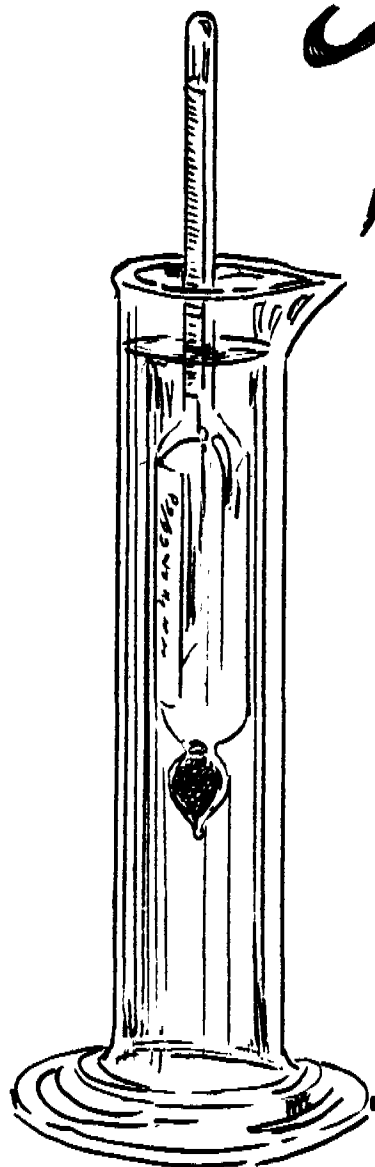


Trammy

Solvent Vinylite

DEPARTMENT



BASIC OPERATING INSTRUCTIONS

CARBIDE & CARBON CHEMICALS COMPANY
SOUTH CHARLESTON, WEST VIRGINIA

UCC
040602

SOLVENT "VINYLLITE" DEPARTMENT

BASIC OPERATING INSTRUCTIONS

by

Mr. J. E. McClure

CARBIDE AND CARBON CHEMICALS COMPANY

SOUTH CHARLESTON, WEST VIRGINIA

1954 ?

UCC
040603

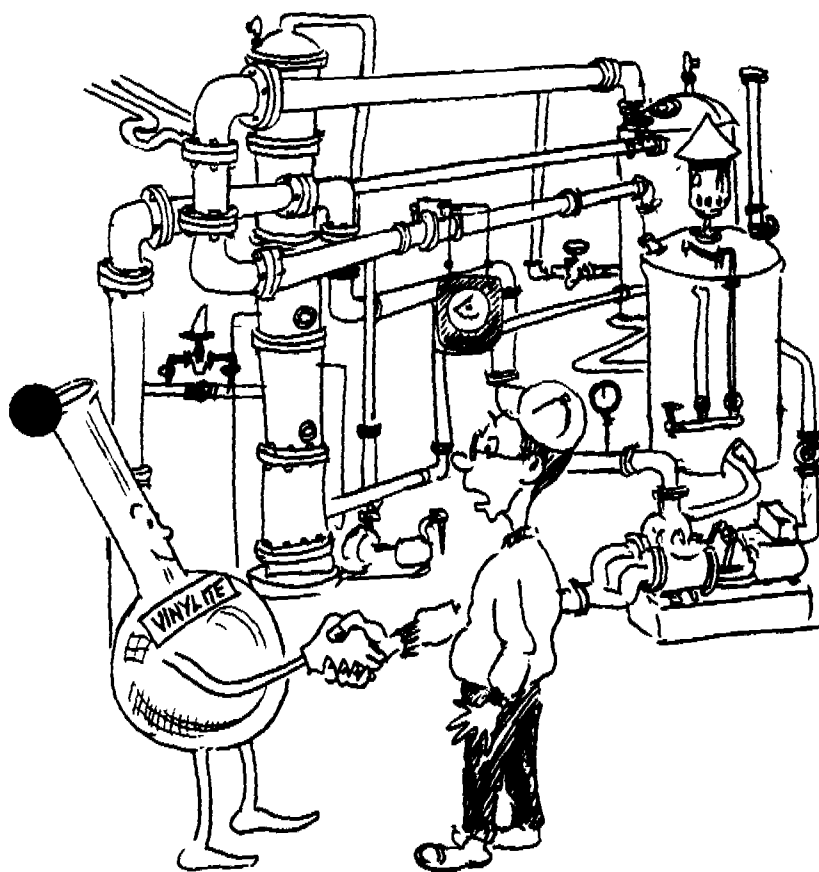
TABLE OF CONTENTS

	<u>Page</u>
Introduction	1
Tools of Measurement	2
Pressure	3
Pressure Gauge	4
Pressure and Vacuum	5
Absolute Pressure	6
Pressure Drop	7
Manometers	8
Differential Pressure	9
Pressure Recorder	10
Temperature	11
Temperature Recorder	12
Measuring Volume	13
Measurement of Flow	14
Measurement of Weight	15
Other Tools of our Craft	16
Valves	17
Safety Valves	18
Compressors	19
Pumps	20
Steam Pump	21
Distillation	22
Still Tray	23
Automatic Control	24
Blow Back	25
Diaphragm Motor Valve	26
Pressure Control	27
Temperature	28
Flow Plan Symbols	29
Simplified Flow Sheet	29
"Vinylite" Solvent Area	30
Autoclave	32
Autoclave Drawing	33
Stripping System	34
Extraction System	36
Vinyl Acetate Recovery	37
Acetone and Isopropanol Recovery	38
"Vinylite" Solvent Resin and Processing	39

INTRODUCTION

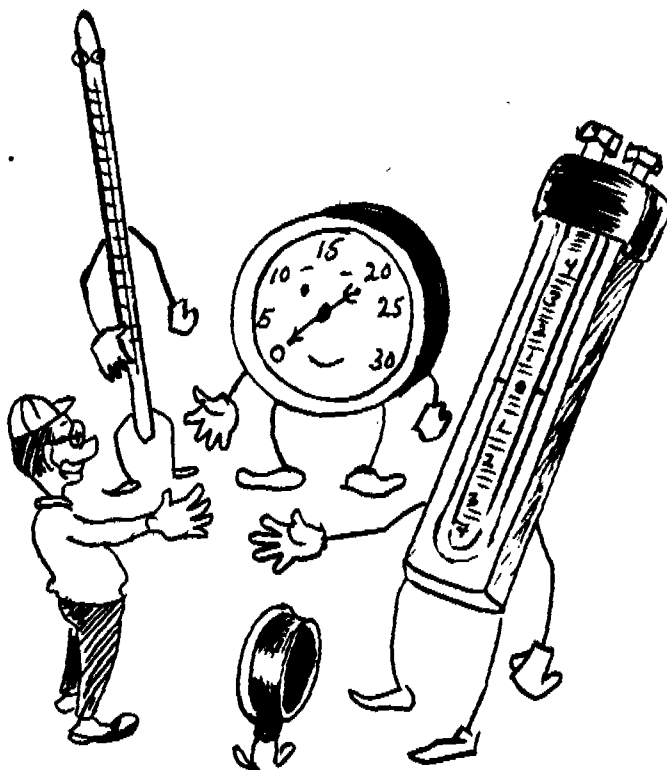
As a chemical operator in the Solvent "Vinylite" Department, you, as any good craftsman, have certain tools to work with. These "tools" are the best to be had and, through research, are being improved daily. The most important phases of operation are safety and efficient production. Through a better understanding of the tools of your trade, you will be a safer as well as a more competent operator.

The basic tools you work with will be the means of doing the work and the means of measuring the results. The means of measurement are most important as in most cases you will not see the product you are making or the raw materials used in making it. Many of the materials cannot be seen or appear as water-white liquids. You are "flying blind" much of the time you are operating so you must understand as well as rely on your tools of measurement for temperature, volume, pressure, and weight. These tools of measurement are your eyes, ears, nose, and taste in chemical production.



UCC
040605

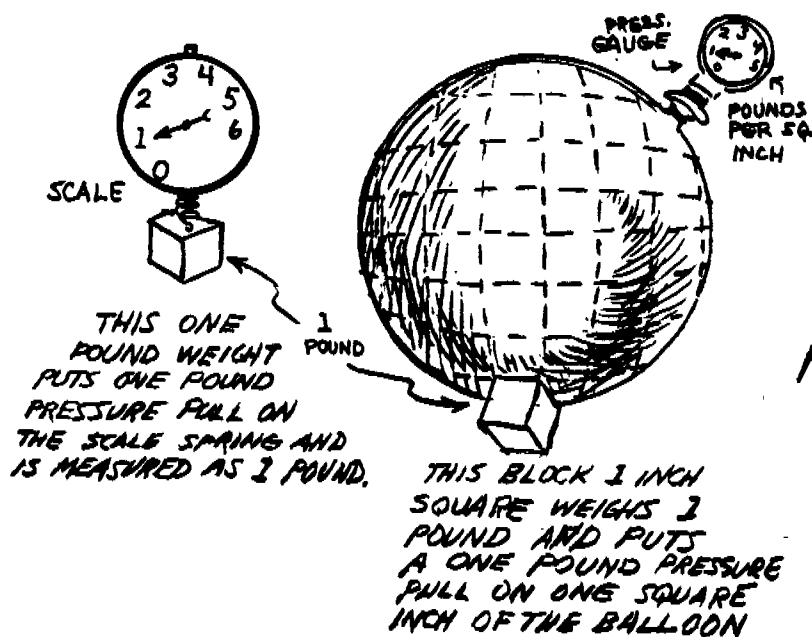
First, we will consider our tools of measurement for only by using gas, salt, air, water, and other materials at the proper temperature, at the proper pressure, and in the correct weights or volumes are we able to convert them into a saleable "Vinylite" resin.



UCC
040606

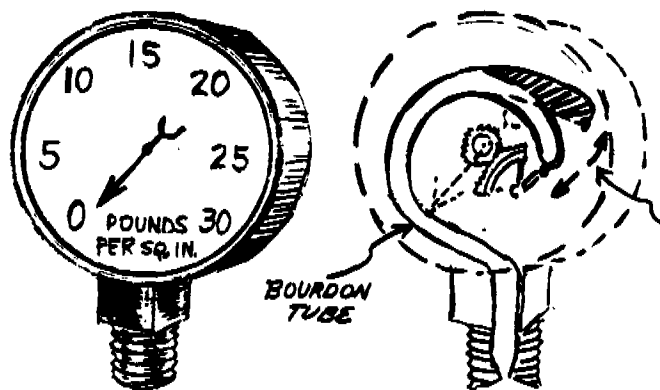
Let us first take up the measurement of pressure.

Pressure may be measured in what is most commonly known as "pounds" or more specifically as pounds per square inch. This means exactly what it says "pounds per square inch." A toy balloon may be inflated to perhaps one pound per square inch. This means that each square inch of the surface of the balloon has a pressure applied to it of one pound, thus the balloon could hold 500 pounds pressure if it had a surface area of 500 square inches. Increasing the pressure causes the balloon to swell while lowering the pressure causes the balloon to become smaller.



EACH SQUARE INCH
OF THE BALLOON'S
SURFACE HAS A
PRESSURE PULL OF
ONE POUND

MEASURING PRESSURE
IN POUNDS PER
SQUARE INCH.
(PSI) ($\frac{\text{lb}}{\text{sq. in.}}$)



The action of the Bourdon tube in a gauge is much the same as the expansion of the balloon, the more pressure in the tube the more expansion.

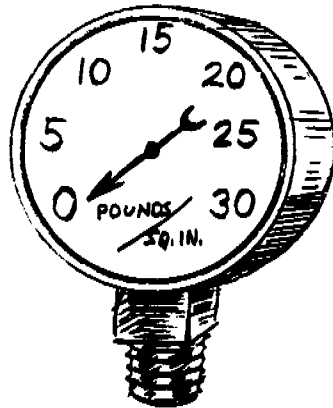
As the Bourdon expands, the action causes the indicator or needle to move around the gauge dial to give a "reading" of pressure in pounds per square inch, p.s.i.

PRESSURE GAUGE

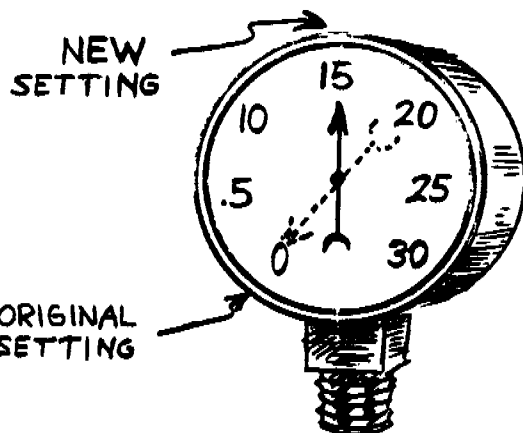
If a pressure gauge is open to the air, that is, the Bourdon tube is not connected to anything which has pressure, the needle will point to 0 (zero). This indicates that the pressure of the atmosphere is 0. This is true as long as we indicate we are speaking of "gauge pressure." The gauge will read 0 if placed on the highest mountain or in the lowest valley even though we know the pressure at these two extremes is different. When a difference of atmospheric pressure, due to altitude above sea level or when barometric pressure has to be considered, pressure is measured in what is called "absolute pressure." This means of measuring pressure starts at 0 absolute pressure which is actually the absence of all pressure. A regular gauge measures the difference between the pressure inside the Bourdon tube and the pressure outside the tube which in most cases is atmospheric pressure. Atmospheric pressure at sea level is 14.7 pounds per square inch absolute.

PRESSURE & VACUUM

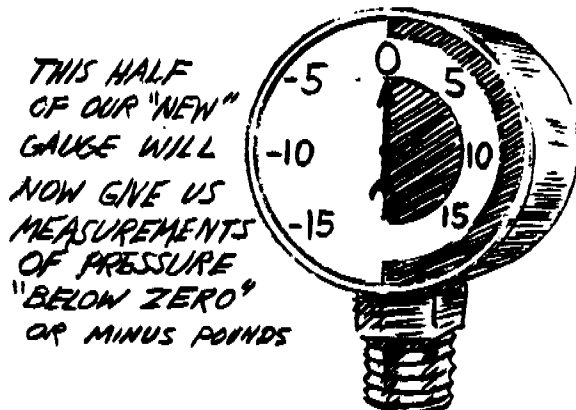
For a simple comparison of pressures, let us measure with an ordinary pressure gauge calibrated to give us pressure in pounds per square inch.



As the Bourdon tube is open to the air the gauge reading is 0, as there is no difference in pressure between the outside and the inside of the Bourdon tube.



Now let us lift the needle from its axle and replace it (without letting the axle turn) so that our gauge reading shows 15 psi even though we know it is actually 0.



Now we will change the dial of the gauge to conform with these new figures. With our "new" gauge we can go "below zero" - so to speak by pulling a vacuum on the Bourdon tube.

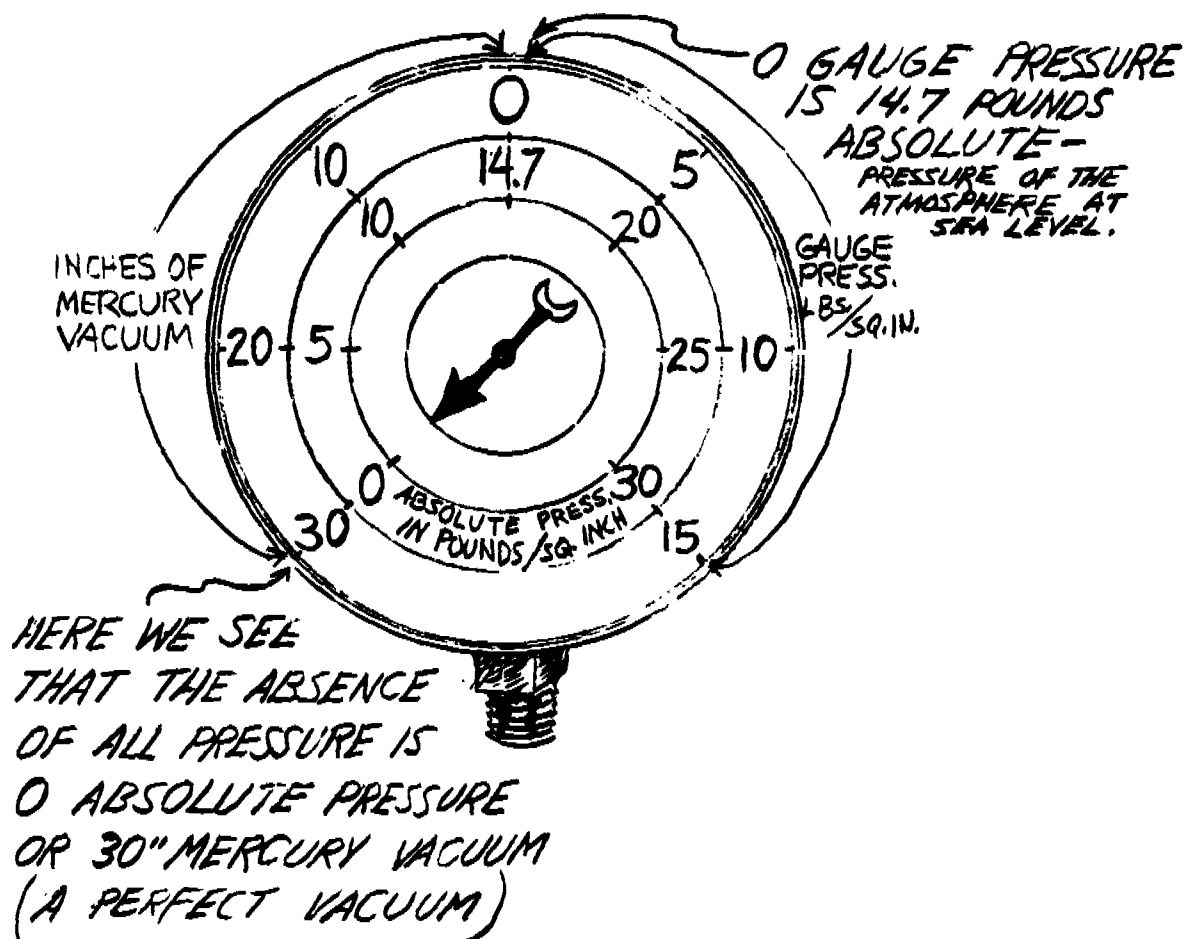
This is the principle of a compound gauge designed to measure pressure and vacuum. Pressure measurements on the shaded half and vacuum measurements on the unshaded half.

UCC
040609

ABSOLUTE PRESSURE

With our "new" gauge, we can now measure most pressures by converting our pounds per square inch to any other convenient form of measurement.

First, to get the lowest possible reading, let us pull all the air out of the Bourdon tube in the gauge. (If we could do this it would mean actually that we would have created an impossible "perfect vacuum." However, for comparison of pressures we will have to assume that it has been done.

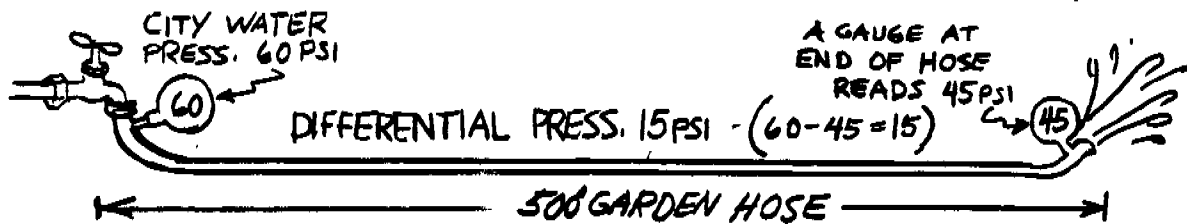


We have seen how pressure is measured by a gauge. Now let us see some different measurements of pressure.

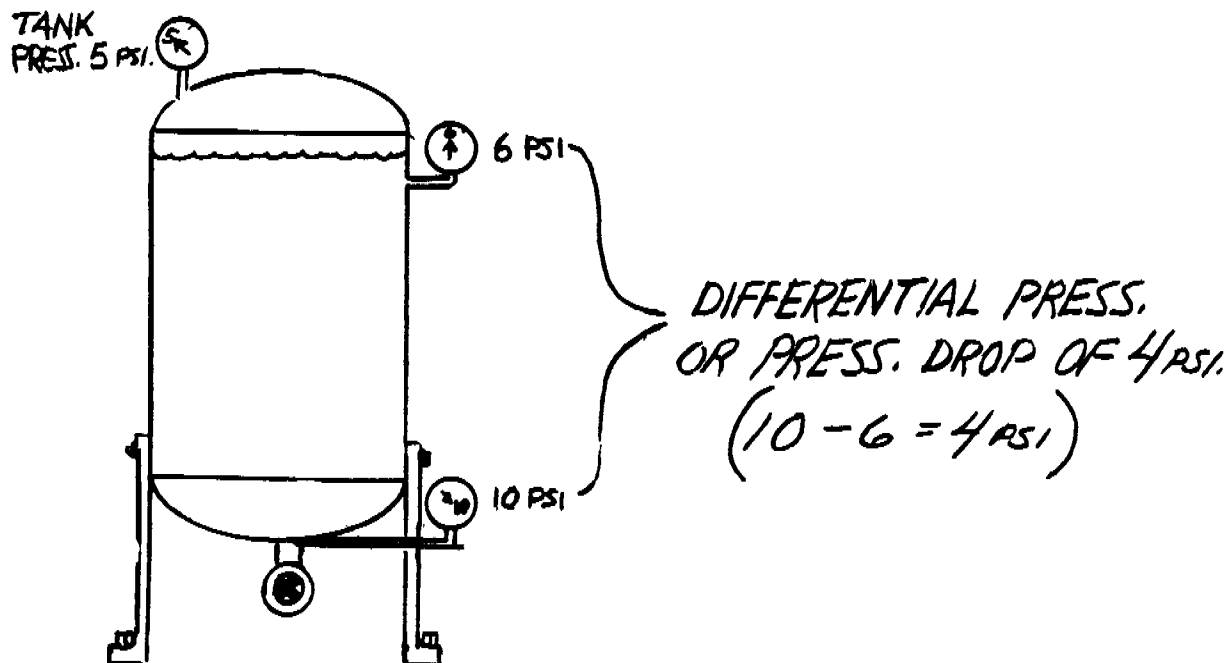
Frequently we will find it necessary to measure the difference in the pressure between two points or how much the pressure drops between two points.

With a garden hose we can see how in great distances the pressure will lessen.

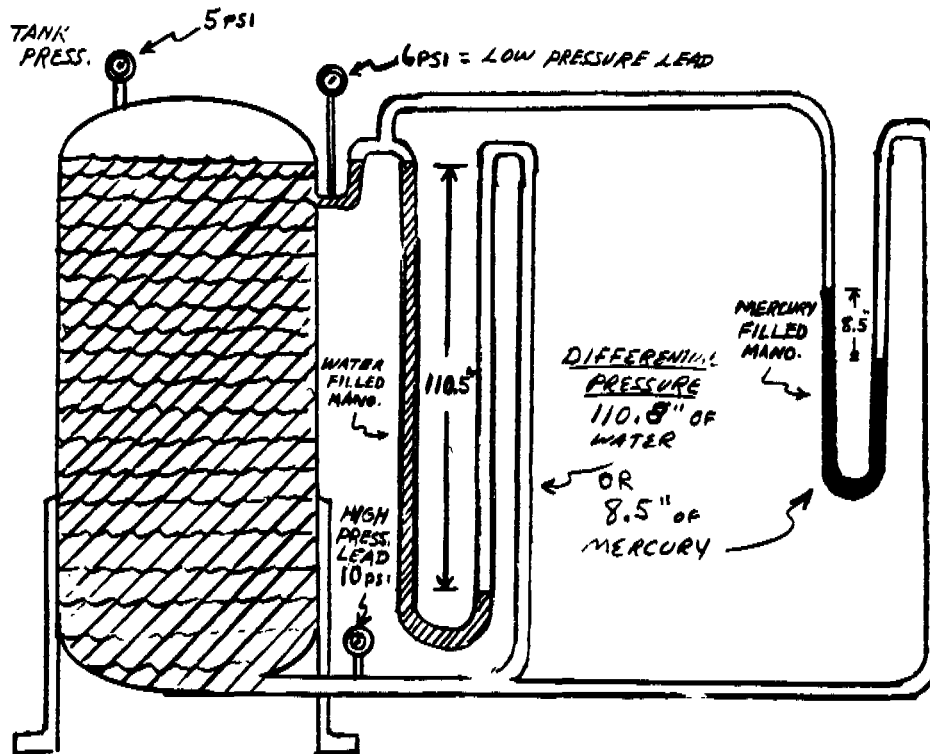
The difference between the supply pressure of 60 psi and the 45 psi pressure at the end of the hose is 15 psi. This would be our pressure drop or differential pressure across the hose.



The same principle applies to measuring the differential pressure of a tank, still column, or other equipment.



MANOMETERS OR "U TUBES"



The water "filled" manometer is a way of measuring pressure drop. The pressure at the high pressure side of the "U" tube will force the water down the high pressure side and up the low pressure side. Our reading is the difference in inches between the high and low levels in the manometer. One side of the manometer is connected to the high pressure lead at the base of the tank where our gauge pressure is 10 psi. The other side of the manometer is connected to the low pressure lead at the top of the tank where our gauge pressure is 6 psi. Our differential pressure in this case would be 4 psi gauge pressure. As 27.7" of water is equal to one psi, the manometer reading would be 110.8".

($27.7 \times 4 = 110.8$ ") The difference in inches between the levels in the manometer.

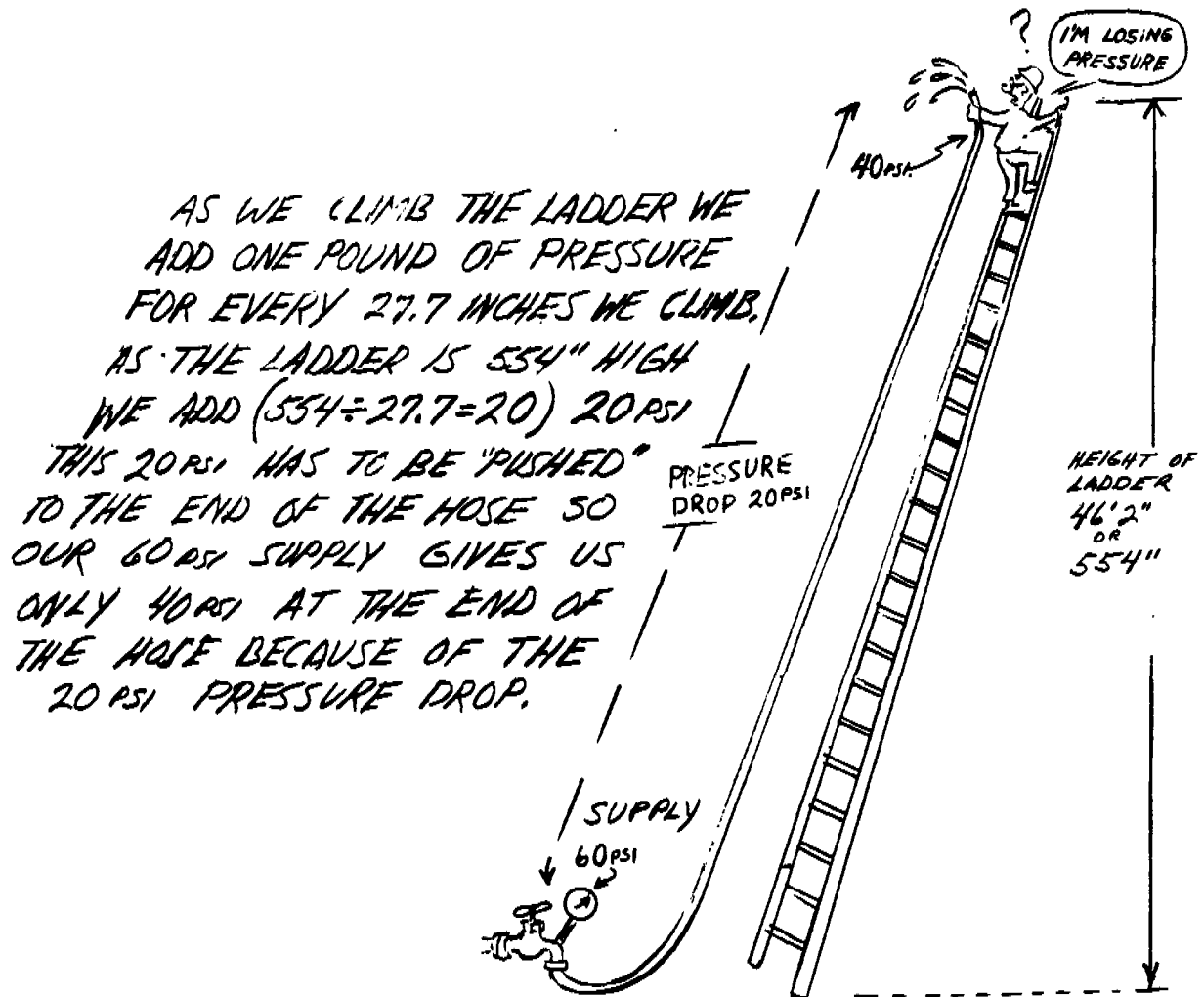
"Tied into" the same leads is another manometer which gives us a reading of 8.5 inches of mercury. This is so because mercury is thirteen times heavier than water. 8.5 inches of mercury is equal to 110.5 inches of water.

$$(8.5 \times 13 = 110.5")$$

Many of our measuring instruments for pressure and pressure drop use a mercury manometer for compactness and then give us a reading converted to inches of water, pounds per square inch, or millimeters (mm) of mercury.

DIFFERENTIAL PRESSURE OR PRESSURE DROP

If, in using a hose with a full flow of water from a 60 psi supply pressure, we were to climb a ladder carrying a hose with us we could see how the pressure drop would effect the water flow at the open end of the hose.

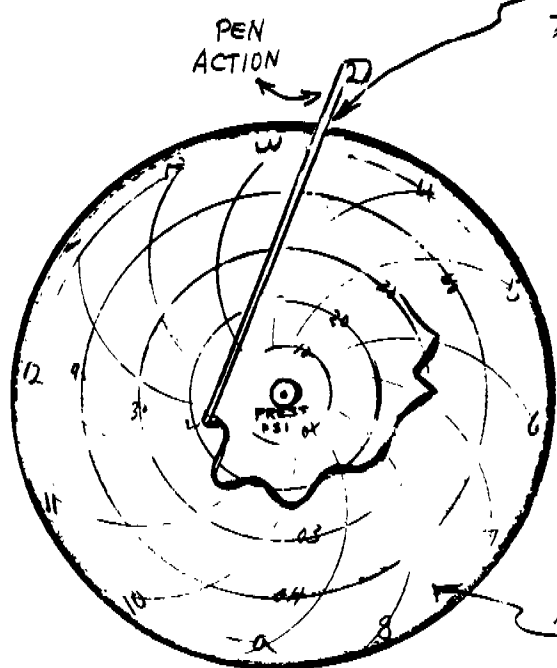
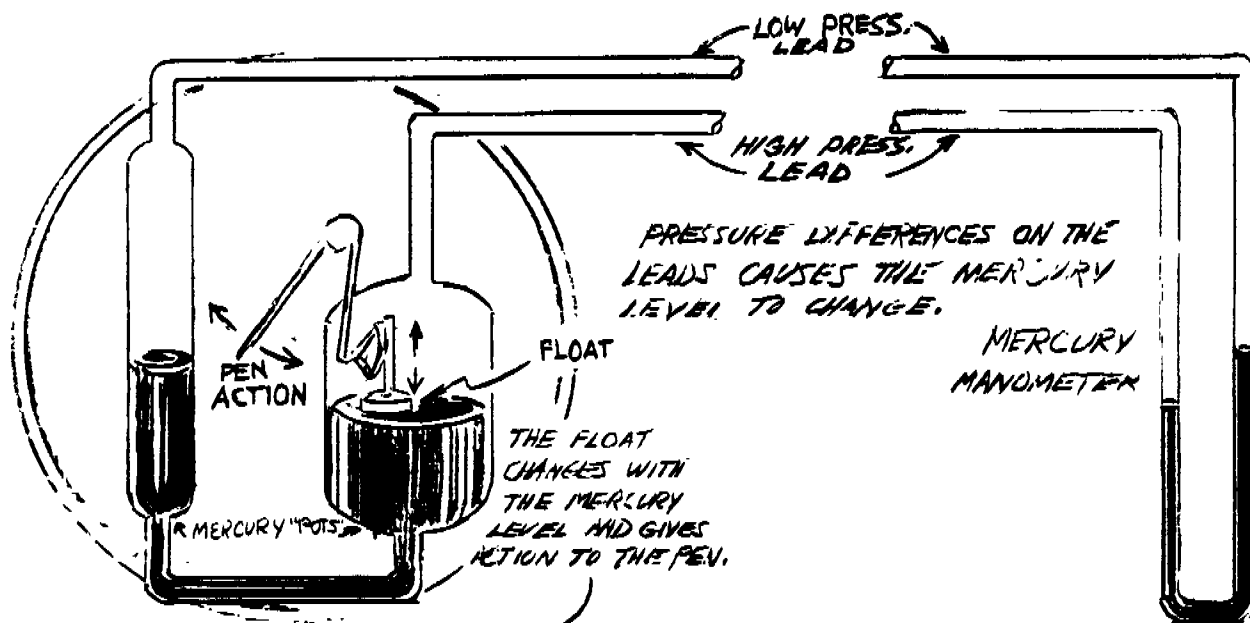


The higher we climb the more the pressure drop increases.

The flow would stop if the hose were carried up 138 feet or 1,662 inches.

$1,662" \div 27.7 = 60$ pounds pressure which equals the 60 psi supply or a pressure to overcome of 60 psi with an equal supply pressure.

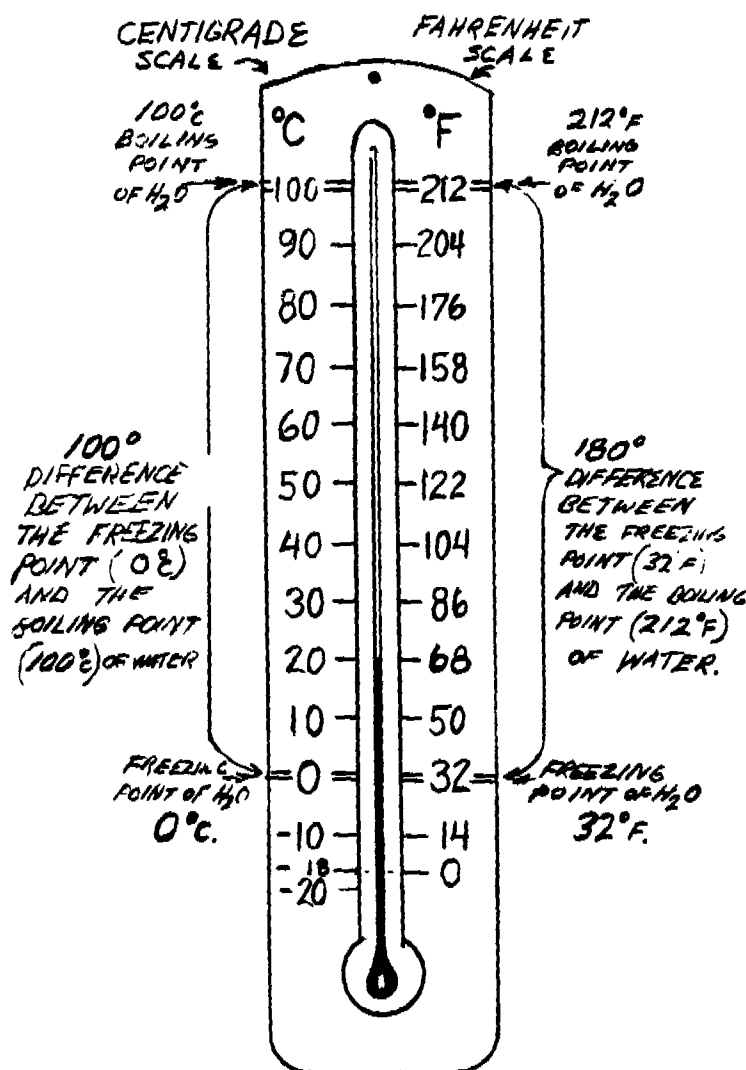
DIFFERENTIAL PRESSURE RECORDER



THE RECORDER WORKS BASICALLY LIKE
A MANOMETER

THIS TYPE OF RECORDER
WILL BE USED WHERE
MEASUREMENTS OF
PRESSURE, DIFFERENTIAL
PRESSURE AND FLOWS, OF
LIQUID OR GAS, THROUGH
LINES ARE TO BE
RECORDED

TEMPERATURE



The Fahrenheit scale of temperature is the one we are most familiar with. The freezing point of water is 32° and the boiling point of water is 212° on this scale, which is a difference of 180° between the freezing and boiling points of water. On the Centigrade scale 0° is the freezing point and 100° is the boiling point of water, or a difference of 100°. We can see that each degree of the Centigrade scale is equal to 1.8° on the Fahrenheit scale. Starting with the freezing point of water we can see that Fahrenheit temperature is 1.8 times Centigrade temperature plus the freezing temperature of water (32° Fahrenheit).

TO CHANGE CENTIGRADE TO FAHRENHEIT - The Centigrade temperature times 1.8 plus 32°.

Example: $50^{\circ}\text{C} \times 1.8 + 32^{\circ} = 122^{\circ}\text{F}$ $50^{\circ}\text{C} = 122^{\circ}\text{F}$

TO CHANGE FAHRENHEIT TO CENTIGRADE - The Fahrenheit temperature minus 32° divided by 1.8.

Example: $50^{\circ}\text{F} - 32^{\circ} + 1.8 = 10^{\circ}\text{C}$ $50^{\circ}\text{F} = 10^{\circ}\text{C}$

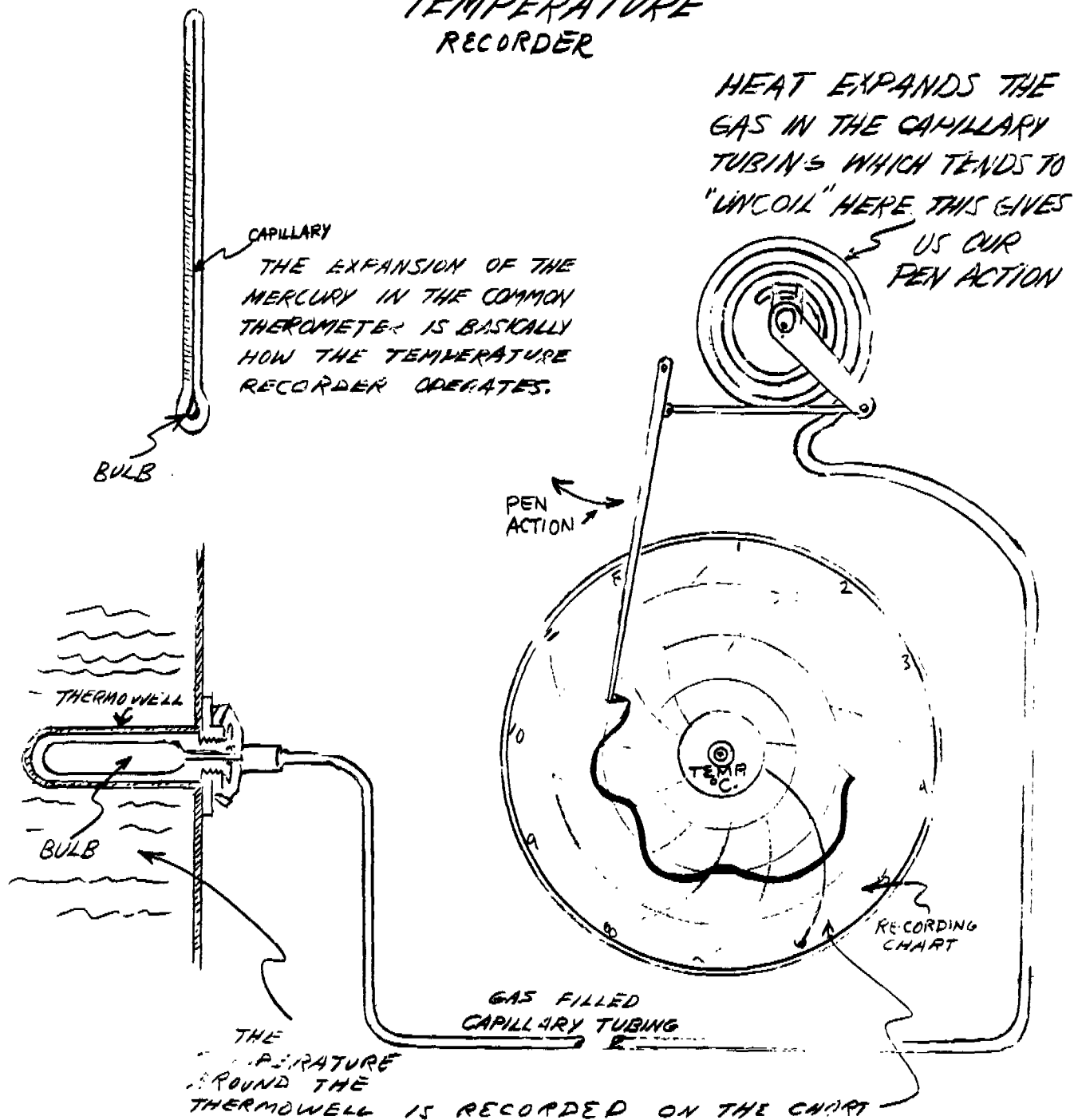
As in pressure there is also an absolute zero in temperature - the lowest conceivable temperature at which matter would contain no heat.

Absolute 0 = 0° Kelvin

273° Kelvin = 0°C

To change Centigrade to Kelvin temperature scale we merely add 273° to the Centigrade temperature.

TEMPERATURE RECORDER

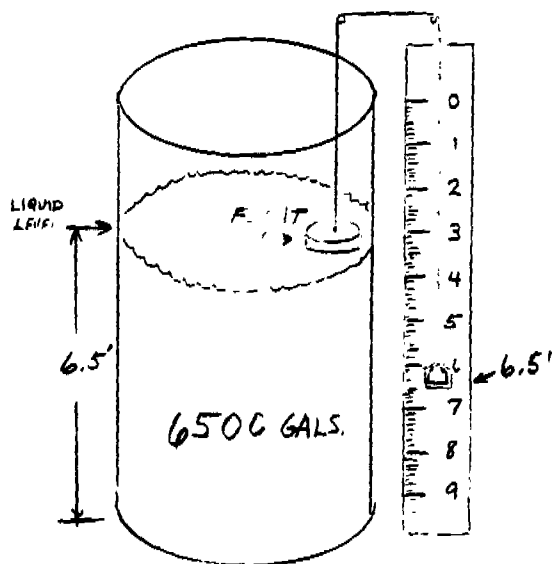


THE MEASUREMENT OF TEMPERATURE

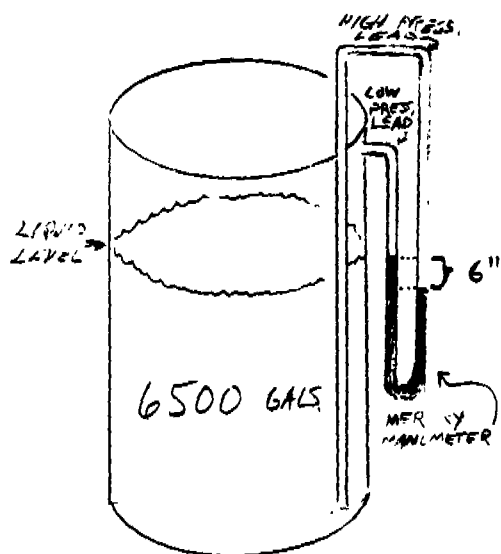
The temperature of most of the materials we use is very important as it can alter the pressure or the volume of the materials. It can also change some liquids to solids, some liquids to gas, and gas to solid. Temperature has a direct bearing on pressure. That is, generally speaking, pressure will rise as the temperature rises.

MEASURING VOLUME

The units of volume measurement in chemistry range from milliliter, found mostly in analyses, to tanks holding thousands of gallons, measured in feet and inches of the liquid level in the tank.



The gauge board measured off in feet and inches shows there is 6 ft. 5 in. of liquid in the tank. If the tank calibration for this tank was 1,000 gallons per foot, the tank now has 6,500 gallons. If this was water in the tank we could convert gallons to pounds by multiplying the weight of water, 8.32 pounds per gallon, by the gallons, 6,500, and see that we have 54,080 pounds.



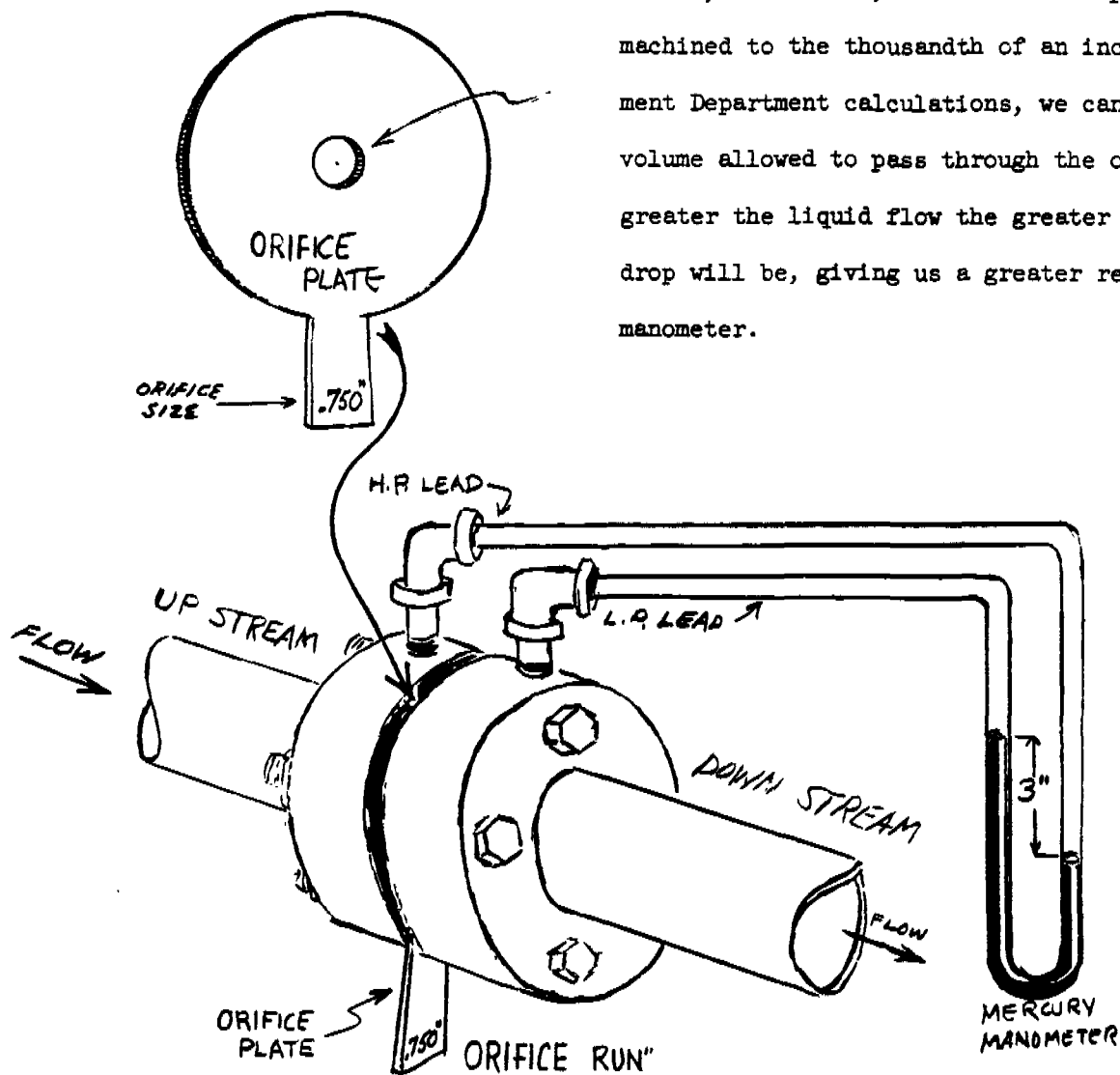
This same tank may be measured by the use of a mercury manometer. Here we measure the pressure drop in inches of mercury. The manometer reads 6". As mercury is 13 times heavier than the water, which is in the tank, we multiply $6" \times 13 = 78"$ or 6.5', the same reading we have on the gauge board. This, of course, may be converted as we did on the gauge board reading.

UCC
040617

MEASUREMENT OF FLOW

Volumes are often measured as they pass through pipe lines from one piece of equipment to another. This measurement, which is usually in gallons per hour for liquids, is gotten by measuring the pressure drop across an orifice.

A hole, or orifice, in the orifice plate is machined to the thousandth of an inch. By Instrument Department calculations, we can measure the volume allowed to pass through the orifice; the greater the liquid flow the greater the pressure drop will be, giving us a greater reading on the manometer.



If the orifice has been "designed" to allow 3,000 gallons per hour for 3" of mercury differential pressure, this flow would be measured as 3,000 gallons/hour.

Measuring of gas flow must take into consideration the pressure on the line, since gases are compressable. More gas would travel through an orifice at higher pressures, so the pressure must be considered for gas flows.

MEASUREMENT OF WEIGHT

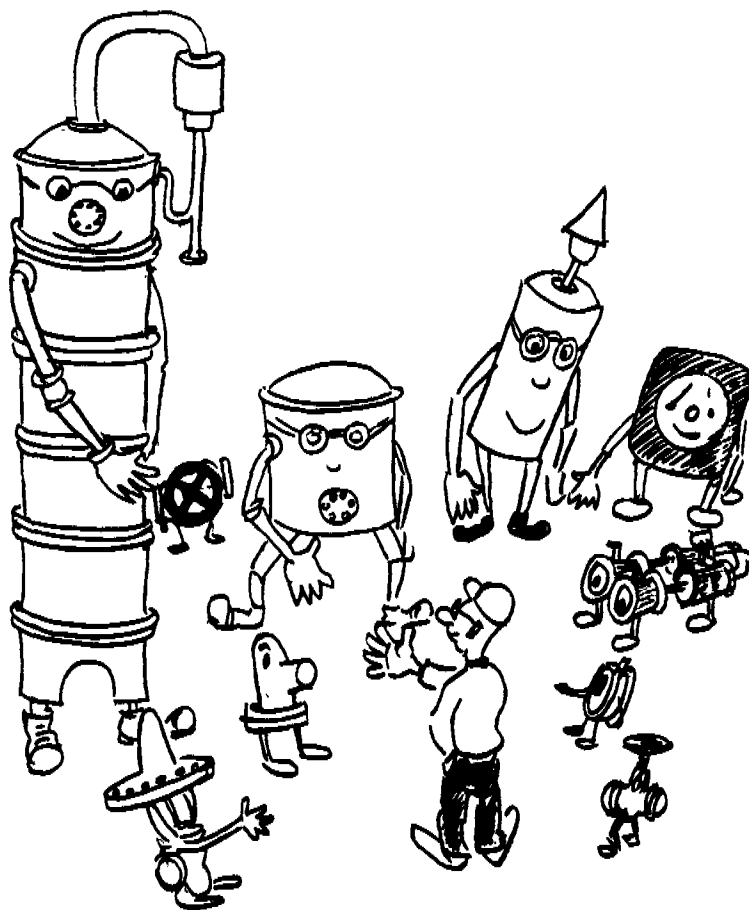
You will find that most of our storage tanks are calibrated in pounds. This is primarily for accuracy, as volume varies with temperature. The instruments for measuring the contents of our tanks, called "telegauges", are worked on the differential pressure principle. The weight of the liquid on the high pressure lead as compared to the pressure on the low pressure lead (usually 0 psi gauge pressure).

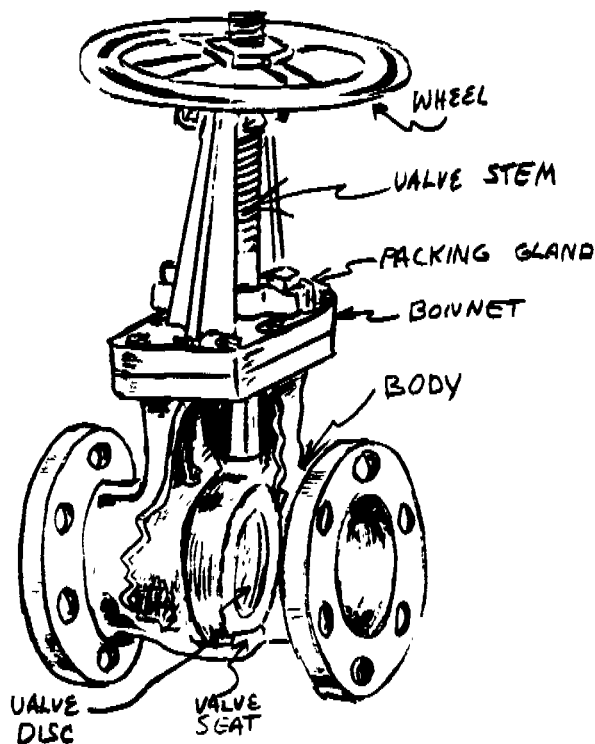
Most liquids expand when heated so we can see that a tank showing 500 gallons of acetone at a temperature of 10°C (50°F) might show an increase of 50 gallons if the acetone were allowed to heat up to 30°C (86°F). When using pounds for our measurement of liquid, we need not be concerned with the temperature since the temperature does not effect the weight as it does the volume.

In many of our chemicals the amount is critical to a small portion of a gallon. To get as nearly perfect as we can, we measure our liquids by the pound. In other words, by pumping 100 gallons of water we could be several gallons off without it showing on our means of measurement, but if we pump 832 pounds (100 x 8.32) from a tank on a scale we are much closer.

We have tanks which are mounted on scales to measure vinyl acetate and vinyl chloride. These are called "weigh" tanks. Operators are able to get the required amount in these weigh tanks "to the pound".

We have partly covered our "tools of measurement". Now let us consider the other tools of our craft, the stills, pumps, valves, pipe lines, extractors, converters, autoclaves, compressors, and other equipment. With these tools we make "Vinylite" resin from natural gas, salt, air, water, and other naturally occurring materials.

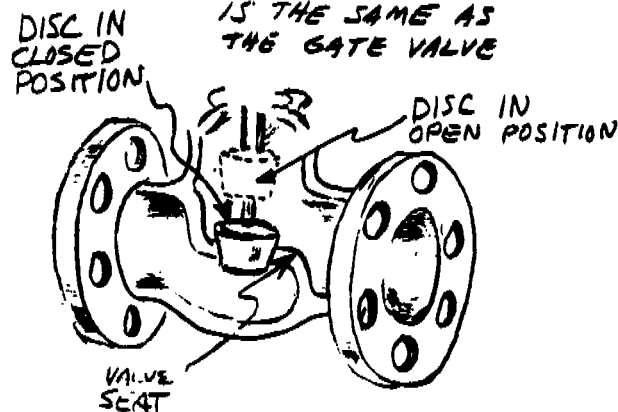




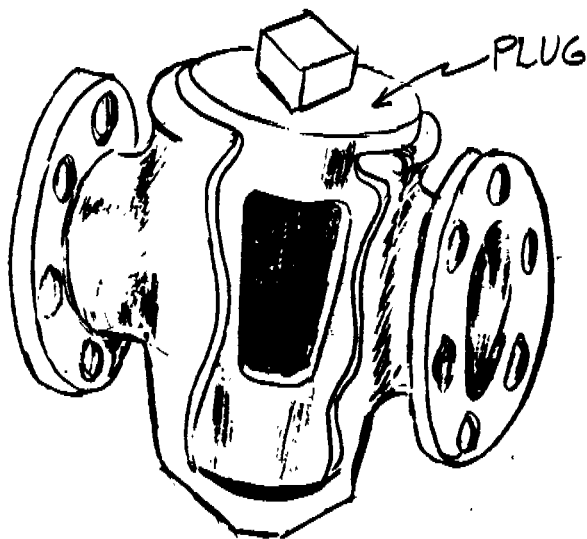
GATE VALVE
(CUT-AWAY VIEW)

VALVES

THE DIFFERENCE IN THE
GLOBE VALVE IS IN THE
WAY THE DISC SEATS -
THE REST OF THE VALVE
IS THE SAME AS
THE GATE VALVE



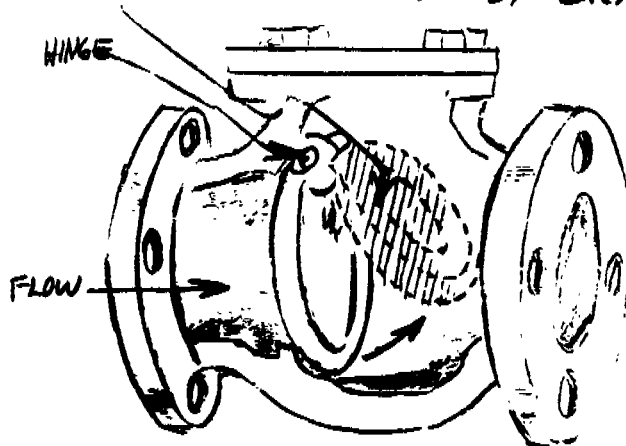
GLOBE VALVE
(CUT-AWAY VIEW)



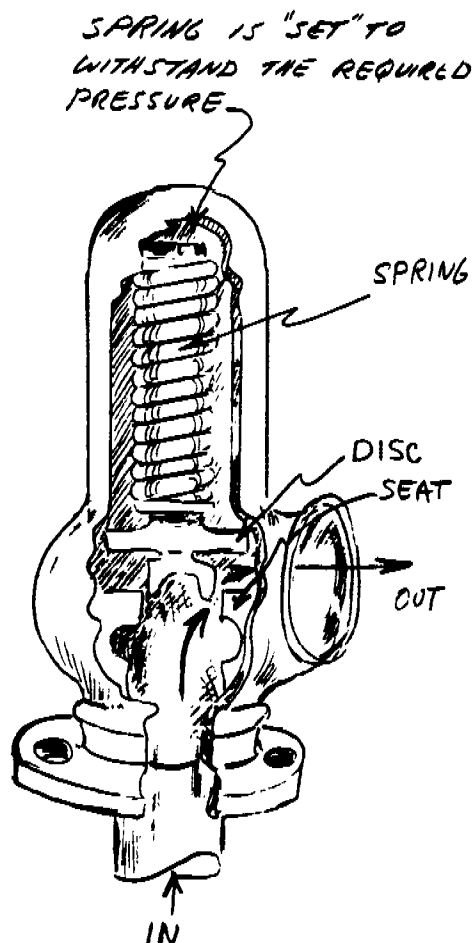
COCK OR PLUG VALVE
(CUT-AWAY VIEW)

CHECK VALVE

VALVE U.C. IS HINGED SO THAT
THE FLOW CANNOT "BACK-UP"

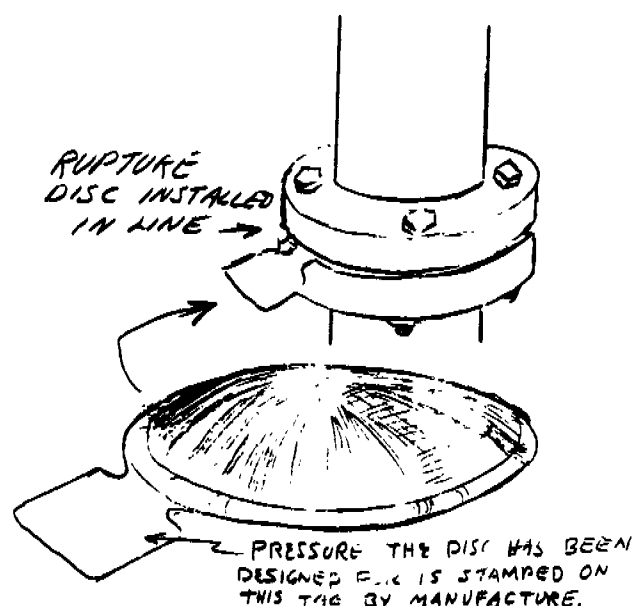


DISC WILL SWING OPEN
IF FLOW IS "BEHIND" IT
AND WILL CLOSE AGAINST
SEAT IF FLOW IN LINE
IS REVERSED. DIRECTION OF
FLOW IS USUALLY MARKED ON
CHECK VALVE - BY AN ARROW



SAFETY (POP) VALVE

SPRING RESEATS VALVE WHEN EXCESS PRESSURE HAS BEEN BLOWN OFF.



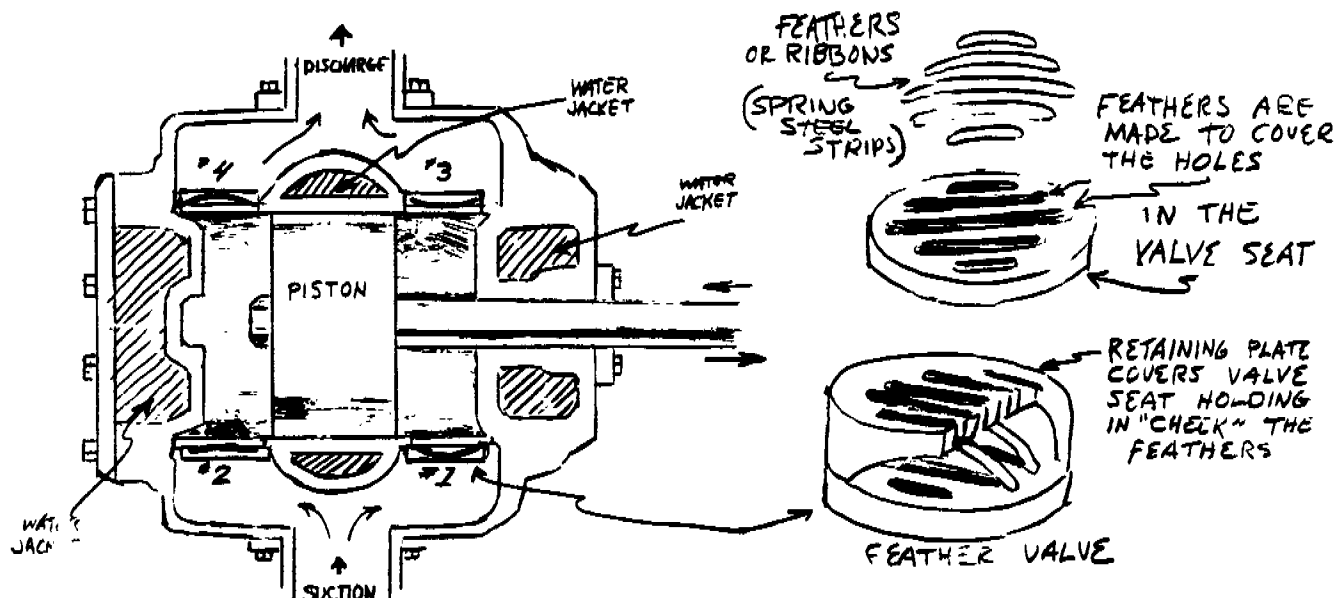
RUPTURE DISC

DISC MUST BE REPLACED WITH A NEW ONE IF THE RUPTURE DISC BLOWS

It must be remembered that pop valves and rupture discs are installed as emergency pressure relief devices. If at any time either is releasing pressure the safe operating pressure has been exceeded.

Until you have been given authority you should never close off a valve to stop the pressure from being released at a pop valve.

Rupture discs may, after being in service for a long period of time, burst at a pressure below the pressure they were designed to hold. If this were to happen, circumstances could make it safer to close off the valve under a rupture disc. With experience and a thorough knowledge of safe operating pressure in your unit, you would close off a rupture disc that bursts falsely.

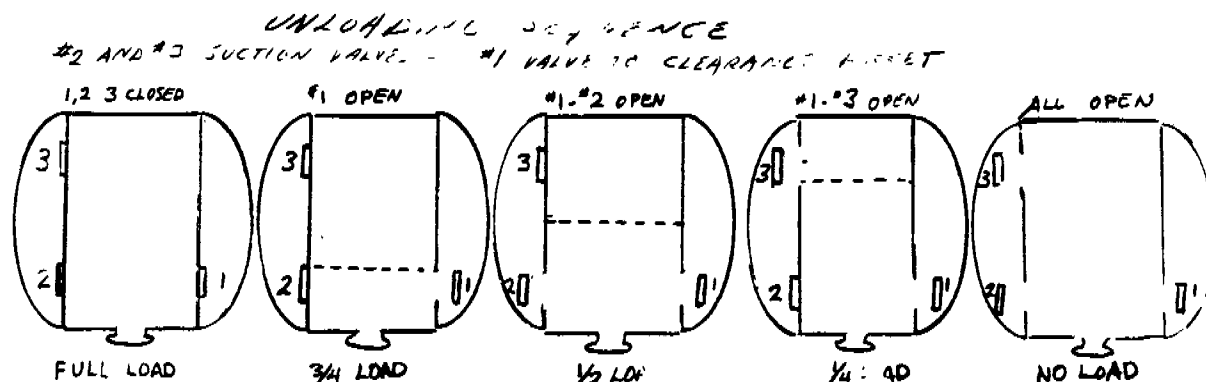


COMPRESSORS

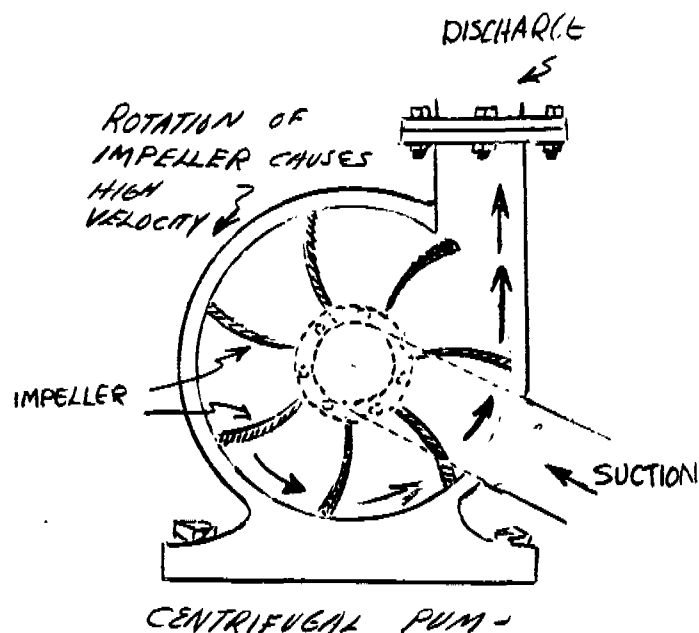
There are various types of compressors, some steam and some electric powered. They all are generally of the same principle. The compressor is very much like a pump except it is made specifically for gas. Liquid, of course, cannot be compressed, so every precaution is taken to keep the cylinder free of liquid. The suction lines of compressors have traps and dryers to keep the cylinder dry. These traps and dryers must be checked often. A flooded trap which would allow liquid to be pulled into the compressor would possibly result in knocking out the head of the cylinder.

Ribbon or feather valves at the sides of the cylinder walls act as check valves to separate the discharge, the suction, and the cylinder thus making compression of the gas by the piston possible. The feather valves #1, #2, #3, and #4 operate in relation to the position of the piston. That is, if the piston were moving forward this would open #1 to pull in gas from the suction and close #3 so no gas would back into the cylinder. On this same forward motion, #4 would open to discharge the compressed gas. At the same time #2 would close.

In the unloading sequence the two suction valves are bypassed and the clearance pocket valve are operated to change the load from full load to no load. The compression lost to the clearance pocket through the #1 valve or the combinations of the suction valves #2 or #3 plus the clearance pocket change the capacity of the compressor.



— PUMPS —



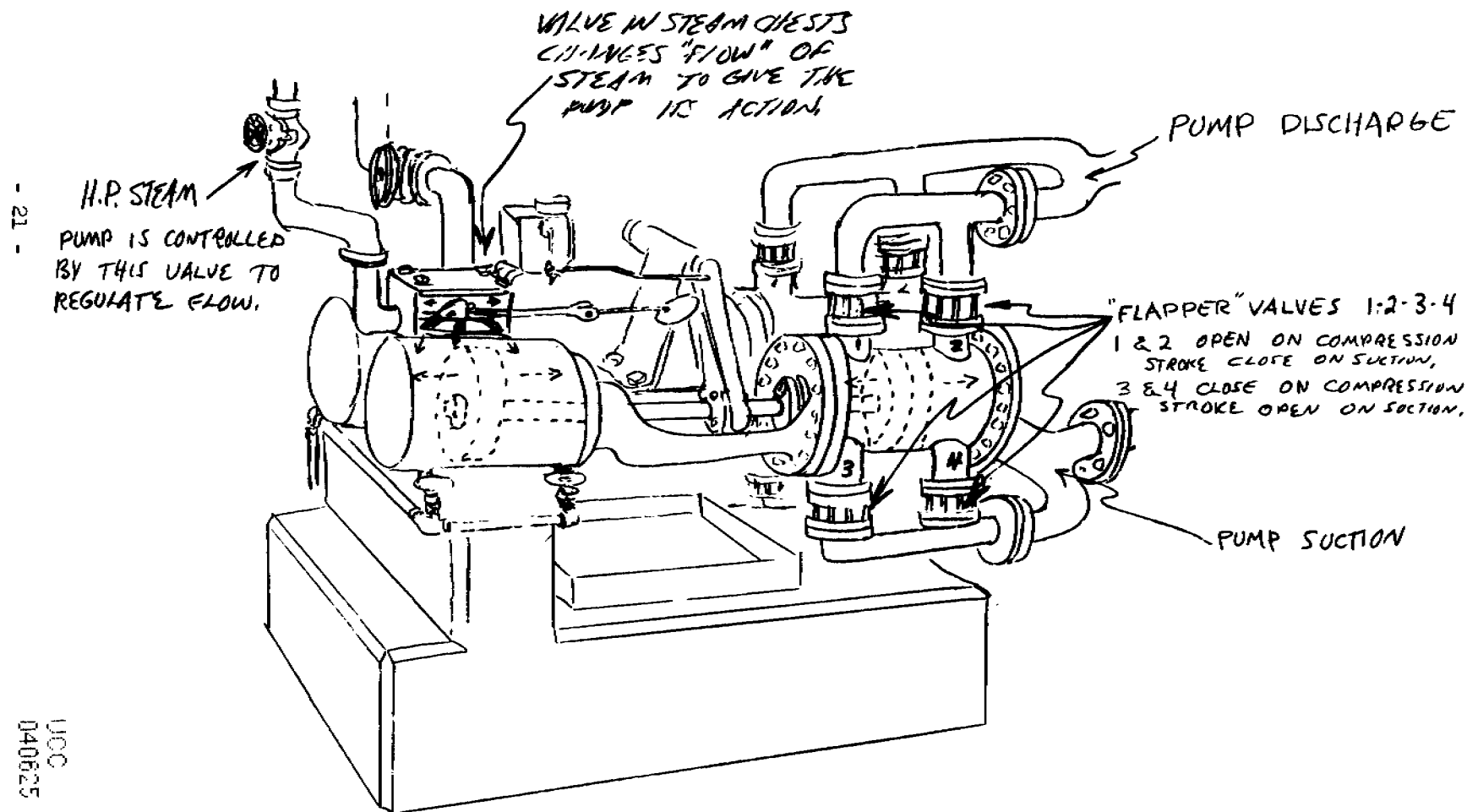
Pumps are used to transfer most of the materials in the "Vinylite" Solvent Area. There are many different types of pumps but the most common are the reciprocating pump, usually a steam driven piston type pump, and the centrifugal pump, usually run by an electric motor.

The reciprocating pump is better for moving materials of a high viscosity (very thick liquids) or for high discharge pressures. The flow can be controlled by the amount of steam allowed to drive the pump. The discharge pressure of the pump will continue to build if

the discharge line is restricted so that it is a risk to attempt control by closing the valves in the discharge line. The pump could build enough pressure in the discharge line to rupture the line. For this reason a "pop" or safety relief valve is installed in many of the discharge lines.

The centrifugal pump is being used widely now. This pump allows us to regulate the flow without the pump building pressure above its designed maximum pressure. Control valves, orifice plates, or other "restrictions" cannot hamper the pump. The valves on the discharge line may even be closed for short periods without harm. Closing the discharge for long periods causes overheating.

RECIPROCATING DUPLEX STEAM PUMP



— DISTILLATION —

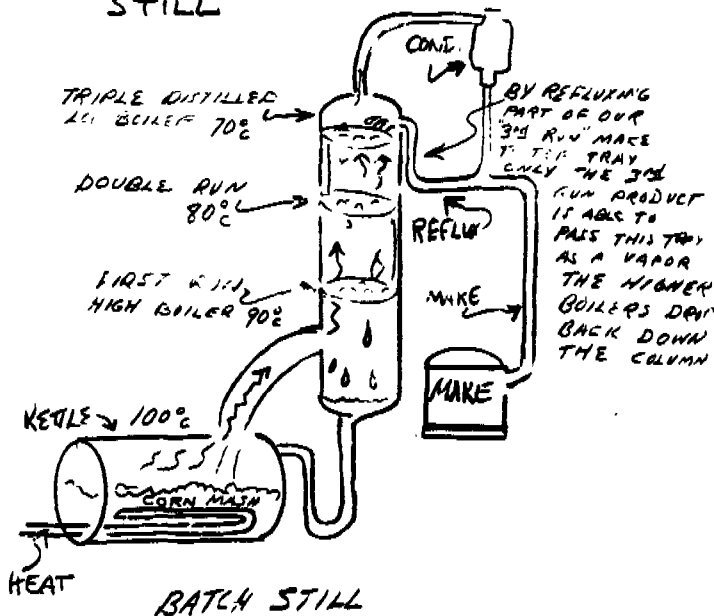
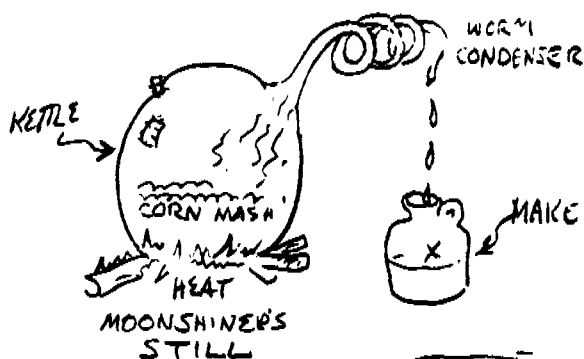
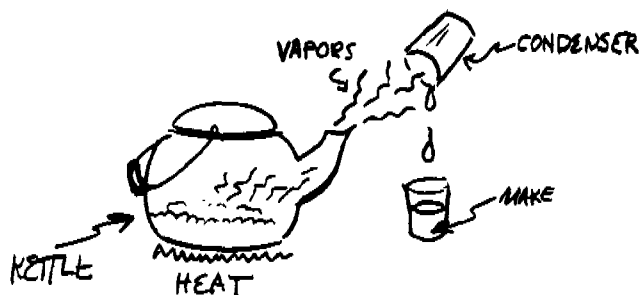
A simple form of distillation would be the boiling of water in a tea kettle. The steam (vapors) condensed in a cool glass would be our make (distilled water).

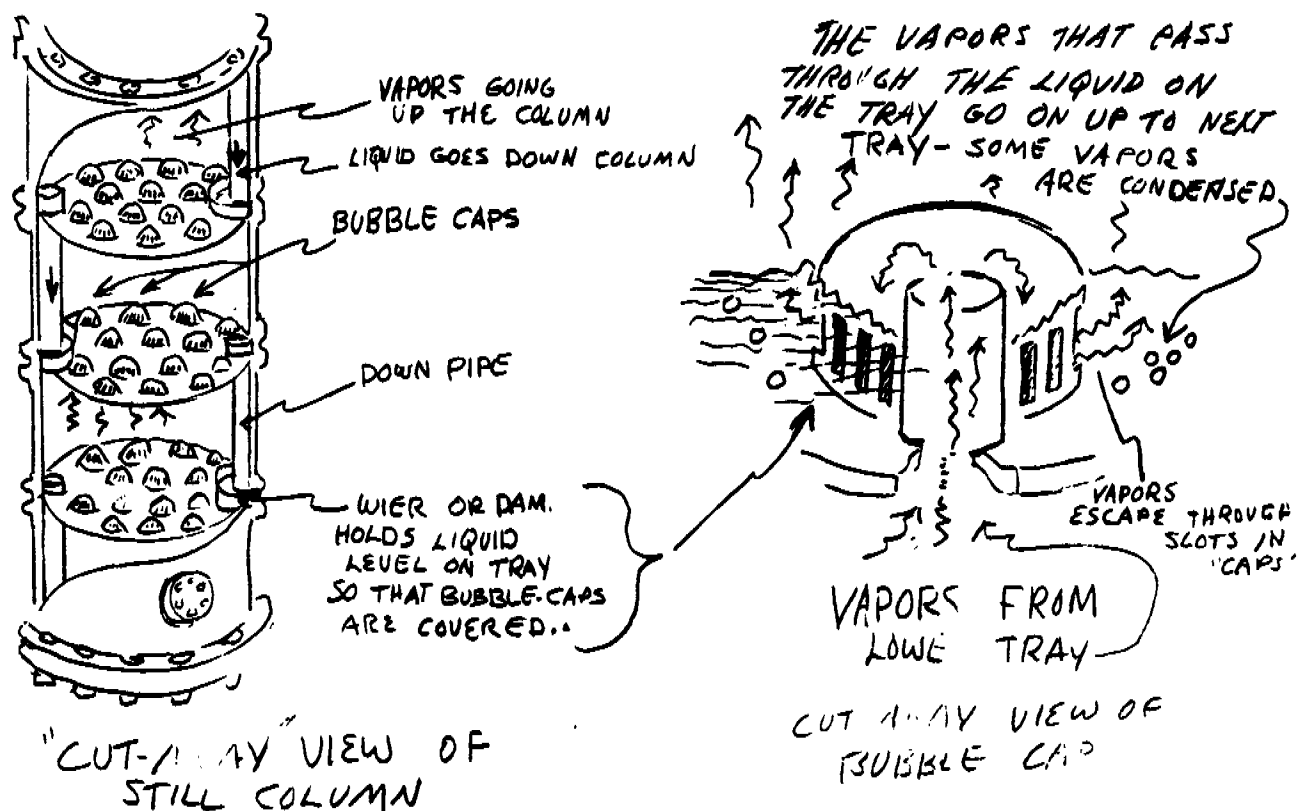
The moonshiner's still is a little more efficient in that all the vapors are condensed in the "worm" or condenser.

The first "batch" of moonshine run off can be made "purer" by rerunning the first batch (make) to give us "double-run" whisky. This could likewise be rerun to give us "third-run" whisky.

We can get a triple distilled product by the use of a still column attached to our kettle. This is "batch distillation". The vapors rise to the top of the column and after being condensed, drop back to the top of the column. This is "total reflux". As the lower boilers (the first to boil off) are returned to the top tray as reflux, the higher boilers condense and drop back down the column. This refluxing gives an extra "scrubbing" effect to vapors which do break through the liquid "seal" of our lowest boiler insuring a purer product. After "total refluxing" our column for a while, the still will come to its equilibrium, that is our temperatures will become "steady" at the different levels of the column the still has "lined out".

The total vapor put through the condenser is the "overhead", the returned portion is "reflux" and the part taken off to our make tank is our "make". The make rate must be "adjusted" so that there is enough reflux to maintain our vapor temperature. As we boil out the low boilers, it will be necessary to reduce our make rate (increasing our reflux) until we can no longer hold a desired head temperature. At this point we have completed the distillation of our good product.





Our still columns have various numbers of sections each having several still trays. The vapors which go up the column, must pass through the slots in the bubble caps on the trays where they either condense or remaining as a vapor go up to the next tray. If in our acetone column the vapor goes through all the trays without condensing, it goes over the top at a temperature of 56°C (vapor temperature) so we know that it is acetone since the water and isopropanol would have condensed.

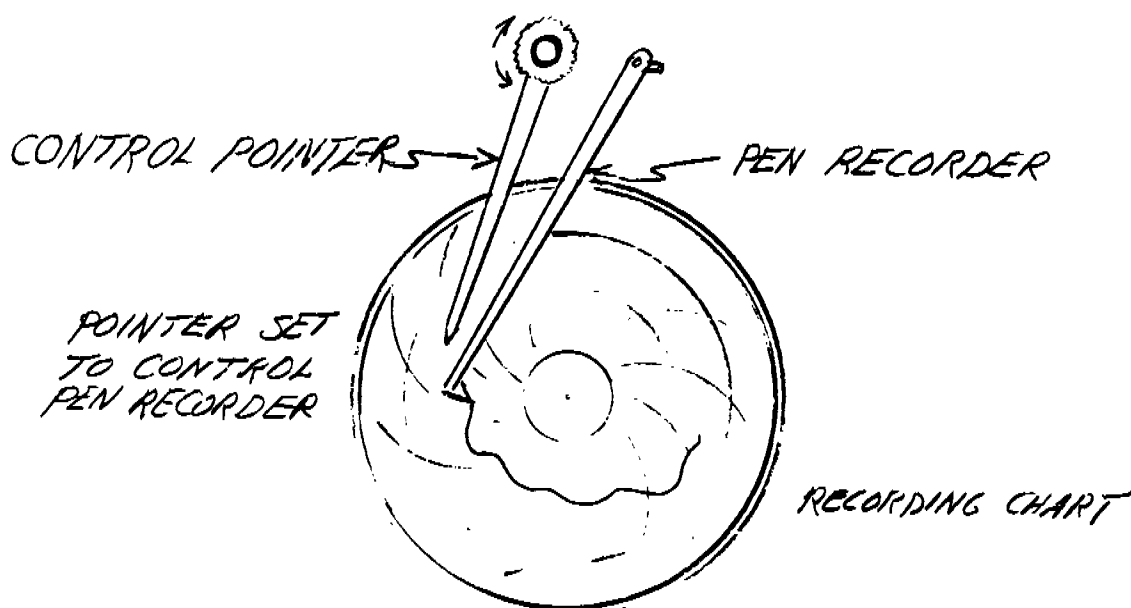
The condensed portion of our feed travels down the column through the down pipes maintaining a level of liquid over the slots in the bubble caps because of the dams, constructed to maintain the required level.

As long as the down flow does not flood some section or sections to a point where the vapors are held back, or as long as there is proper vapor flow up the column, the column is functioning. If the down flow does flood a section or sections to the point that the vapor flow drops off, the still is "slugged". This will be evident by the increase in pressure drop or a reduction in steam flow for the same pressure drop.

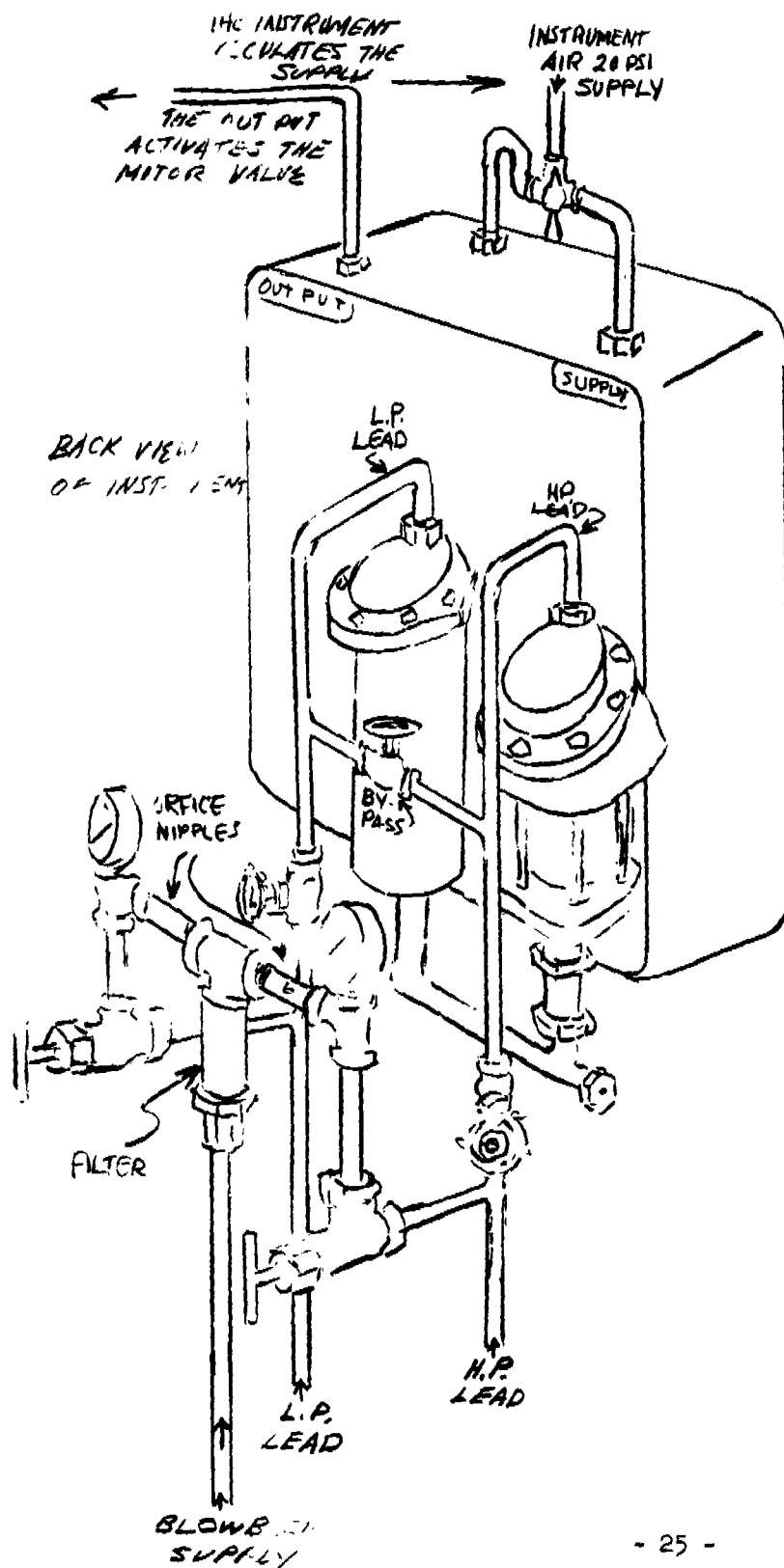
AUTOMATIC CONTROL

The pressure and temperature recorders which we have already covered are often used to automatically control the flow through lines so that the required temperature or pressure is maintained. This is made possible by the automatic regulating of the supply of instrument air to the diaphragm motor valve, DMV. The motor valve is opened or closed in accordance with the amount of instrument air supplied to the diaphragm, which is determined by the variation of the pen with the set pointer.

When the recording pen varies from the position we have set with the pointer, a complicated series of baffles, bellows, diaphragms, and other means regulates the instrument air supply to the DMV to open or close the valve so that our "pen", when it lines up with the pointer, will show us we have controlled our pressure, temperature, or flow to the desired set point of the pointer.



Instruments or controllers are the "tools" of an operator. They are, in most cases, precision instruments and are not to be tampered with. The operator needs to learn only if the instrument is working properly. All repairs and adjustments are made by instrument mechanics trained for this type of work.

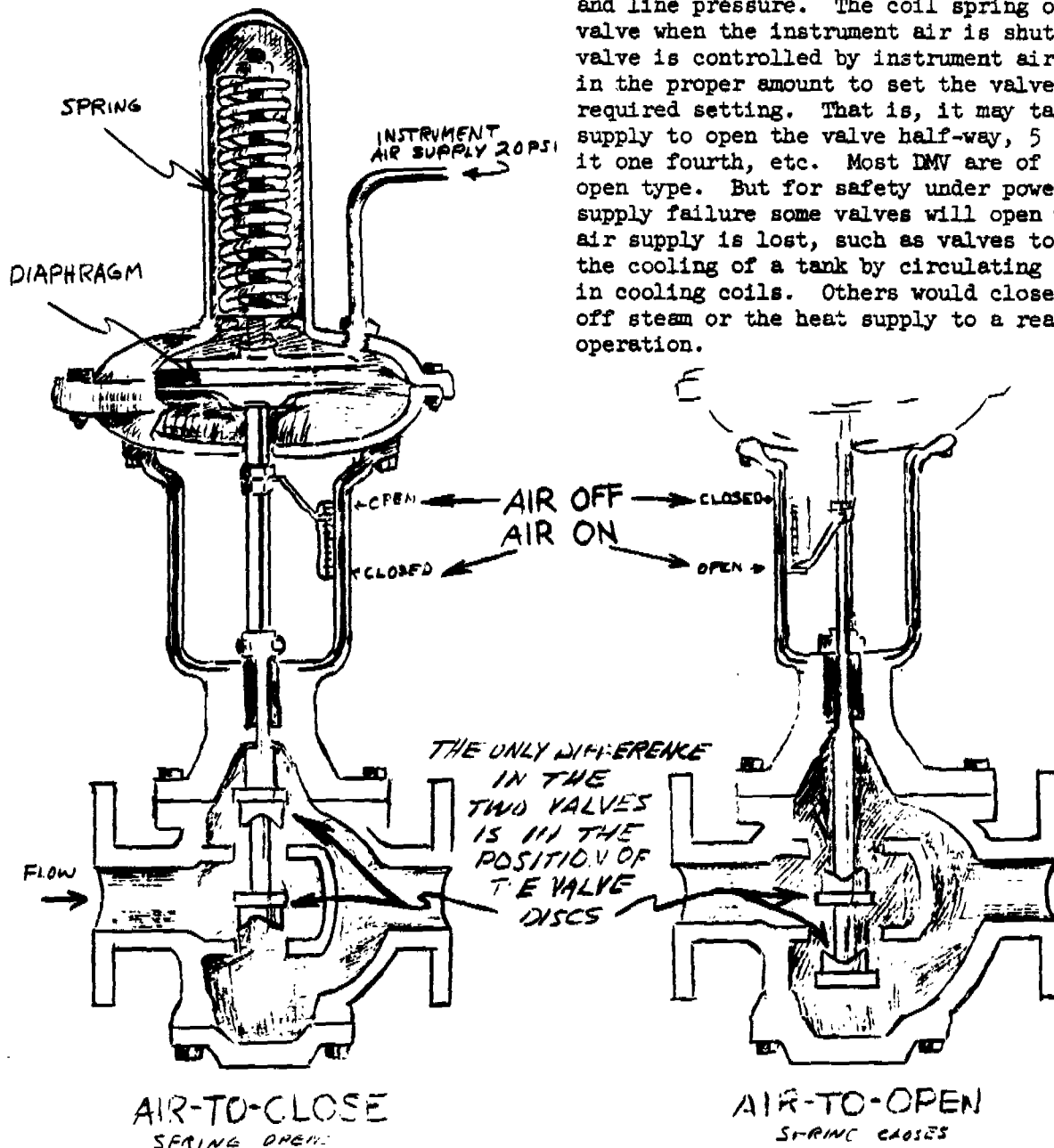


The operators should know where all the high and low pressure leads from the controlling and recording instruments go. So that our leads are kept free to maintain a correct reading, most of our pressure type meters have "blow-back". Blow-back is a small stream or flow (with pressure greater than the pressure on the leads) "injected" into the lead through an orifice so small that it has very little effect on the pressure in the leads, but this very small blow-back flow is able to keep the leads from "plugging off" or fouling.

DIAPHRAGM MOTOR VALVE DMV

Automatic valves, controlled by a 20 psi air supply (instrument air), are used for controlling the flows through the lines which will regulate the pressure, temperature, and flows throughout the plant.

The instrument air released to allow a 20 psi air supply on a 6" diaphragm would place a force of about 550 pounds on the diaphragm to offset the spring compression and line pressure. The coil spring operates the valve when the instrument air is shut off. The valve is controlled by instrument air pressure in the proper amount to set the valve at any required setting. That is, it may take a 10 psi supply to open the valve half-way, 5 psi to open it one fourth, etc. Most DMV are of the air to open type. But for safety under power or air supply failure some valves will open when the air supply is lost, such as valves to control the cooling of a tank by circulating cold water in cooling coils. Others would close to shut off steam or the heat supply to a reacting operation.

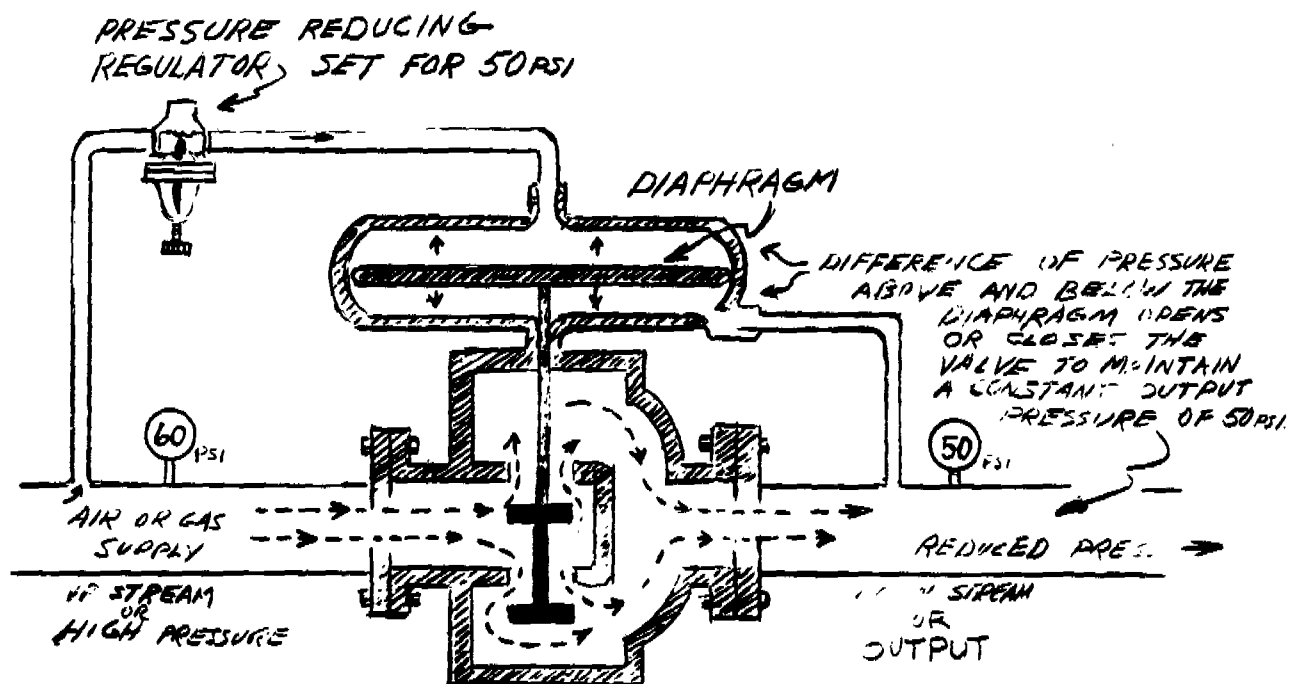


On double-seated valves (pictured), the upstream pressure enters the valve between the two discs so that there is as much pressure on one disc to push it up as there is on the other disc to push it down. A double-seated valve required approximately the same force to open it as to close it. Large motor valves are almost always double-seated to reduce the diaphragm size of the motor.

PRESSURE CONTROL

Pressure may be controlled by venting off or releasing excessive pressure to tanks or equipment which have a lesser pressure. To maintain a specific pressure, a pressure balanced air or gas regulator is used.

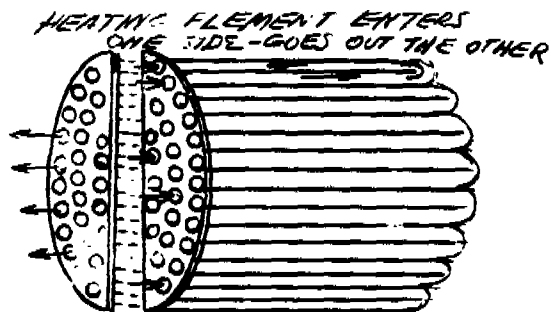
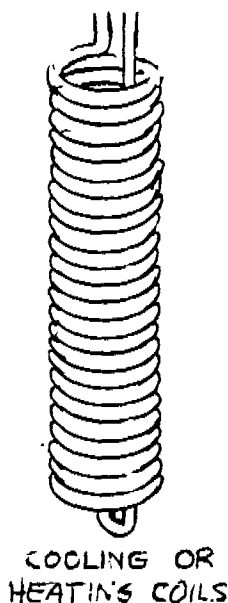
This type control valve opens when output pressure drops, and closes when the output pressure is equal to the regulated supply on the small line going in above the diaphragm. This diaphragm is a disc made of a pliable rubber-like plastic which responds readily to moving up or down to force the control valve disc to open or close.



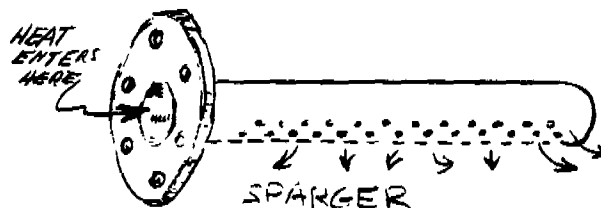
PRESSURE BALANCED AIR
OR GAS REGULATOR

TEMPERATURE

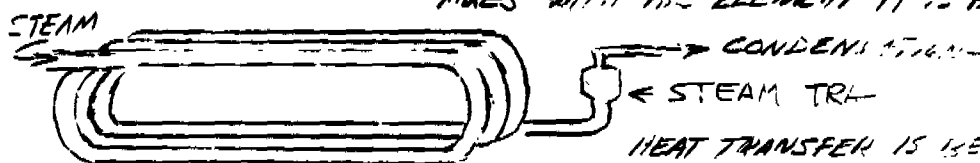
For good temperature control the coils must be kept clean. If the insides of the tubes or coils become partially plugged, the flow, due to increased pressure drop will be lessened, and if the outsides become dirty, loss of heat transfer will result as the outside cake around the tube would act as insulation.



TUBE BUNDLE

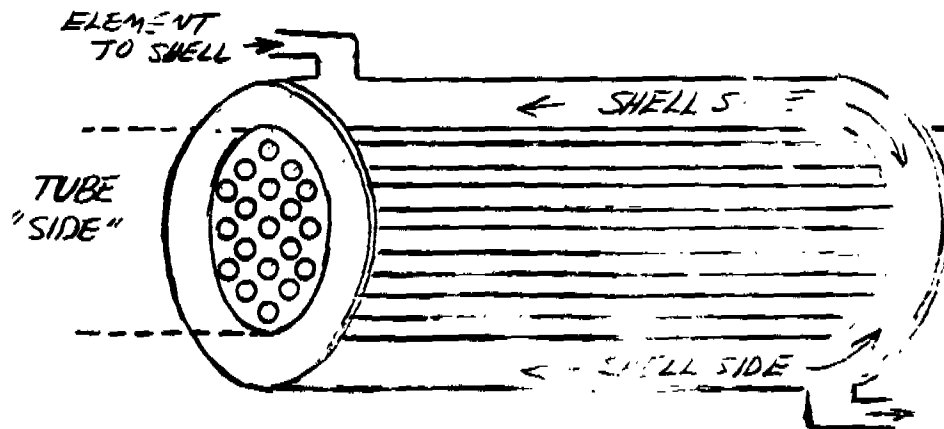


THE HEATING ELEMENT FROM A SPARGER MIXES WITH THE ELEMENT IT IS HEATING.



STEAM COILS

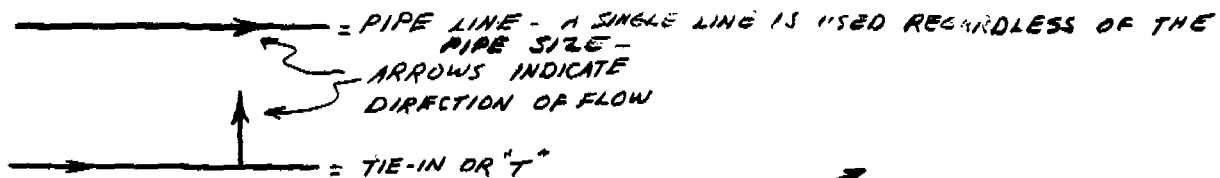
HEAT TRANSFER IS BETTER IF THE STEAM CONDENSES IN THE COILS. THE TRAP CLOSES TRAPPING THE STEAM UNTILL IT CONDENSES. WHEN THE TRAP FILLS WITH CONDENSATION IT RELEASES THE CONDENSATION AND THEN CLOSES AGAIN.



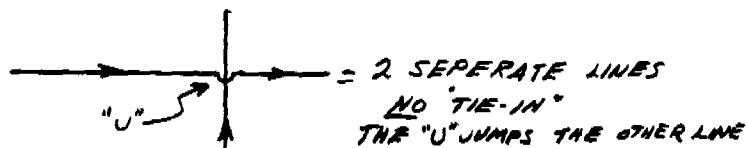
THIS TYPE OF COIL - HEATER MAY HAVE THE HEAT ON THE SHELL SIDE OR TUBE SIDE

SYMBOLS USED IN FLOW PLANS

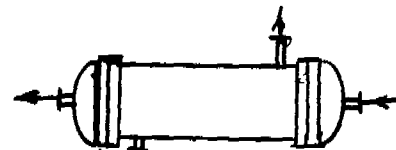
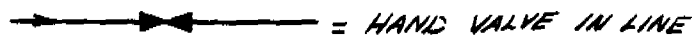
Along with the tools of your craft it would be well to know how to read a "flow sheet" or "flow plan". A flow sheet is a "map" of a process or unit showing the pipe lines, valves, and equipment. These flow sheets are seldom drawn to scale and symbols are used to designate much of the equipment. These symbols are the sign language of the operator and much can be learned from a flow sheet if you are able to interpret the signs or symbols.



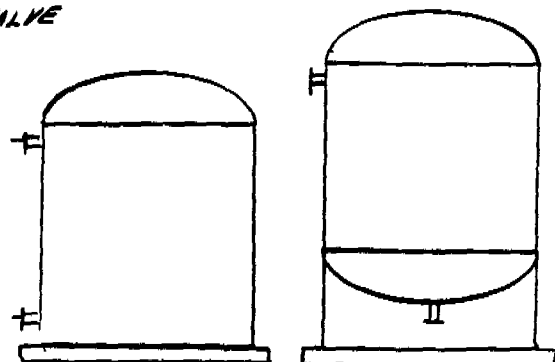
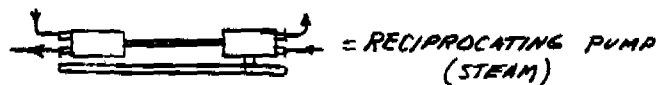
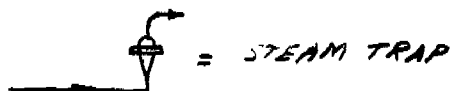
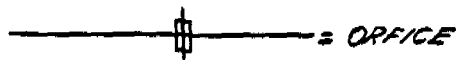
↪ CROOKED ARROWS ARE USED FOR "POINTING OUT" EX.



----- BROKEN LINES ARE INSTRUMENT LEADS ETC.

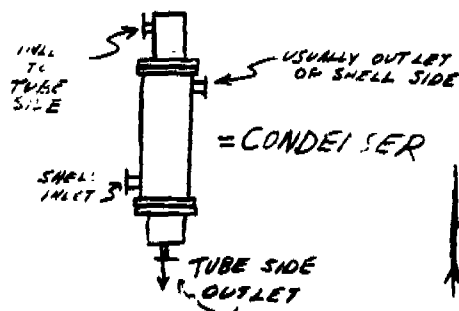
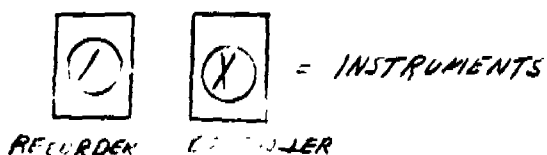
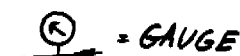


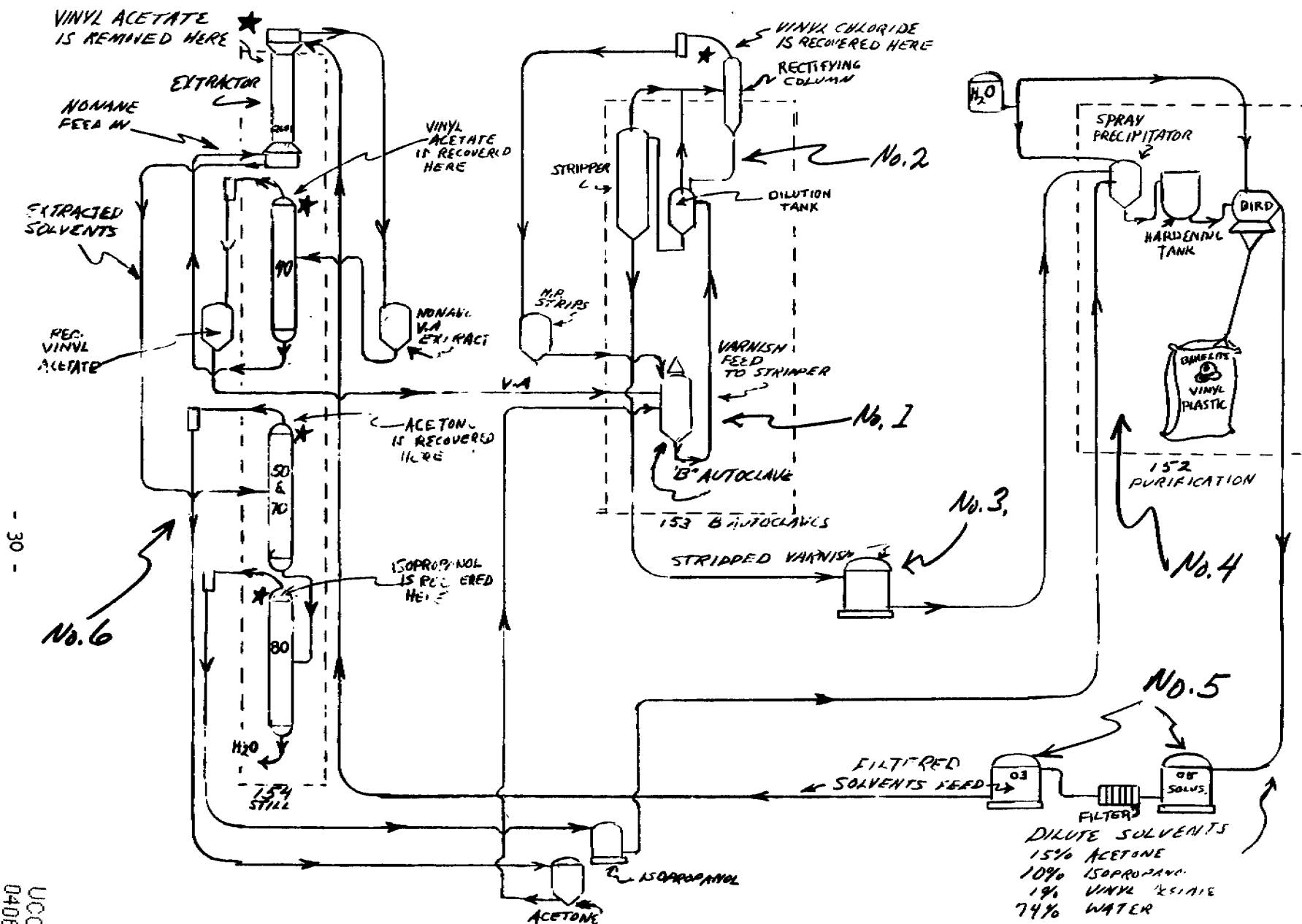
HEATER-COOLER
OR AS LABELED



TANKS

UCC
040633





VINYLLITE SOLVENT RESINS AREA

"VINYLITE" SOLVENT RESIN AREA FLOW SHEET

NO. 1

On the flow plan we can start with the "B" autoclave where the "charge" of vinyl chloride, vinyl acetate, acetone, and catalyst is reacted.

NO. 2

The reacted varnish is next pumped to the stripping system where the unconverted vinyl chloride is recovered.

NO. 3

The stripped varnish is then stored in varnish tanks to be pumped to the resin processing unit.

NO. 4

The resin processing unit precipitates, dries, and blends the resin which is then shipped as "Vinylite Solvent Resin" to plastic manufacturers.

NO. 5

In the finishing process at resin processing all unreacted materials are dropped back to the solvent storage tanks where they are used as feed for the distillation unit.

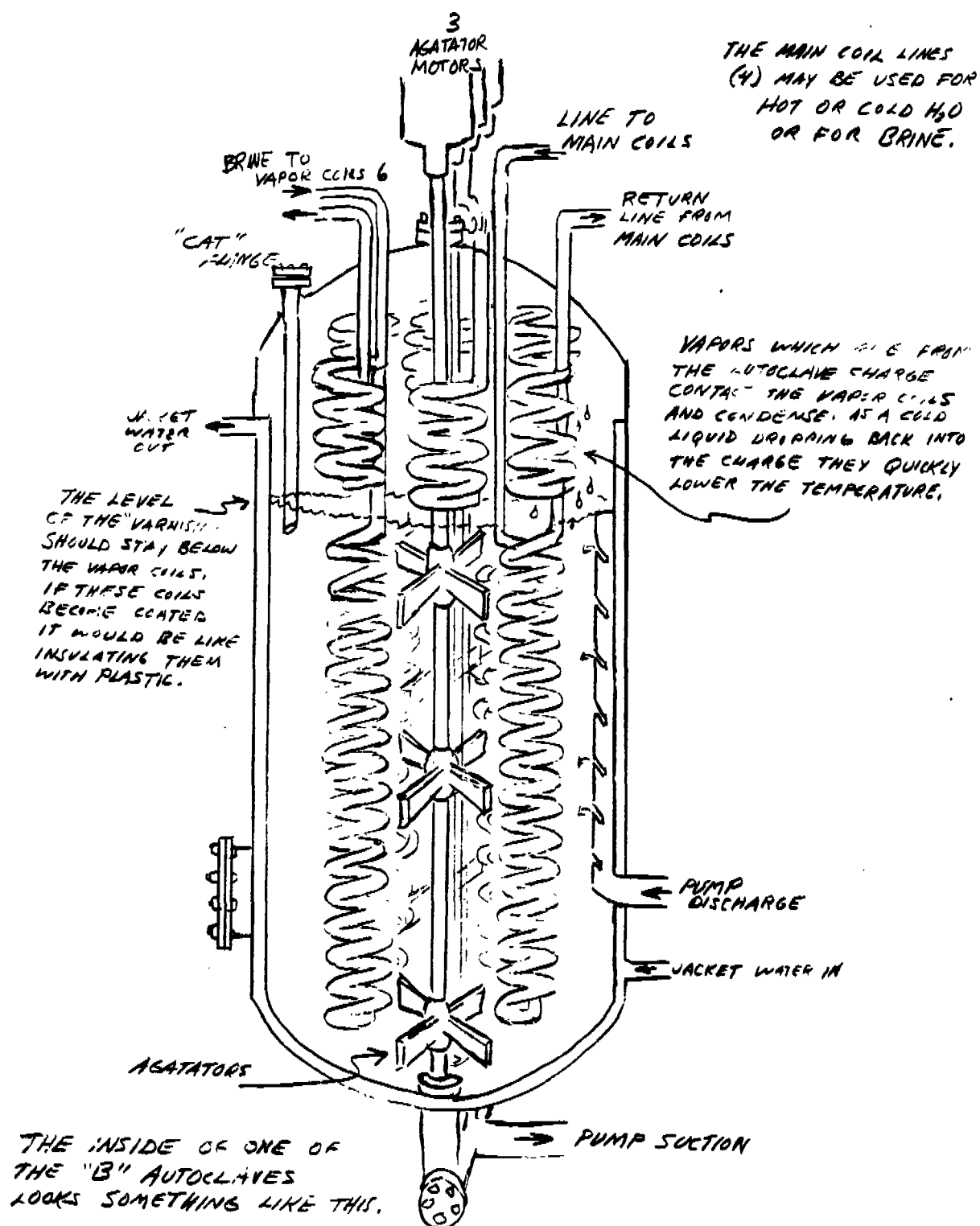
NO. 6

The vinyl acetate is recovered at the still unit in 2640 still, the acetone is recovered in 2650 and 2670 stills, and the isopropanol is recovered in 2680 still. These recovered materials are then reused to again make "Vinylite" solvent resins.

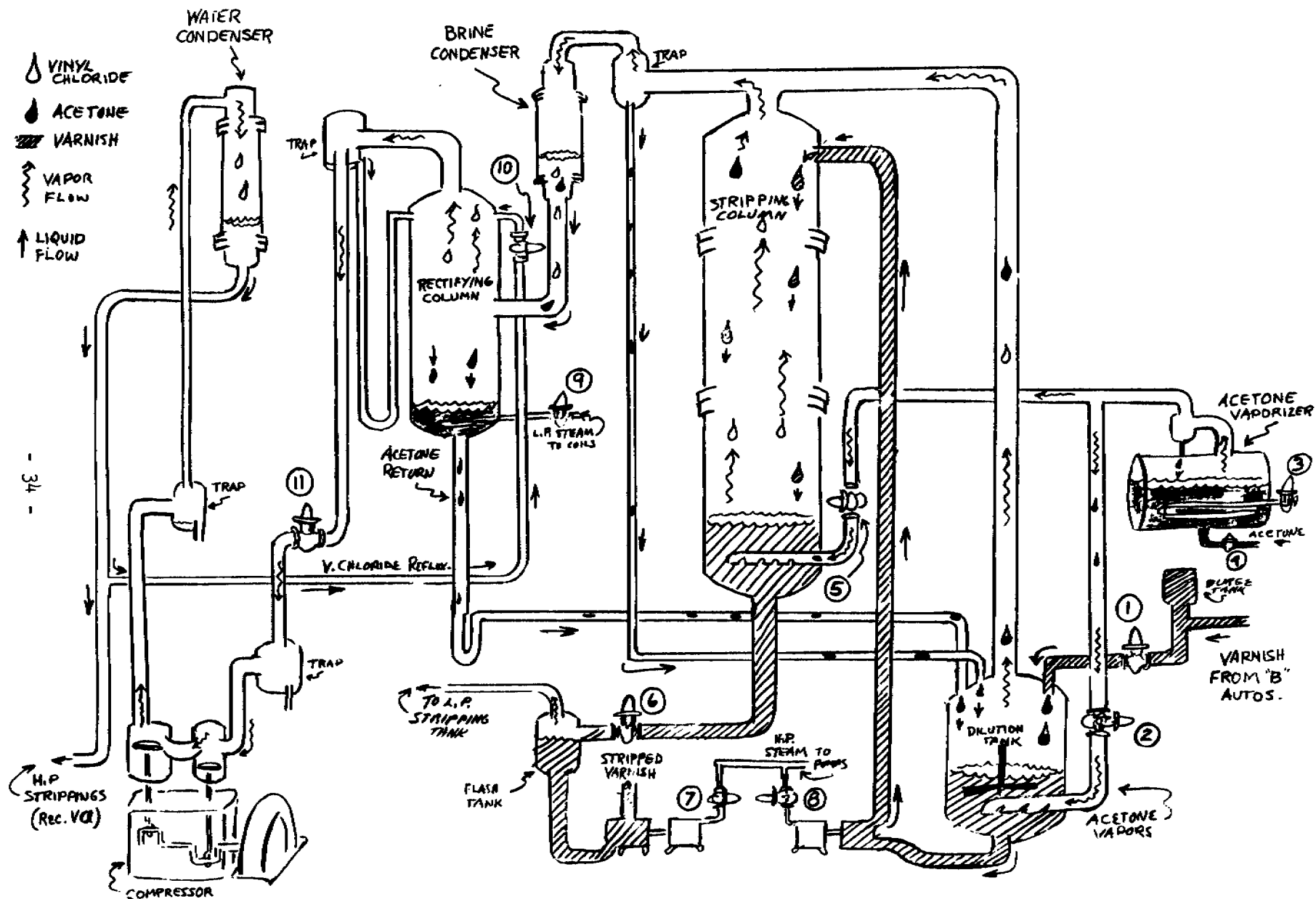
If we were to add agitation to a "pressure cooker" we would have a small autoclave, as the autoclaves are pressure cookers for the "charge" or mixture of vinyl acetate, vinyl chloride, acetone, and catalyst.

As the charge is heated and the catalyst starts the reaction, the mixture will get "thicker". This "thickening" is the result of particles of the vinyl acetate and vinyl chloride "polymerizing", a chemical change in the particles which combined with other like particles to form a solid. This solid or polymer is "Vinylite" resin or plastic. Acetone is able to dissolve this resin, thus acetone in the charge dissolves the resin formed. This type resin is called a "solvent" resin. In the complete charge of 65,000 pounds, only about 20 per cent will end up as resin. The remainder will have to be recovered.

In the "B" autoclaves, the reaction causing polymerization of vinyl chloride and vinyl acetate is controlled by control of temperature and pressure.



UCC
040637

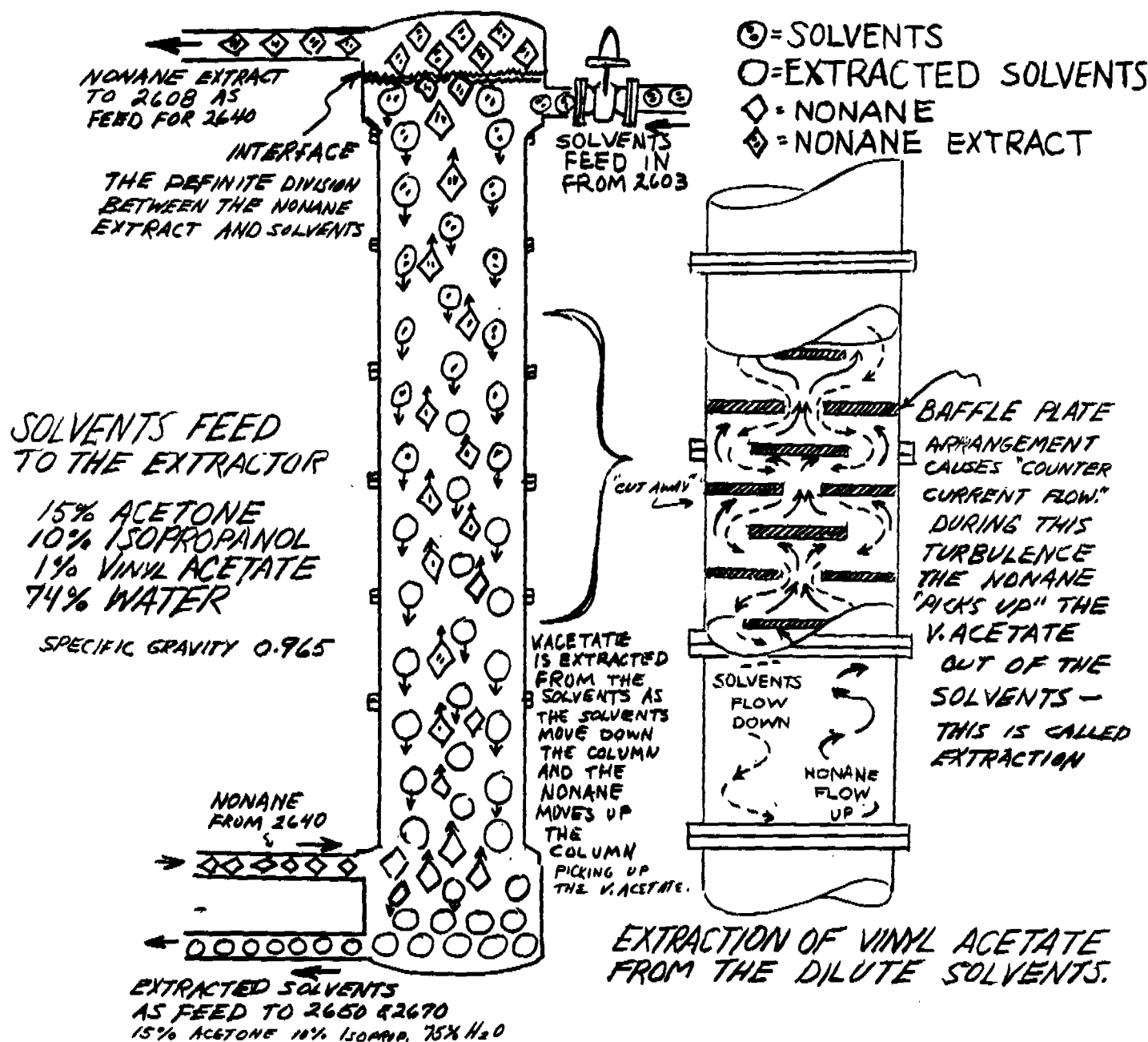


After the "varnish" completes its reaction stage in the "B" autoclaves it is pumped to the stripping system where the "free" vinyl chloride is taken off. "Free" means the "unreacted" vinyl chloride and vinyl acetate.

The varnish is pumped first to a dilution tank which is kept warm by acetone vapors from the vaporizer through a sparger in the dilution tank. This flashes off much of the free vinyl chloride. The varnish is then pumped to the exhausting column where the rest of the free vinyl chloride is "stripped" from the varnish. The varnish as it comes from the base of the stripper or exhausting column is free of all unreacted vinyl chloride. It is then pumped to varnish tanks where it is stored for the purification unit.

The free vinyl chloride, which as a vapor is pulled off the top of the dilution tank and exhausting column, "picks up" some acetone as vapor. These vinyl chloride and acetone vapors are separated in the rectifying column. The vinyl chloride is pulled off the top and the acetone drops from the base back to the dilution tanks where it helps in keeping the varnish "thin".

The vinyl chloride removed from the top of the rectifying column is condensed and is stored in brine-cooled tanks for use as vinyl chloride feed to the "B" autoclaves.

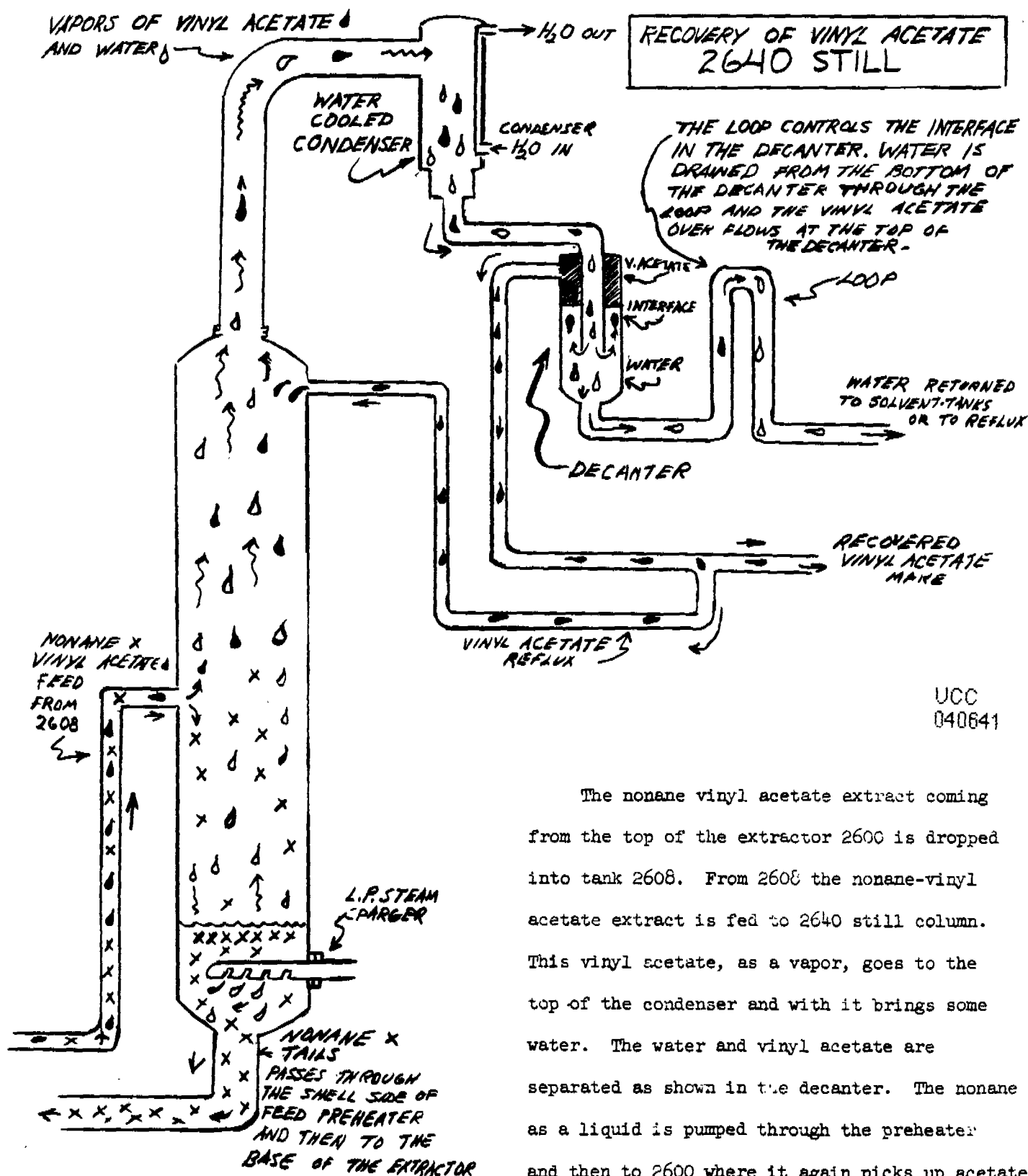


The "Vinylite" Distillation Unit is responsible for the recovery of acetone, isopropanol, and vinyl acetate from the dilute solvents.

The first step, after the solvents have been filtered, is the extraction series where nonane is added to the solvents to extract the vinyl acetate.

If we added oil to a "mixture" of gasoline and water, the oil would "pick up" or "join with" the gasoline and float to the top. We would then have the gasoline and oil mixture on top and the water on the bottom. The "point" where we could see a definite dividing of the oil and water would be the "interface". This is much like what happens in the extractor and the wash columns.

UCC
040640

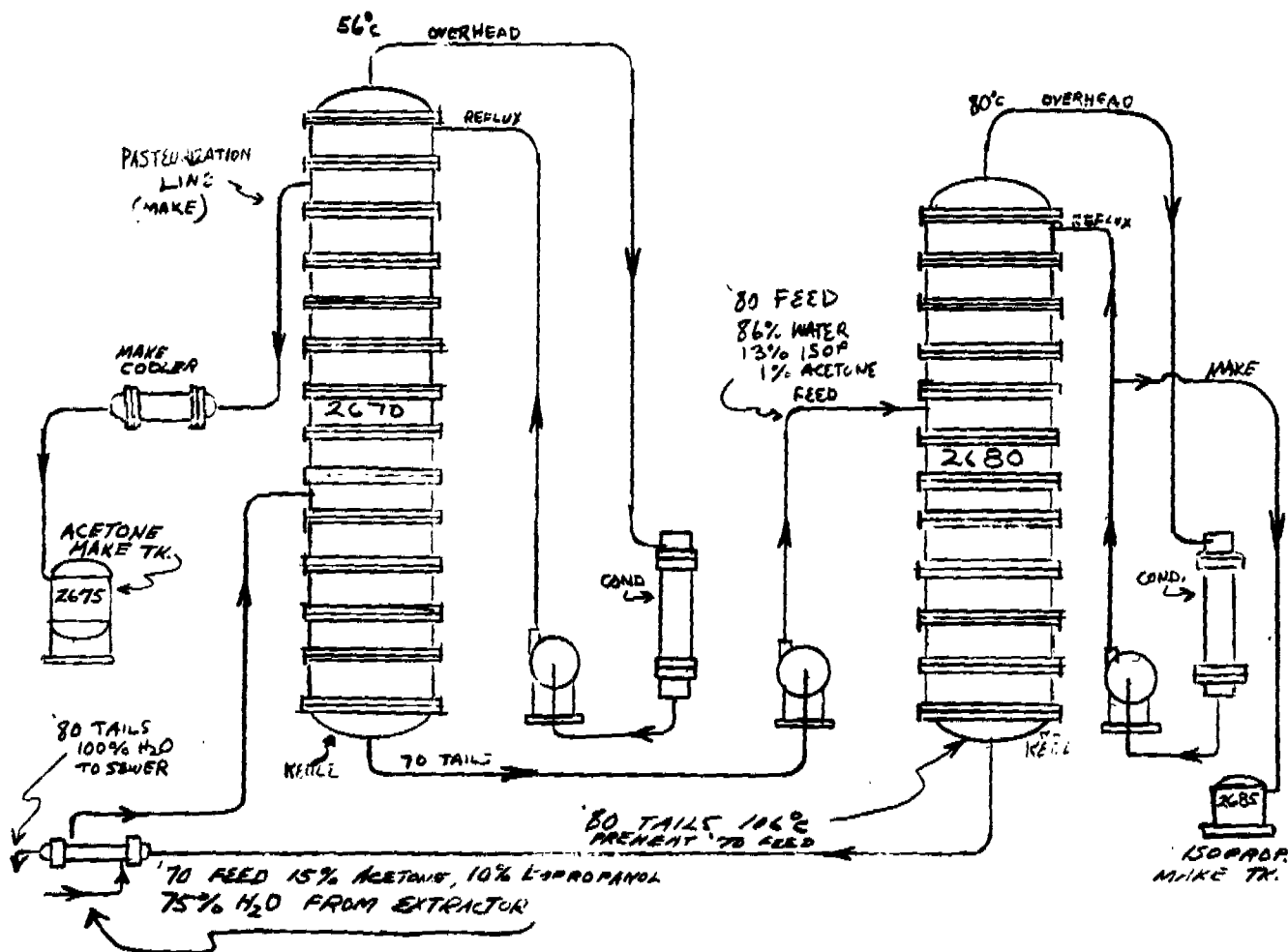


UCC
040641

The nonane vinyl acetate extract coming from the top of the extractor 2600 is dropped into tank 2608. From 2608 the nonane-vinyl acetate extract is fed to 2640 still column. This vinyl acetate, as a vapor, goes to the top of the condenser and with it brings some water. The water and vinyl acetate are separated as shown in the decanter. The nonane as a liquid is pumped through the preheater and then to 2600 where it again picks up acetate from the solvents feed. The recovered vinyl acetate is the make and is reused in charging the "B" autoclaves.

ACETONE & ISOPROPANOL RECOVERY

CONTINUOUS DISTILLATION



In continuous distillation we are able to do the same thing that the batch process does but there is no shutting down and recharging of the kettle.

The feed from the extractor is fed through a preheater into the side of 2670 column (feed section). The acetone in the feed has a boiling point of 56°C. so it remains a vapor as long as it is not cooled below 56°C. These acetone vapors work their way up the column and as overhead into the water-cooled condenser where they are condensed and pumped back to the top of the column as reflux. This insures us a good product in the top section where through a pasteurization line we take off our good acetone make to our make tank.

Usually a 3 to 1 reflux ratio is maintained. The liquid in the column (isopropanol and water which will not boil at 56°C) drops down to the kettle section and, as tails, is pumped into the feed section of 2680 where the isopropanol vapors which boil at 80°C are taken over the top then into the condenser. The good isopropanol make is taken off of the reflux line where a reflux ratio of 2 to 1 is held.

The tails at 106°C are used to preheat 2670 feed and are then sewered.

The stripped varnish stored in the varnish tanks is pumped to the clarifiers or "skimmers" where the varnish is cleaned, then to a varnish feed tank into the impregnator where by addition of isopropanol the resin is partially precipitated. The resin, soluble in acetone, is insoluble in acetone and isopropanol mixtures, thus isopropanol "knocks it out" of solution. The spray precipitator finishes up the "knock out" of the polymer and then drops it into the hardening tank. It is then pumped to the double wash tank where most of the effluent is taken off the top of the double wash tank and dropped into the stills solvent feed tank. From the bottom of the double wash tank a slurry (like sand and water) is pumped into the Bird centrifugals where the solids and the liquid are separated by centrifugal force. The liquid effluent is dropped down to lower section of the wash tank. The solids from the Bird centrifugal are dropped into a mill (grinder) and from the mill they are transferred, by heated air supply and fans, through four stages of drying in the cyclones, then into the air separator where the heavier particles or tails are separated from the finished resin or fines by centrifugal force.

The fines are transferred to storage bins through an air conveyor or Dracco system. To maintain an "evenly balanced" product the several bins are blended together and dropped to the Shipping Department for bagging and shipment as Bakelite vinyl plastic.

UCC
040644