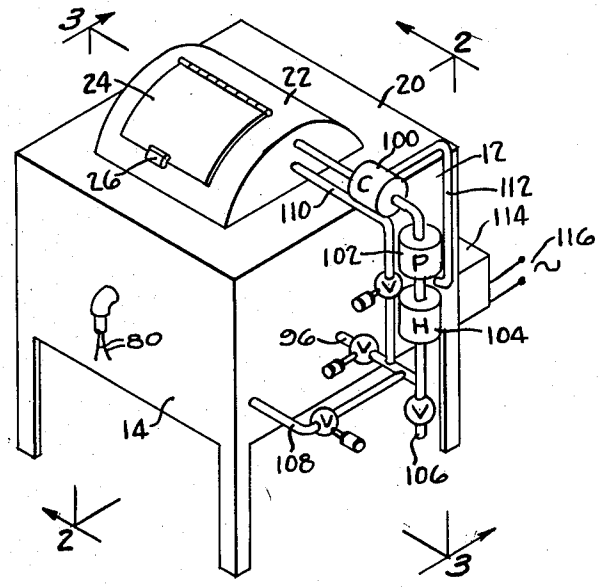
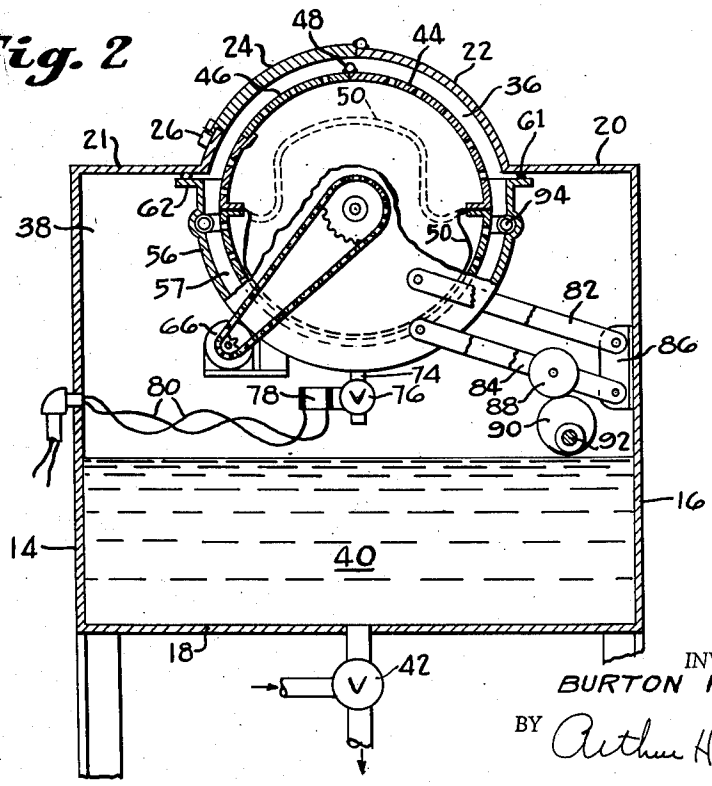


Fig. 2



INVENTOR.
BURTON RAND
BY Arthur H. Seidel
ATTORNEY

Jan. 8, 1963 B. RAND 3,071,953

DRY CLEANING MACHINE

Filed July 10, 1961 2 Sheets-Sheet 2

Fig. 3

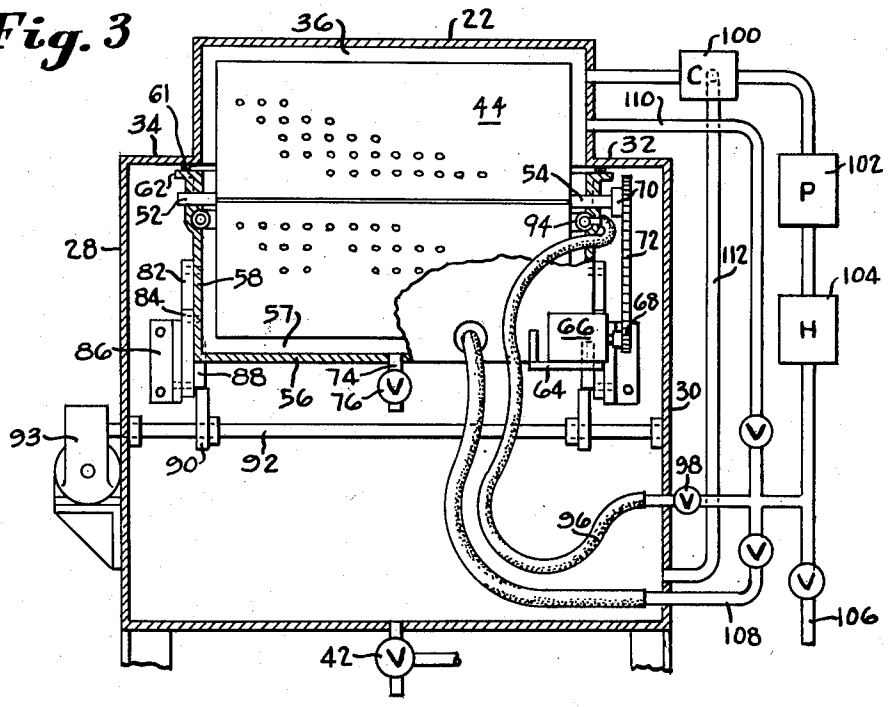
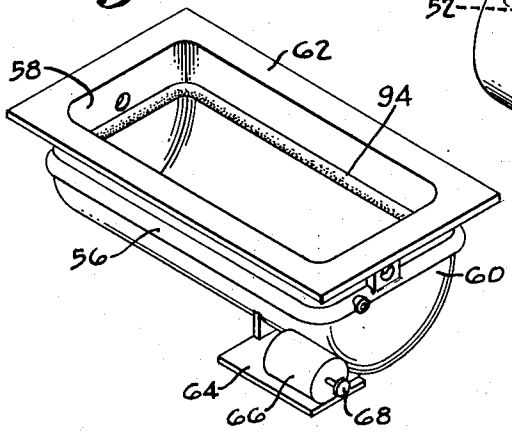


Fig. 4



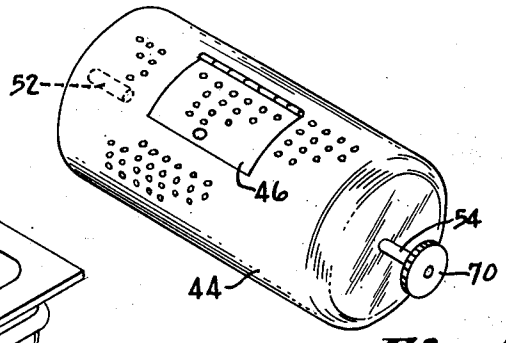


Fig. 5

INVENTOR.
BURTON RAND

BY Arthur H. Seidel

ATTORNEY

United States Patent Office 3,071,953 Patented Jan. 8, 1963

3,071,953
DRY CLEANING MACHINE

Burton Rand, Bala Cynwyd, Pa., assignor to Autosonics Inc., Philadelphia, Pa., a corporation of Pennsylvania

Filed July 10, 1961, Ser. No. 123,001
12 Claims. (Cl. 68—18)

This invention relates to a dry cleaning machine, and more particularly to a cleaning machine adapted to operate through a predetermined cycle to dry clean textile articles.

The dry cleaning machine of the present invention, if desired, may be provided with a coin-operated mechanism for controlling the operation of the same. In this manner, the dry cleaning machine of the present invention may be utilized in laundromats, self-service laundries, etc. If a coin-operated mechanism is not provided, the dry cleaning machine is adapted to be utilized by dry cleaning establishments and lends itself to mass production for use as a home appliance.

In dry cleaning machines utilizing a volatile liquid such as chlorinated hydrocarbons, trichlorethylene, perchlorethylene, etc., it is necessary to have a housing which is hermetically sealed. When the door providing access to the interior of the machine is open, the vapors from within the machine are permitted to escape to the atmosphere. The vapor lost to the atmosphere with each batch of material is an inevitable loss in presently designated machines and represents a major factor in solvent consumption. The dry cleaning machine of the present invention reduces the vapor loss to the atmosphere by approximately fifty percent. The loss of vapor to the atmosphere is substantially reduced in accordance with the present invention by providing a novel bladder or diaphragm which is responsive to a novel evacuation system whereby the volume of air within the machine which communicates with the atmosphere when the door is open is substantially reduced.

The dry cleaning machine of the present invention includes a rotatable perforated drum in which the articles to be dry cleaned are disposed. The drum is provided with a bladder which is secured at diametrical points on the inner periphery of the drum and overlies approximately one-half of the inner peripheral surface of the drum. The drum is rotatably supported by a novel pan which is in the nature of a trough which supports a motor for rotating the drum. The pan and drum are mounted for reciprocation into and out of a supply of dry cleaning fluid. Also, in the uppermost position of the drum and pan, the drum is disposed in a chamber which is sealed with respect to the chamber containing the dry cleaning liquid.

It is an object of the present invention to provide a novel dry cleaning machine.

It is another object of the present invention to provide a novel dry cleaning machine having a rotatably mounted reciprocably supported perforated drum and means for substantially reducing the volume of said drum when desired.

It is still another object of the present invention to provide a novel dry cleaning machine adapted to utilize highly volatile solvents such as the Du Pont Company's Freon dry cleaning liquid.

It is a still further object of the present invention to provide a novel dry cleaning machine wherein two separate hermetically sealed compartments are provided, wherein one of said compartments is adapted to be placed in communication with atmosphere when an access door is opened and includes means for removing vapors from the air within said one chamber prior to the opening of the access door.

It is still another object of the present invention to provide a novel dry cleaning machine which is simpler and more economical than comparable machines proposed heretofore.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a perspective view of the dry cleaning machine of the present invention.

FIGURE 2 is a transverse sectional view taken along lines 2—2 of FIGURE 1.

FIGURE 3 is a longitudinal sectional view taken along lines 3—3 of FIGURE 1.

FIGURE 4 is a perspective view of the drum pan.

FIGURE 5 is a perspective view of the rotary drum adapted to retain the articles to be dry cleaned.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a perspective view of a dry cleaning machine designated generally as **10**.

The dry cleaning machine **10** of the present invention includes a housing designated generally as **12**. The housing **12** is comprised of spaced substantially parallel side walls **14** and **16**, a bottom wall **18** extending between the side walls, spaced top wall sections **20** and **21**, and a housing extension **22**. The housing extension **22** is substantially semi-cylindrical and is disposed intermediate the top wall sections **20** and **21**.

The extension **22** is provided with an access door **24** pivotably secured thereto by means of a hinge along one side of the door. A solenoid actuated lock **26** is provided so that the access door **24** may not be opened until the dry cleaning cycle has been completed.

As shown more clearly in FIGURE 3, the housing **12** is provided with end walls **28** and **30**. The end wall **30** is provided with an inwardly directed flange **32**. The end wall **28** is provided with an inwardly directed flange **34**. The flanges **32** and **34** are disposed in the same horizontal plane as the top wall sections **20** and **21**.

The flanges **32** and **34** cooperate with the extension **22** to define an upper chamber **36** within the housing **12**. The remainder of the housing **12** disposed below the flanges **32** and **34** is designated as a lower chamber **38**. A supply of dry cleaning solvent **40** is disposed within the lower chamber **38**. The dry cleaning solvent **40** may be any one of a plurality of solvents such as perchorethylene. Preferably, the dry cleaning solvent **40** is Du Pont Company's Freon. Freon is the preferred solvent because it is substantially less toxic than other solvents such as perchlorethylene and may be utilized in the dry cleaning of synthetic fabrics which are damaged when perchlorethylene is utilized as the solvent. In addition, Freon reduces considerably the drying time so that the total cycle is $<\frac{1}{2}$ the time cycle when using perchlorethylene.

The use of a Freon solvent facilitates the provision of structural elements within the housing **12** which may be immersed within the solvent without any adverse effect thereon. Freon is an extremely volatile liquid and as will be made clear hereinafter, means are provided to minimize the loss of the volatile vapors to the atmosphere when the access door **24** is opened. The solvent **40** is supplied to the housing **12** and withdrawn therefrom by means of a supply and exhaust valve **42** connected to a short conduit depending from the bottom wall **18** of the housing **12**.

A perforated cylindrical drum **44** having an access door **46** pivotably secured thereto is provided for retaining the fabrics to be dry cleaned in the machine **10** of the present invention. It will be noted that the access door **46** is of smaller configuration than the access door **24** and is pivotably secured to the drum **44** by means of a hinge **48**, see

FIGURE 2. The relative disposition of the access doors **24** and **46** are as shown in FIGURE 2 at the beginning and end of any dry cleaning cycle.

A bladder **50** is disposed within the drum **44**. The peripheral edges of the bladder **50** are fixedly secured to the inner periphery of the drum **44** at diametrically opposite points so that the bladder **50** overlies approximately one-half of the inner peripheral surface of the drum **44**. The bladder **50** is preferably made from a flexible readily deformable material such as rubber, plastic, etc.

The drum **44** is provided with axles **52** and **54**. The drum **44** is supported within the housing **12** by means of a pan **56**. The drum **44** is spaced from the pan **56** to define a chamber **57**. As shown more clearly in FIGURE 4, the pan **56** is semi-cylindrical in shape with aligned holes being provided in end walls **58** and **60** of the pan **56**. Thus, the axle **52** extends through the hole in the end wall **58** with a seal being provided therebetween. The axle **54** extends through the hole in the end wall **60** with a seal being provided therebetween. The pan **56** is provided with an outwardly directed peripheral flange **62**.

A readily deformable seal means is provided on the upper surface of the flange **62**. Such seal means may, for example, be an O-ring seal **61**. As shown more clearly by a comparison of FIGURES 2 and 3, the seal on the flange **62** cooperates with the flanges **32** and **34** and the top wall sections **20** and **21** to selectively isolate the upper chambers **36** from the lower chamber **38**.

A mounting plate **64** is fixedly secured to the periphery of the pan **56** in any convenient manner such as by welding, bolts, etc. A motor **66** is fixedly secured on the mounting plate **64** offset from the longitudinal axis of the pan **56**. The output shaft of the motor **66** is provided with a pulley **68**. A pulley **70** is fixedly secured to one end of the axle **54** on the drum **44**. An endless belt **72** extends around the pulleys **68** and **70**. Accordingly, the motor **66** is disposed in a manner so that it may selectively rotate the drum **44**.

A short flow conduit **74** extends through the pan **56** at its lowermost point as shown more clearly in FIGURE 2. A valve **76** is disposed within the conduit **74**. A solenoid is provided for selectively operating the valve **76**, with electric wires **80** being provided to operate the solenoid **78**.

A pair of lever arms **82** and **84** are pivotably secured to the end walls **58** and **60** of the pan **56**. The ends of the lever arms **82** and **84** remote from the pan **56** are pivotably secured to a mounting bracket **86**. The mounting bracket **86** is fixedly secured on the inner periphery of side wall **16** of the housing **12**. A rotatably mounted cam follower **88** is secured to the lever arm **84**. The cam follower **88** is in abutting contact with a cam **90** which in turn is fixedly secured to a rotatably mounted cam shaft **92**. Cam shaft **92** is rotated by means of motor **93**.

An inflatable seal **94** is fixedly secured within an annular groove on the inner periphery of the pan **56** adjacent the point where the bladder **50** is secured to the drum **44**. The inflatable seal **94** is selectively supplied with pressurized air by means of conduit **96** having a solenoid operated valve **98** therein. The valve **98** is preferably of the supply and exhaust type whereby the supply of air to the inflatable seal **94** causes the same to expand into contact with the outer peripheral surface of the drum **44**. The purpose of the inflatable seal **94** will be made clear hereinafter.

Means are provided for withdrawing the solvent laden air within the chamber **36** so as to remove the solvent and thereafter return such air to said chamber **36**, or to the lower chamber **38**, or to atmosphere. Thus, a condenser **100** is provided as shown more clearly in FIGURES 1 and 3.

Thus, a conduit extends between the upper chamber **36** and the inlet side of condenser **100**. The outlet side of the condenser **100** is connected to the inlet side of a pump or fan **102**. The pump or fan **102** has a very low capacity such as five cubic feet per minute in a small model of the

present invention. The pump capacity will vary with the size of the machine. The outlet side of the pump or fan **102** is connected to a heater **104**. Since the pump capacity is small, the power rating of heater **104** may be low. The outlet side of the heater **104** is provided with branch conduits **106**, **108**, and **110**.

The branch conduits **106**, **108** and **110** are provided with solenoid operated valves for controlling flow therein. Conduit **106** communicates with the atmosphere. Conduit **108** communicates with the lower chamber **38**. Conduit **110** communicates with the upper chamber **36**. A conduit **112** extends from the condenser **100** to a point slightly below liquid level in the lower chamber **38**.

A control device **114** is provided. The control device **114** is connected to a source of current **116**. The control device is a commercially available controller which selectively operates the various motors and solenoids so that the machine **10** of the present invention has a predetermined operating cycle.

The operation of the machine **10** of the present invention is as follows:

The respective elements of the machine **10** assume a disposition as shown in FIGURE 2. The access door **24** is manipulated to an open position and then the access door **46** is manipulated to an open position. Thereafter, the articles to be cleaned such as fabrics, clothing, etc. are disposed within the drum **44**. Thereafter, the access doors **46** and **24** are closed. A button for initiating the operating cycle is thereafter manipulated. Then, the solenoid **26** locks the access door **24** in its closed disposition so that the machine **10** may not be opened until the cycle has been completed. This prevents the upper chamber **36** from being placed in communication with atmosphere so as to prevent a loss of vapors therefrom. Thus, the access door **24** is disposed so as to provide a vapor tight seal with respect to the housing extension **22**.

The vacuum pump **102** will evacuate the upper chamber **36** so as to attain a pressure therein comparable with the pressure which existed at the time of completion of the previous batch, and before unloading the previous batch. The valves in conduits **110** and **98** are actuated to a position wherein the pressure in inflatable seal **94** is exhausted into chamber **36**, thereby equalizing the pressure on both sides of the bladder **50** at atmospheric pressure.

Thereafter, control device **114** operates the motor **93** so that the cam **90** is disposed in a position to cause the drum **44** to descend and at the same time opens valve **76** to equalize the pressures in the upper and lower chambers **36** and **38** respectively. The drum **44** is lowered to a position wherein a portion of the drum **44** is disposed below the level of solvent **40**. Simultaneously, the motor **66** causes the drum **44** to rotate slowly. At all times, the drum **44** is disposed within the pan **56** with the solvent entering the pan **56** through the valve **76**.

The drum **44** continues to rotate within the solvent for a predetermined period of time controlled by the control device **114**. Upon completion of the immersion stage, and while still revolving, the drum **44** is raised to an intermediate position whereby the flange **62** is spaced slightly from the plane of the flanges **32** and **34**. In this intermediate position, the solvent within chamber **57** drains out through the valve **76** which is above liquid level. In addition, the drum **44** is rotated rapidly in this position so as to permit centrifugal extraction of solvent from the articles of fabric and clothing disposed therein.

Thereafter, the rate at which the drum revolves is decreased and the cam **90** causes the lever arms **82** and **84** to raise the pan **56** and the drum **44** until the flange **62** is sealed with respect to the top wall section **20** and **21** and the flanges **32** and **34**. In this position, the drum continues to revolve slowly, thereby tumbling the clothing and fabrics disposed therein. At the same time, valve **76** is closed and the pump **102** begins to recirculate the air of the upper chamber **36**. The solvent laden air disposed within chamber **57** and the upper chamber **36**

passes through the condenser **100** which separates the same into cool air and liquid solvent. The liquid solvent is returned to the lower chamber **38** by way of conduit **112**. The cool air passes through the pump **102** and is heated by the heater **104**.

The heated air is returned from the heater **104** to the upper chamber **36** by way of conduit **110**. This process continues for a predetermined period of time so as to accentuate the drying of the clothes and at the same time remove as much solvent vapor from the upper chamber **36** as possible.

Following the drying cycle, the rotation of the drum **44** is halted and the drum **44** is indexed to a preset unloading position as illustrated in FIGURE 2 wherein the access doors **24** and **46** are in alignment with one another. Thereafter, the inflatable seal **94** is inflated by pump **102** through conduit **96** so as to hermetically isolate the upper chamber **36** from the interior of the pan **56**. The inflatable seal **94** expands until it is in contact with the periphery of the drum **44**. Then the valve in conduit **96** is closed, locking air in seal **94** which remains in its expanded condition.

Thereafter, the control device **114** closes the valve in conduit **110** and opens the valve in conduit **108**. In this position of the elements of the machine **10** and during this portion of the cycle, the air is being directed into the pan **56**. The air in pan **56** expands the bladder **50** to the phantom position illustrated in FIGURE 2. While the vacuum created in the upper chamber **36** is too slight so as to cause the bladder **50** to raise to the phantom position shown in FIGURE 2, such vacuum does cooperate with the pressurized air being directed in chamber **57** to accomplish this result.

The bladder **50** is pressurized to the phantom position shown in FIGURE 2 so as to substantially reduce the volume of the upper chamber **36**. While the bladder **50** is being pressurized, the heater **104** may be turned off.

Thus, a combination of pressure and vacuum causes the bladder **50** to assume the phantom position shown in FIGURE 2 thereby reducing the volume of the upper chamber **36** and at the same time placing the dried articles adjacent the access door **46**. When the access doors **24** and **46** are opened, it will be seen that a very small portion of the volume of chamber **36** will be exposed to the atmosphere. Accordingly, only the solvent vapors remaining in this volume of the chamber **36** will be lost to the atmosphere. In this manner, I am able to reduce the loss of solvent to the atmosphere by more than fifty percent as compared with machines proposed heretofore. Thus, the machine **10** of the present invention loses less solvent per batch of clothes than those proposed heretofore while at the same time is designed to utilize Freon as a solvent which is less toxic and faster drying than machines utilizing perchlorethylene.

At the end of the drying cycle, the control device **114** deactivates the solenoid lock **26**, stops the pump **102**, closes the valve in conduit **108**, and opens the valve in conduit **106**.

When a new batch of clothes are disposed within the drum, the control device will close the valve in conduit **106**. Thereafter, the cycle will be repeated in the manner set forth above.

While the drum **44** has been illustrated with an actuating mechanism comprising lever arms, it is within the scope of the present invention to provide an equivalent device which reciprocates the drum vertically in a direction substantially perpendicular to the flange **32** and **34**.

It will be appreciated that the normal accessories such as filters, solvent recovery still, etc. are not illustrated since they form no part of the present invention.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A dry cleaning machine comprising a housing, said housing having an upper chamber, said housing having a lower chamber adapted to have a cleaning solvent disposed therein, a perforated drum mounted for movement from a first position wherein said drum is disposed in said lower chamber to a second position wherein said drum is at least partially disposed within said upper chamber, means selectively isolating said drum and upper chamber from communication with said lower chamber in said second position of said drum, means for selectively causing said movement of said drum and for selectively rotating said drum, means for selectively removing volatile vapors from said upper chamber, and selectively operable means for reducing the volume of said drum exposed to said upper chamber.

2. A machine in accordance with claim 1 wherein said selectively operable means for reducing the volume of said drum includes an inflatable flexible bladder disposed within said drum and secured to the inner periphery of said drum.

3. A machine in accordance with claim 1 wherein said means selectively isolating said drum and said upper chamber from communication with said lower chamber includes a semi-cylindrical pan disposed beneath said drum and mounted for movement therewith, said pan having a peripheral flange adapted to sealingly contact a portion of said housing which partially defines said upper chamber.

4. A machine in accordance with claim 1 wherein said means for selectively removing volatile vapors from the upper chamber includes a condenser in communication with said upper chamber, a pump in communication with the outlet side of said condenser, a heater in communication with the outlet side of said pump, a conduit from the outlet side of said heater being in communication with said upper chamber, and a drain conduit extending from said condenser to said lower chamber, whereby a mixture of volatile vapors and air are withdrawn from such upper chamber into said condenser and separated into liquid condensate and air, with such air being returned to said upper chamber by said conduit connected to the outlet side of said heater.

5. In a dry cleaning machine comprising a housing adapted to have a supply of dry cleaning solvent therein, means rotatably mounting a perforated drum in said housing, an access door on said drum in alignment with an access door on said housing in one rotative position of said drum, a flexible bladder disposed within said drum, means sealing the periphery of said bladder to the inner periphery of said drum at a line separating top and bottom portions of said drum, selectively operable means for inflating said bladder, and a selectively operable vacuum means coupled to said housing for sealing said housing and the bottom portion of said drum from the top portion of said drum and withdrawing a mixture of air and vaporized solvent from within the bottom portion of said drum and said housing, whereby the volume of air within said drum which is exposed to atmosphere when said doors are open and the amount of vaporized solvent in the air in said drum may be substantially reduced.

6. In a cleaning machine comprising a housing, means rotatably mounting a perforated drum within said housing, means mounting said drum for movement from a first drying position to a second immersion position, a pan disposed within said housing and mounted for movement with said drum as said drum moves from said first position to said second position, a selectively operable valve controlling a flow port through said pan, and means on said pan for cooperation with a portion of said housing to divide said housing into an upper and lower chamber when said drum is in said first drying position, whereby

said drum and upper chamber are isolated from communication with said lower chamber.

7. A machine in accordance with claim 6 wherein said drum is rotatably supported by said pan, and means for reducing the volume of said drum exposed to said upper chamber in said first position of said drum.

8. In a dry cleaning machine comprising a housing, a semi-cylindrical pan, means mounting said pan for substantially vertical movement within said housing, a cylindrical drum disposed within said pan and rotatably supported by said pan, a motor means operatively disposed with respect to said drum for rotating the same, said drum having a plurality of perforations therethrough and an access door for providing access to the interior of said drum, selectively operable means controlling flow through said pan, and said housing being adapted to contain a supply of dry cleaning fluid so that said pan and said drum may be at least partially disposed within the dry cleaning fluid during a portion of the substantially reciprocatory motion of said pan.

9. A dry cleaning machine comprising a housing, said housing having an upper chamber, said housing having a lower chamber adapted to have a dry cleaning solvent therein, a perforated drum disposed within said housing, said drum being rotatably supported by a semi-cylindrical pan, means mounting said pan and drum for movement from a first position wherein said drum and pan are disposed within said lower chamber to a second position wherein said drum is at least partially disposed within said upper chamber, wall means selectively cooperating with said pan in said second position of said drum to isolate said drum and said upper chamber from communication with said lower chamber, means for selectively

rotating said drum, means in communication with said upper chamber for selectively removing a mixture of air and volatile vapors from said upper chamber and returning thereto only air removed from said upper chamber.

10. A machine in accordance with claim 9 including selectively operable means for reducing the volume of said drum exposed to said upper chamber, inflatable means selectively operable for expansion into contact with the periphery of said drum when said drum is in said second position.

11. A machine in accordance with claim 10 wherein said means for selectively reducing the volume of said drum includes a flexible bladder, the peripheral edges of said bladder being fixedly secured to the inner periphery of said drum, with said bladder overlying a portion of the inner periphery of said drum.

12. In a dry cleaning machine comprising a housing, said housing having an access door providing access to the interior thereof, means mounting a perforated drum for rotation about its longitudinal axis within said housing, means mounting said drum for movement into and out of an area of said housing adapted to contain a dry cleaning solvent, and imperforate means for reducing the volume of said drum exposed to the atmosphere when said access door is opened.

References Cited in the file of this patent

UNITED STATES PATENTS

1,549,027	Perry	Aug. 11, 1925
1,917,096	Chamberlin	July 4, 1933
2,187,770	Chamberlin	Jan. 23, 1940
2,611,257	Kahn	Sept. 23, 1952
2,645,916	Green	July 21, 1953