LEARN YOUR WAY AROUND A HOUSE

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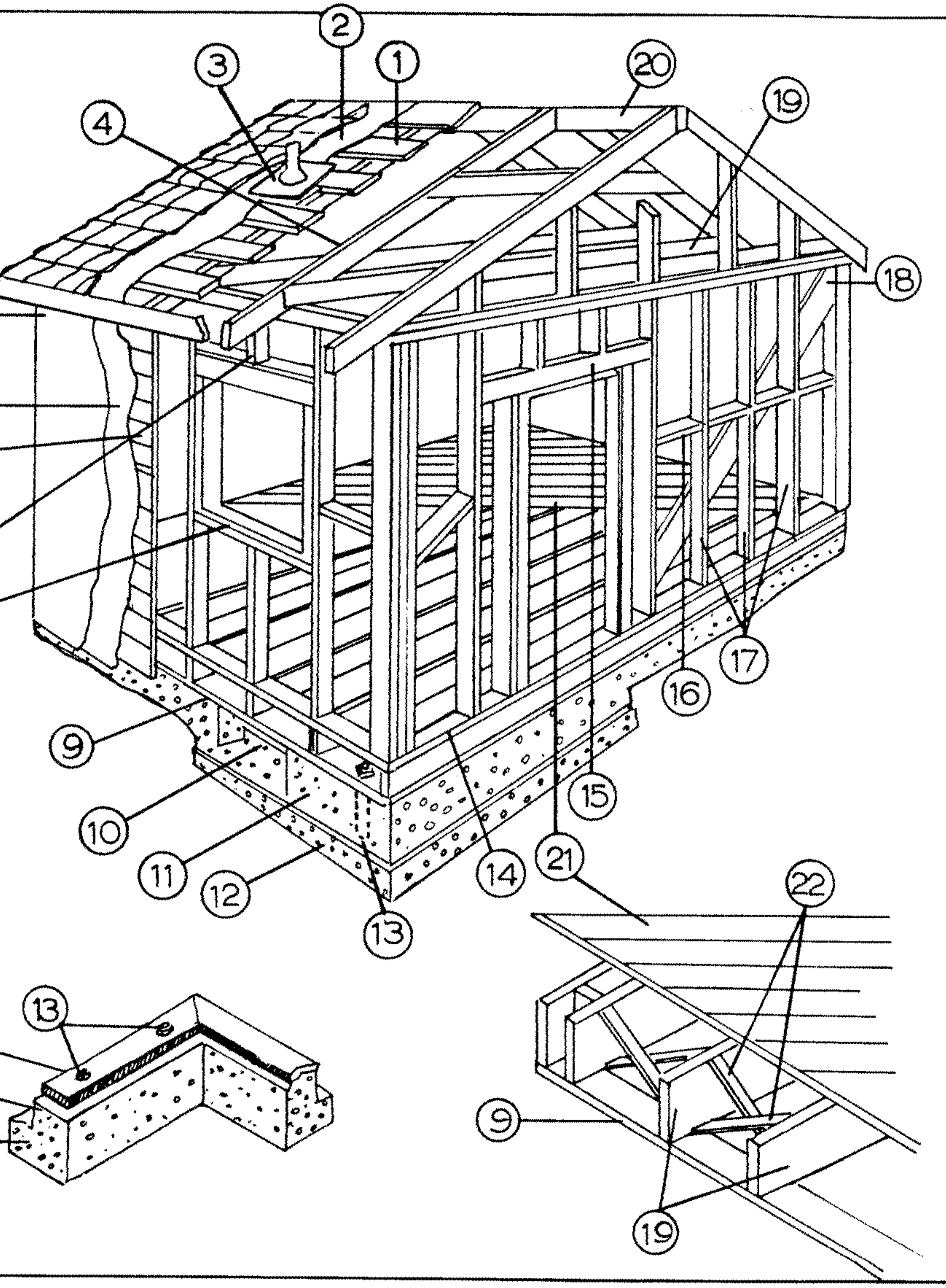
PARTS OF A DWELLING

1. Sheathing
2. Building Paper
3. Flashing or Roof Jack
4. Rafters
5. Stucco
6. Sheathing
7. Cripple
8. Window Ledge
9. Mud Sill
10. Vent Hole
11. Foundation
12. Foundation Footing
13. Anchor Bolts
14. Plate
15. Header
16. Fire Blocks
17. Studs
18. Diagonal Bracing
19. Ceiling or Floor Joists
20. Ridge Board
21. Sub Floor
22. Cross Bracing

PARTS OF A DWELLING



FOUR TYPES OF WELLS

The cross section is of four types of wells in general use in the United States and Canada. One of the four types of "shallow" wells shown will be adequate when the water table (the uppermost level of ground water) lies less than 25 feet below the ground surface, and when the formations of soil directly below the water table yield water readily.

A so-called "deep well" is needed when the soil beneath the water table consists of rock such as shale, which will absorb water but does not yield it, or when the water table is farther down.

Both the shallow drilled well and the deep drilled well require professional equipment to drill them. They are expensive, but reliable.

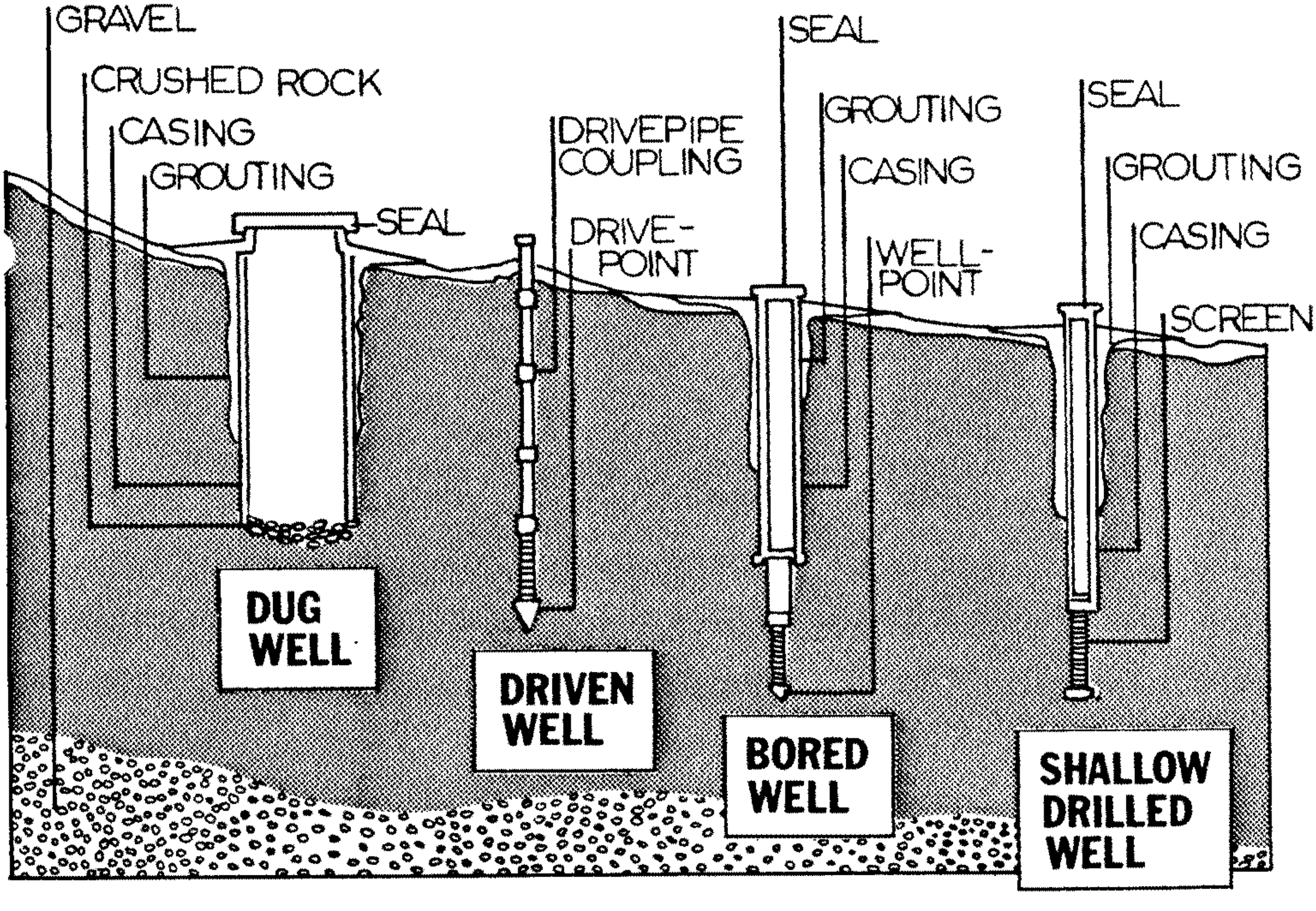
The other three shallow wells can be constructed by using simple tools. The narrow, low yield, driven well consists of lengths of pipe fitted with a drive point and coupled together in succession as they are hammered into the ground. It is especially suited for sandy soils.

The bored well is made with a sharp well point, which is twisted into the ground with a powered auger or by hand. Although it equals the drilled well for dependability, it cannot be drilled through rock formations.

The old fashioned hand dug well uses little more than a pick and shovel to dig the shaft, and a rope and bucket to lift out the dirt, but you cannot dig the well more than a few feet below the water level. One drawback to this kind of well is that if the water table drops, the well runs dry.

All of these wells contain certain basic components, except for the driven well, which consists entirely of its own coupled pipes.

To protect them from collapsing, they use cement, metal, ceramic, and plastic casings. To protect them from being contaminated, the well openings are capped, and the space around the upper part of the casing is grouted with cement.


GRAVEL
CRUSHED ROCK
CASING
GROUTING
SEAL
DUG WELL
DRIVEPIPE COUPLING
DRIVE-POINT
DRIVEN WELL
SEAL
GROUTING
CASING
WELL-POINT
BORED WELL
SEAL
GROUTING
CASING
SCREEN
SHALLOW DRILLED WELL

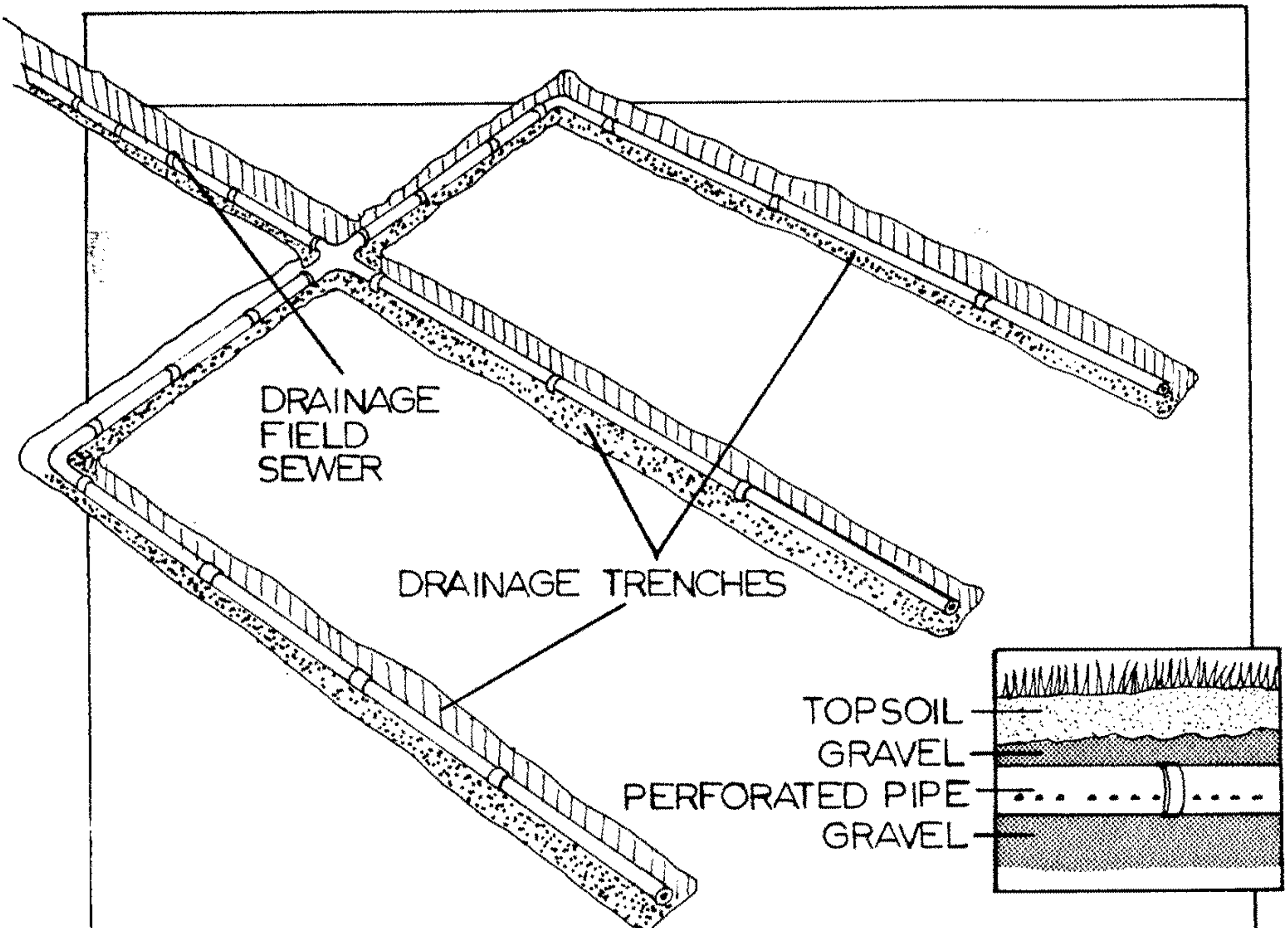
TYPICAL DRAINAGE FIELD

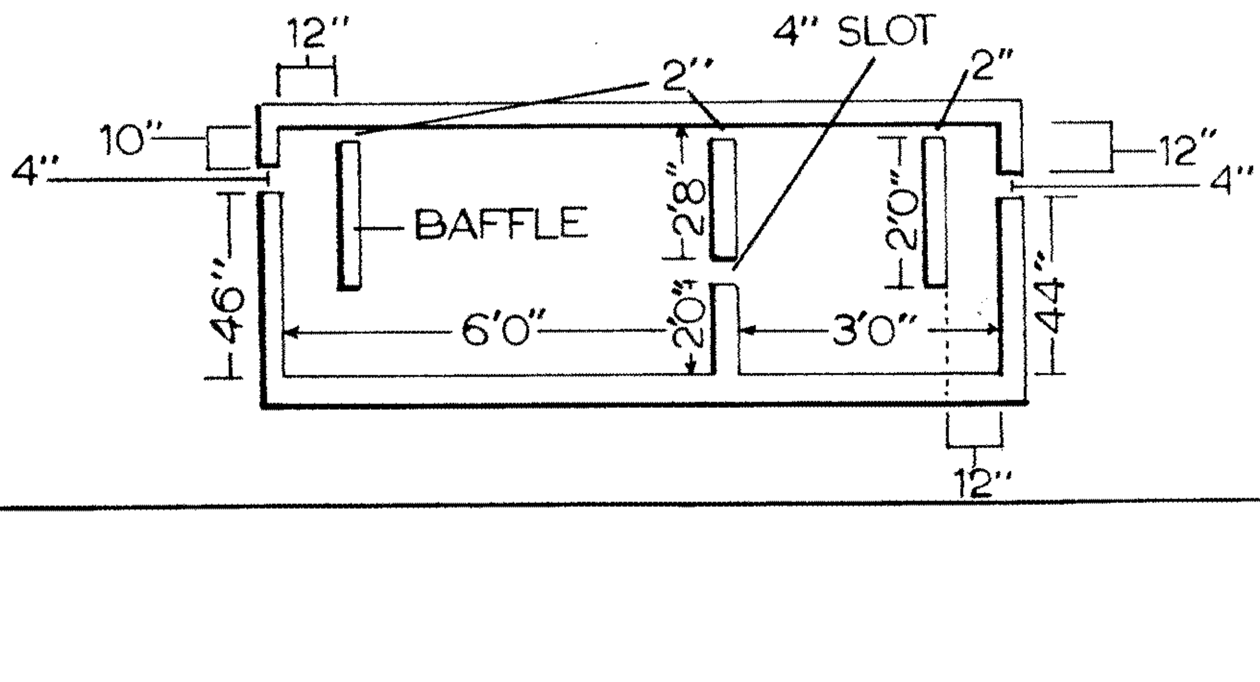
For independent sewage disposal, this drawing shows the preferred setup, in which sewage flows from your house through the sewer line to a concrete septic tank for treatment. The sewage, upon entering the septic tank will separate into compartments. You have sludge and scum, which go into a compartment, and a liquid sewage called effluent. The tank gas or fumes will escape back through the sewer line to the house vents.

The effluent will flow from the septic tank to the drainage field, which is composed of perforated pipes that are laid on gravel. (See cross sectional diagram.) As the liquid effluent trickles through the perforations in the pipe and seeps down into the ground, the impurities are neutralized.

In some areas, instead of baffles in a septic tank, they use septic tank elbows. The minimum distance to a house is five feet. The minimum drain field is 125 feet, and double that if you have "heavy soil." From the drain line to the property line it must be ten feet. Keep it ten feet from any building, and 100 feet from all wells and streams. Your drain pipe pitch is not more than 2" in 100 feet, and the width of the drain trench should be 24" minimum.

NOTE: Check with your local building department for their requirements, as all areas have different soils and requirements.


DRAINAGE
FIELD
SEWER
DRAINAGE TRENCHES
TOPSOIL
GRAVEL
PERFORATED PIPE
GRAVEL


12"
2"
4" SLOT
2"
10"
4"
12"
4"
BAFFLE
2'8"
2'0"
46"
6'0"
2'0"
3'0"
44"
12"

OIL FIRED HEATING PLANT

The oil burner unit mixes air and oil in the air tube, ignites the mixture, and burns it in the combustion chamber.

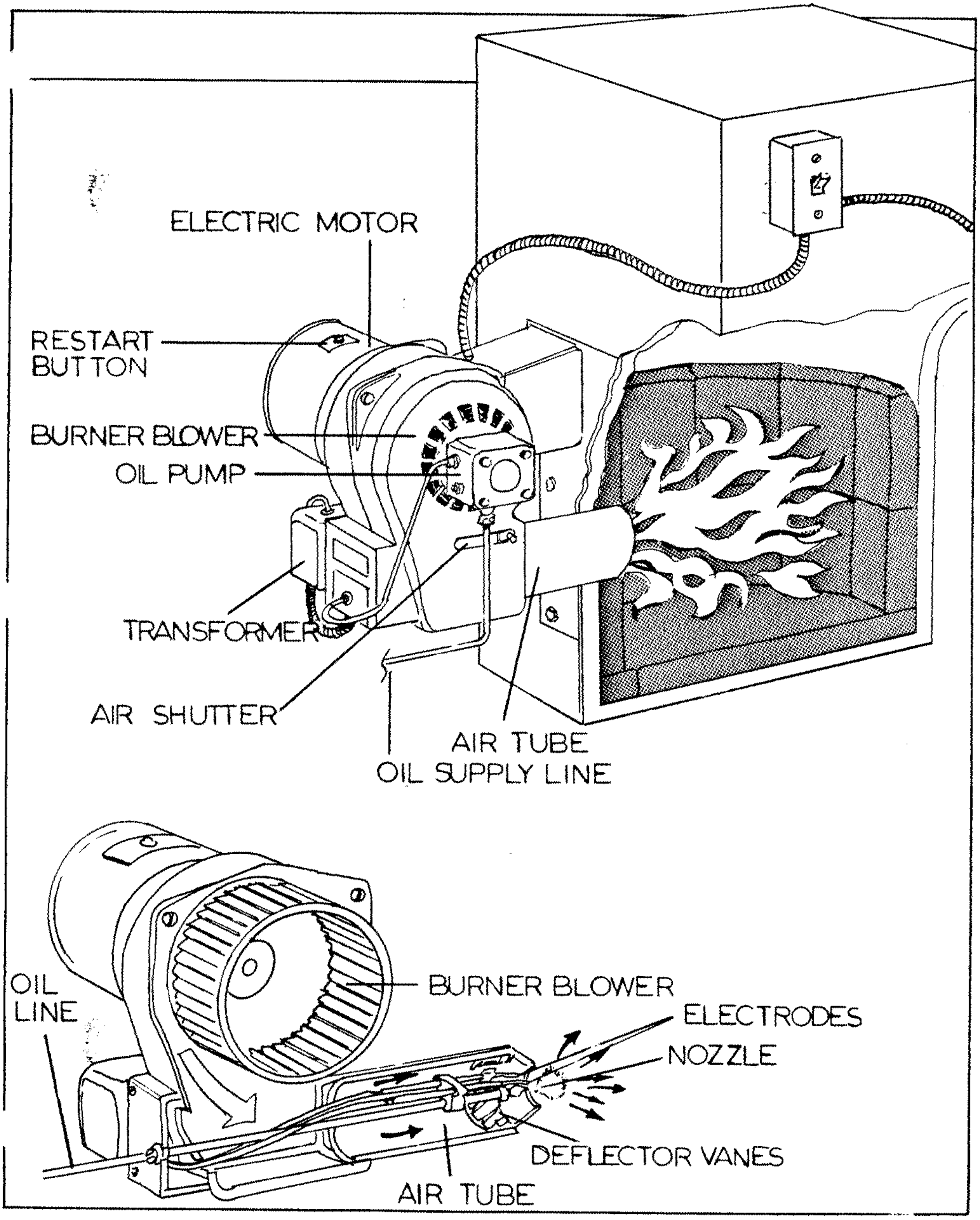
The motor drives a fan that pulls air through the air shutter, and also a pump that draws the oil through a filtered fuel line to make a fuel mixture.

The normal 120 volt current is stepped up to approximately 10,000 volts by a transformer to ignite it.

To turn the burner on and off manually, a master switch is used, but if the ignition fails, a light-detecting cell in the burner or a heat-sensor in the stack control will shut off the motor. The automatic draft regulator monitors the exhaust gas as it flows through the vent and up the chimney.

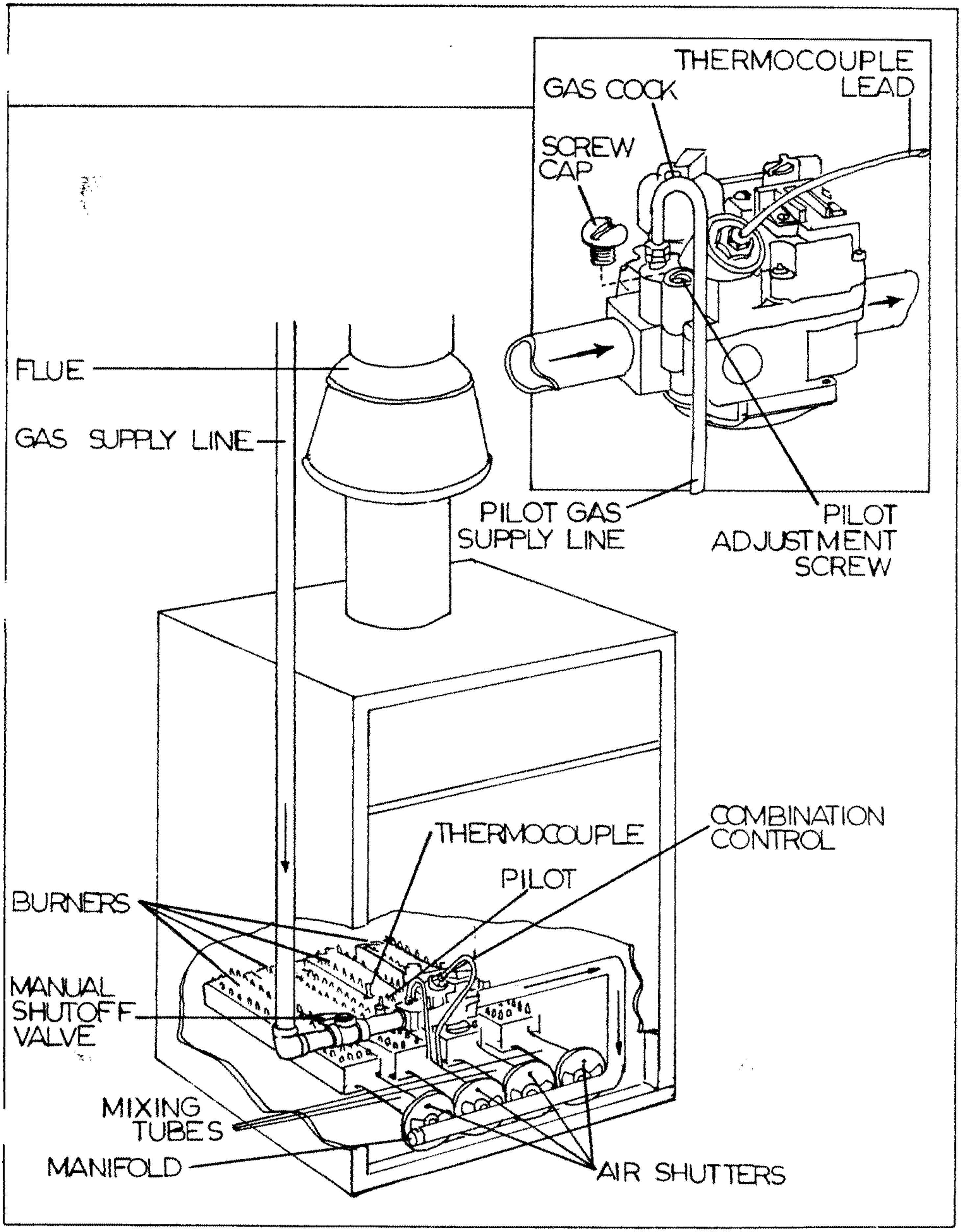
HOW THE BURNER WORKS

The outside air is forced into the air tube by the burner blower, and passes by deflector vanes that force the air flow into a swirling spiral. At the same time, the oil pump forces oil from the tank through an oil line to the nozzle, where it comes out in a cone-shaped spray. The air and oil combine into a highly flammable mixture at the nozzle, which is ignited when the burner first goes on by a high-voltage spark between two electrodes. The spark is required only for ignition; afterwards, the flame continues to burn on its own.


ELECTRIC MOTOR
RESTART BUTTON
BURNER BLOWER
OIL PUMP
TRANSFORMER
AIR SHUTTER
AIR TUBE
OIL SUPPLY LINE
OIL LINE
BURNER BLOWER
ELECTRODES
NOZZLE
DEFLECTOR VANES
AIR TUBE

HOW THE GAS BURNER WORKS

When the house thermostat contact points close, a current will flow to a solenoid valve, which in turn will open a diaphragm valve in the combination control valve. Gas then flows from the supply line, through a manual shutoff valve, into a combination control valve connected to the manifold, and then to tubes that mix the gas with air. From there the mixture goes to the burners, where it is ignited by the pilot light. It then makes heat for hot water, warm air, or heat that a heat exchanger turns to steam. The thermocouple, along with another solenoid, act as safety valves if the pilot light goes out.

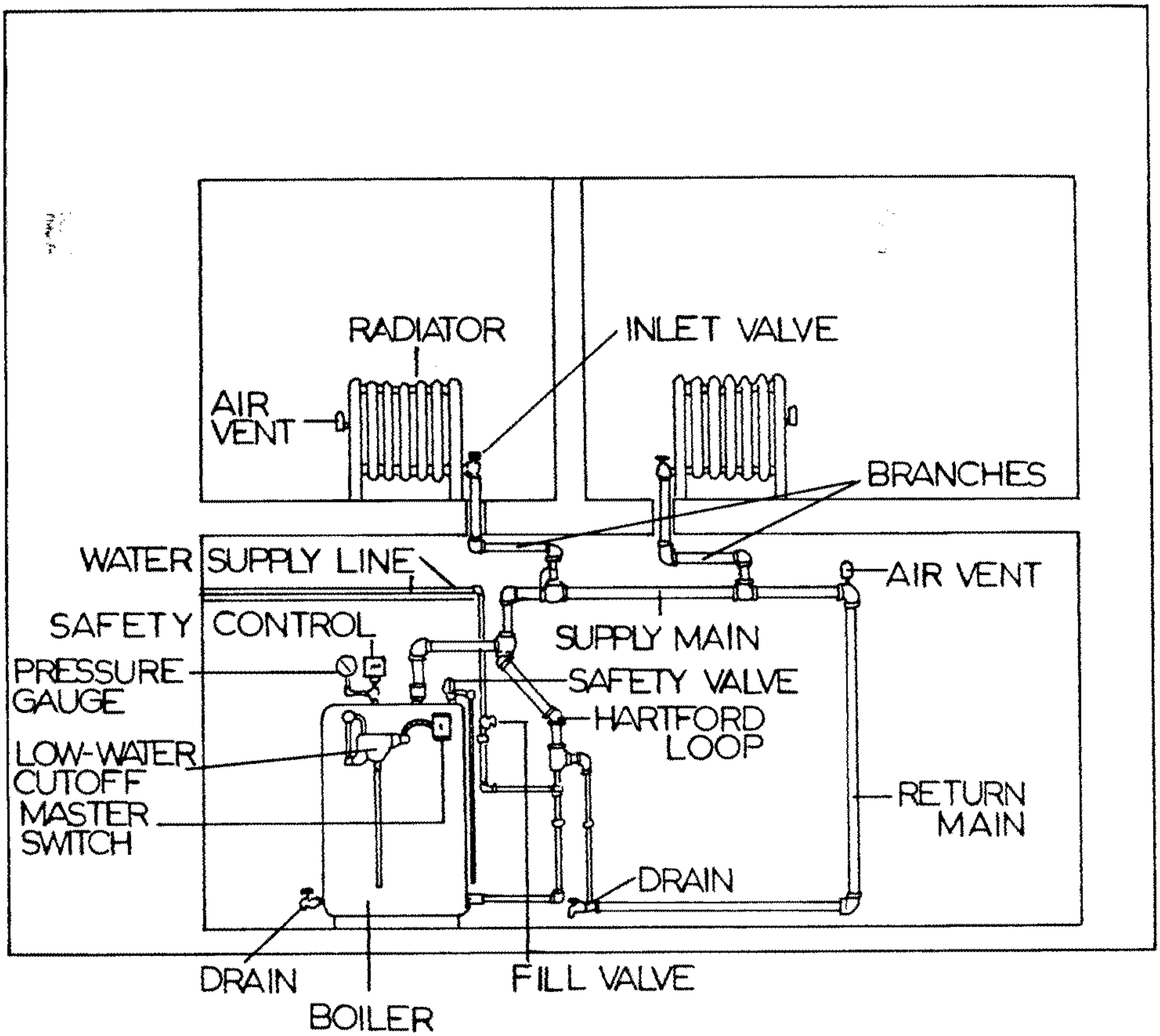

THERMOCOUPLE LEAD
GAS COCK
SCREW CAP
FLUE
GAS SUPPLY LINE
PILOT GAS SUPPLY LINE
PILOT ADJUSTMENT SCREW
THERMOCOUPLE
COMBINATION CONTROL
PILOT
BURNERS
MANUAL SHUTOFF VALVE
MIXING TUBES
MANIFOLD
AIR SHUTTERS

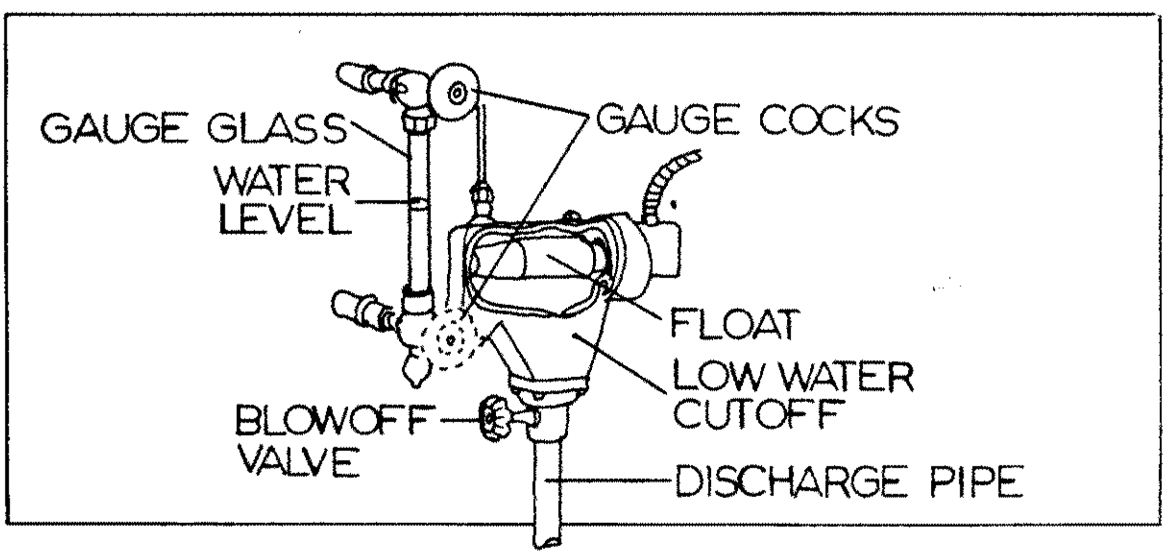
STEAM HEAT SYSTEM

The steam is produced in a boiler well equipped with pressure gauges and safety devices, a fill valve, drains, and a low-water cutoff. The steam rises through a supply main to branch lines, and then into the radiators. As the steam rises, the air that is pushed ahead is released through air vents on the radiators. As the steam returns to water, the return flow of water through the branches to the supply main goes into a large vertical pipe, called a return main, and from there into the boiler. This is a cross connection called a "Hartford Loop." It applies steam pressure to the last leg of this return to prevent boiler water from backing up in the event the pressure gets too high.

HOW TO CHECK AND ADJUST THE WATER LEVEL

A sight glass shows the water level in the boiler. When the gauge water stands halfway between the gauge petcocks, the boiler water is at the proper operating level. The low-water cutoff is activated by a float which shuts down the boiler if the water level gets too low. Check the sight gauge once a week, unless you have an automatic system, and fill the boiler to the middle of the glass by opening the fill valve, if necessary. Once a month, to keep the low-water cutoff free of sediment, open the blowdown valve and run water through the discharge line until it runs clear; then refill your boiler.


RADIATOR
INLET VALVE
AIR VENT
BRANCHES
WATER SUPPLY LINE
AIR VENT
SAFETY CONTROL
SUPPLY MAIN
PRESSURE GAUGE
SAFETY VALVE
HARTFORD LOOP
LOW-WATER CUTOFF
MASTER SWITCH
RETURN MAIN
DRAIN
DRAIN
BOILER
FILL VALVE

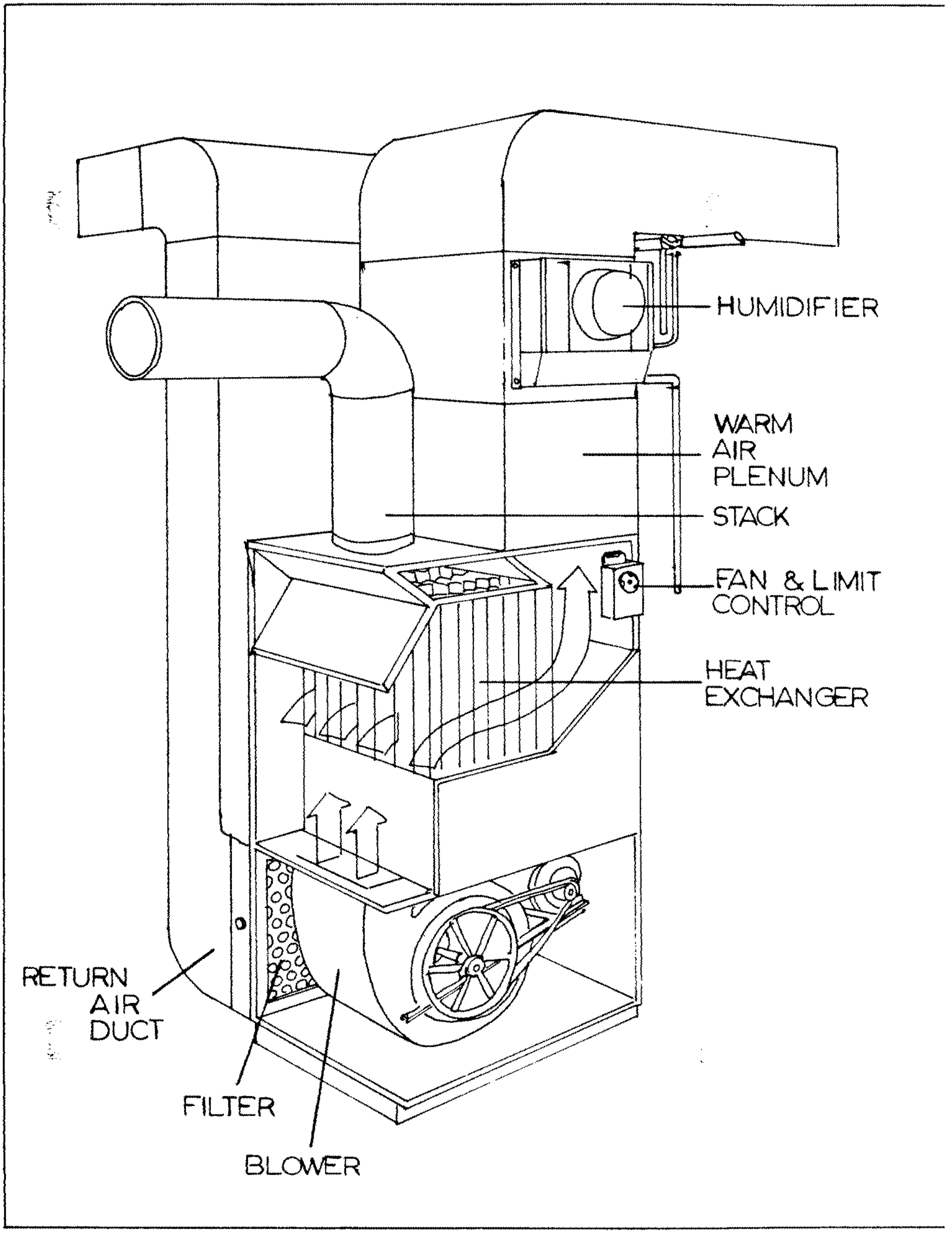

GAUGE GLASS
GAUGE COCKS
WATER LEVEL
FLOAT
LOW WATER CUTOFF
BLOWOFF VALVE
DISCHARGE PIPE

HOW THE FORCED-AIR FURNACE WORKS

In a gas or oil-burner furnace, circulating air enters at the bottom through a filter which will trap dirt. The blower forces the air up into the heat exchanger compartment, which has metal passageways heated to several hundred degrees temperature by the combustion gases.

The outsides of the passageways heat the air as the blower forces it past and into the warm-air plenum, and then to the supply ducts. A fan and limit control turns the blower on and off and, if the temperature gets too high, turns off the burner. The combustion gases never mix with the heated air, and vent through a stack to the exterior of the house.

During the winter, cold air is drier than warm air. With the use of a humidifier you can alter this situation and enhance a heating system's efficiency, because a person will feel more comfortable at a lower temperature in moist air than they will in dry air at a higher temperature. The operation is explained on another page.


HUMIDIFIER
WARM AIR PLENUM
STACK
FAN & LIMIT CONTROL
HEAT EXCHANGER
RETURN AIR DUCT
FILTER
BLOWER

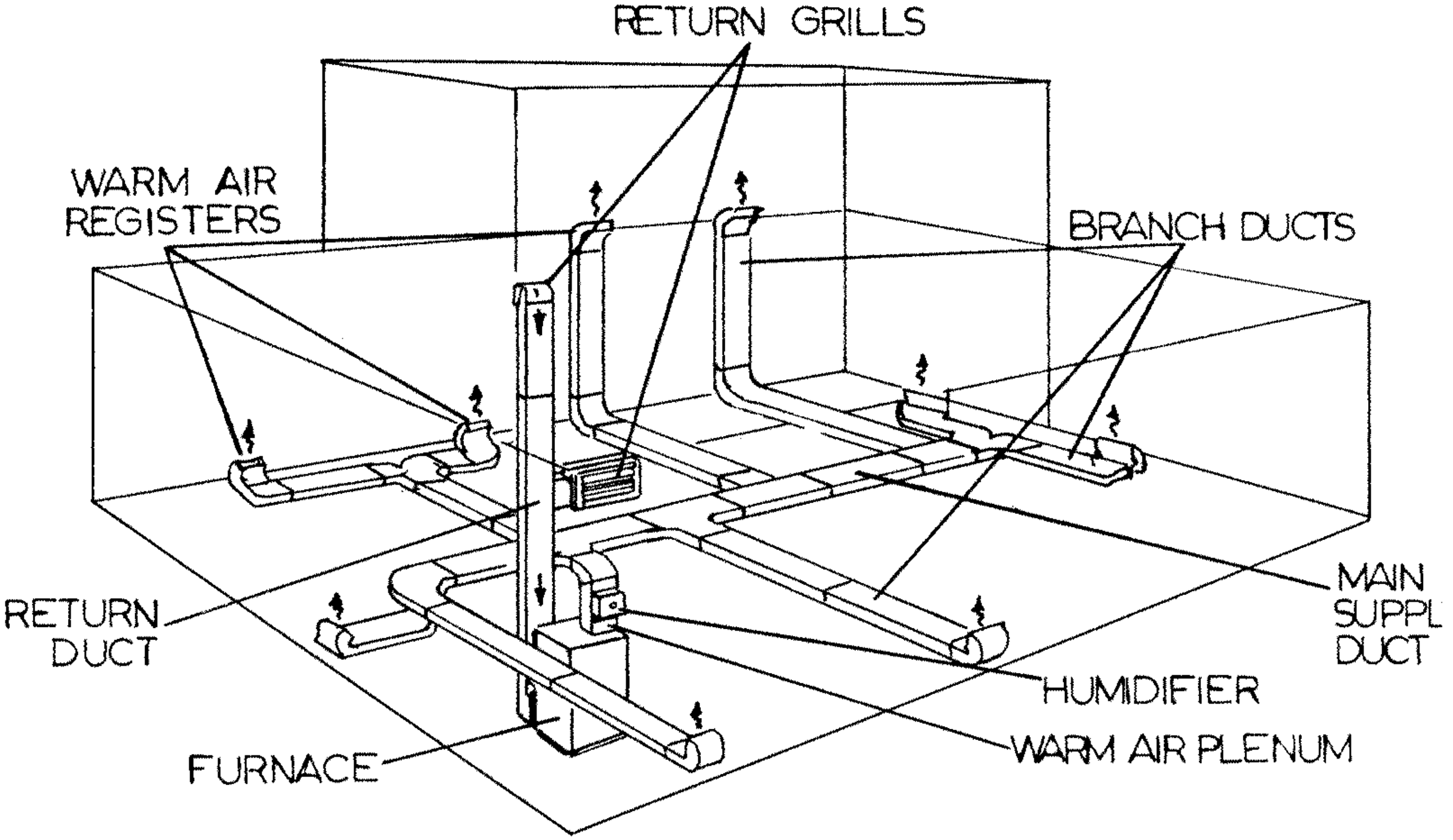
WARM AIR CIRCULATION

The duct system shown is for a typical two-story house. It shows the path that heated warm air travels away from the furnace and back to the furnace through the return duct. The furnace contains both the burner and blower, while on the top is a chamber called the warm-air plenum. The plenum chamber connects to the long main supply duct, which has branch ducts to the various rooms. The branch ducts each contain an opening called a warm air register that releases the heated air into each room.

By the use of dampers in the main and branch ducts, you can balance the flow of warm air with the lever handles, so that each register outlet will receive the desired amount of heat.

Each register outlet can also regulate the flow of warm air. From the outlet, warm air will flow upwards. Cooler, heavier air drops to the floor area and flows back to the furnace via the return air grilles and through the return air duct.

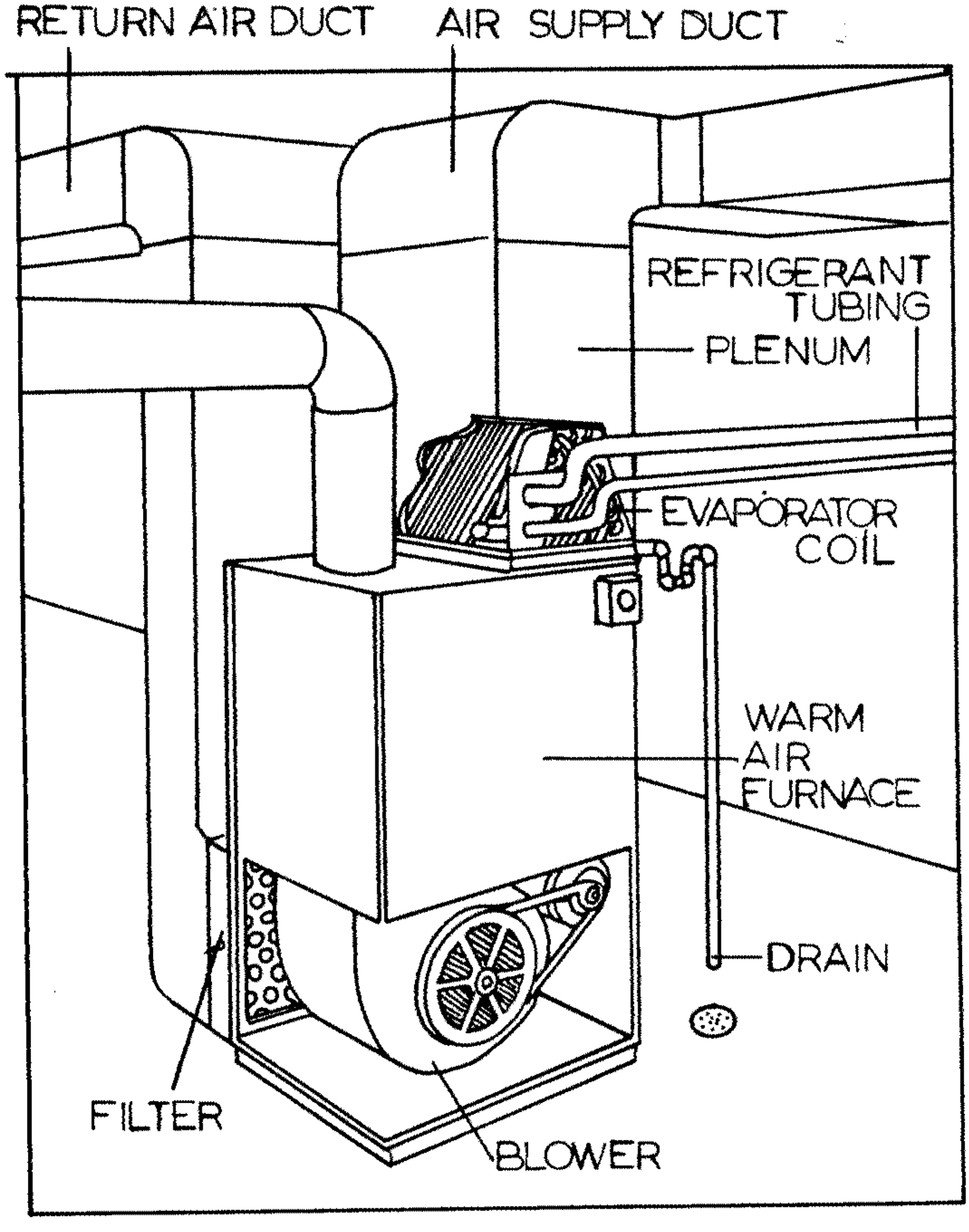
The two-story house generally has two return air ducts or grilles, one on each floor. Custom or larger homes may have a return air grille in every room.


RETURN GRILLS
WARM AIR REGISTERS
BRANCH DUCTS
RETURN DUCT
MAIN SUPPL DUCT
HUMIDIFIER
WARM AIR PLENUM
FURNACE

AIR CONDITIONING

When you install an air conditioning unit in a forced-air heating system, you have only a minimum modification of the existing furnace. Also, your air flow will remain the same in summer as in winter. Hot air from the house will flow through the return air duct and through the air filter. It requires an increased air flow to force cold air throughout the house, so it is necessary to check your air filter monthly, and either replace it, or remove all dust and dirt that has been collected on it.

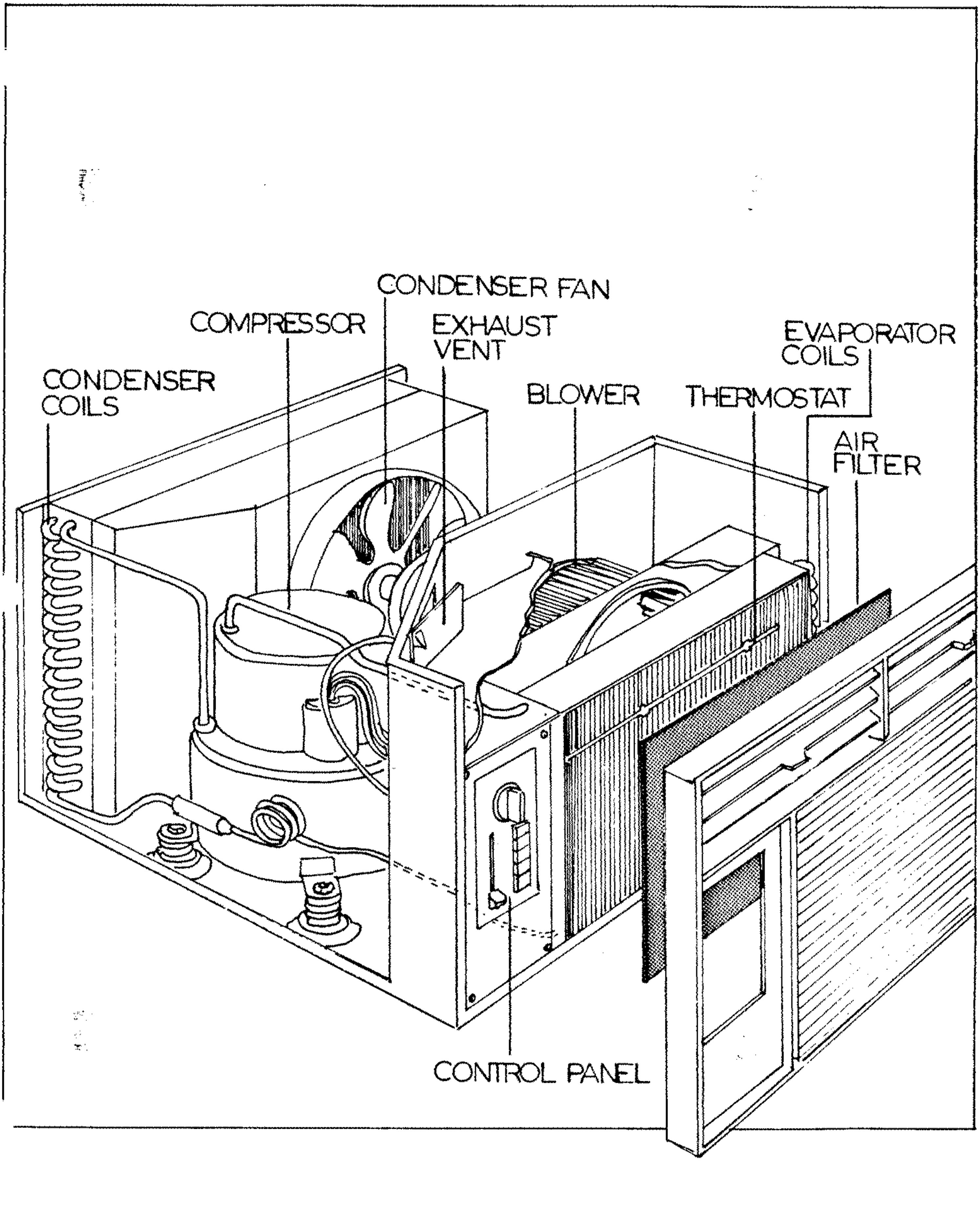
After you reset the controls to a higher speed for air conditioning, the furnace blower will force the incoming hot air across the evaporator coils. The evaporator coil is located in the plenum chamber over the furnace, and it is cooled by a refrigerant from the outside condenser unit. The condensation from the coil will go to the drain pan, and from there through the drain pipe to either a floor drain or to the exterior of the house. The blower pushes the cooled air through the supply ducts to all the rooms.


RETURN AIR DUCT
AIR SUPPLY DUCT
REFRIGERANT TUBING
PLENUM
EVAPORATOR COIL
WARM AIR FURNACE
DRAIN
FILTER
BLOWER

ROOM AIR CONDITIONER

There are two compartments, separated by an airtight barrier, behind the front panel of a room air conditioner. Facing the room, the compartment has the cold evaporator coils that cool the air. The rear compartment houses the hot condenser coils that discharge the heat. The condenser circulates the refrigerant from the condenser to the evaporator coils, which absorb heat from within the room and discharge it outside. The air is moved through the two compartments separately by use of the condenser fan and a blower.

Some room air conditioners come equipped with a stale air exhaust vent, a room air filter, directional louvers, and a thermostat controlled compressor.


CONDENSER FAN
COMPRESSOR
EXHAUST VENT
EVAPORATOR COILS
CONDENSER COILS
BLOWER
THERMOSTAT
AIR FILTER
CONTROL PANEL

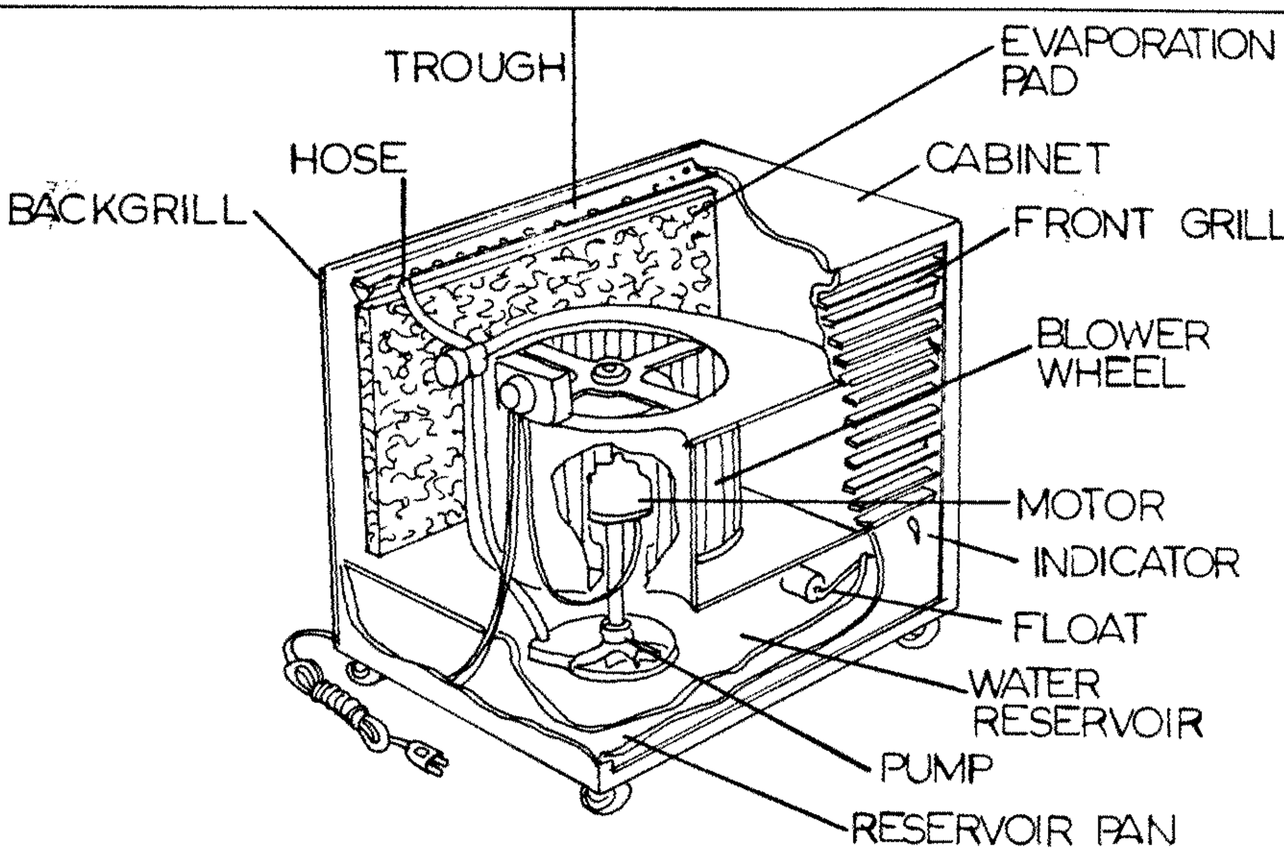
HUMIDIFIERS

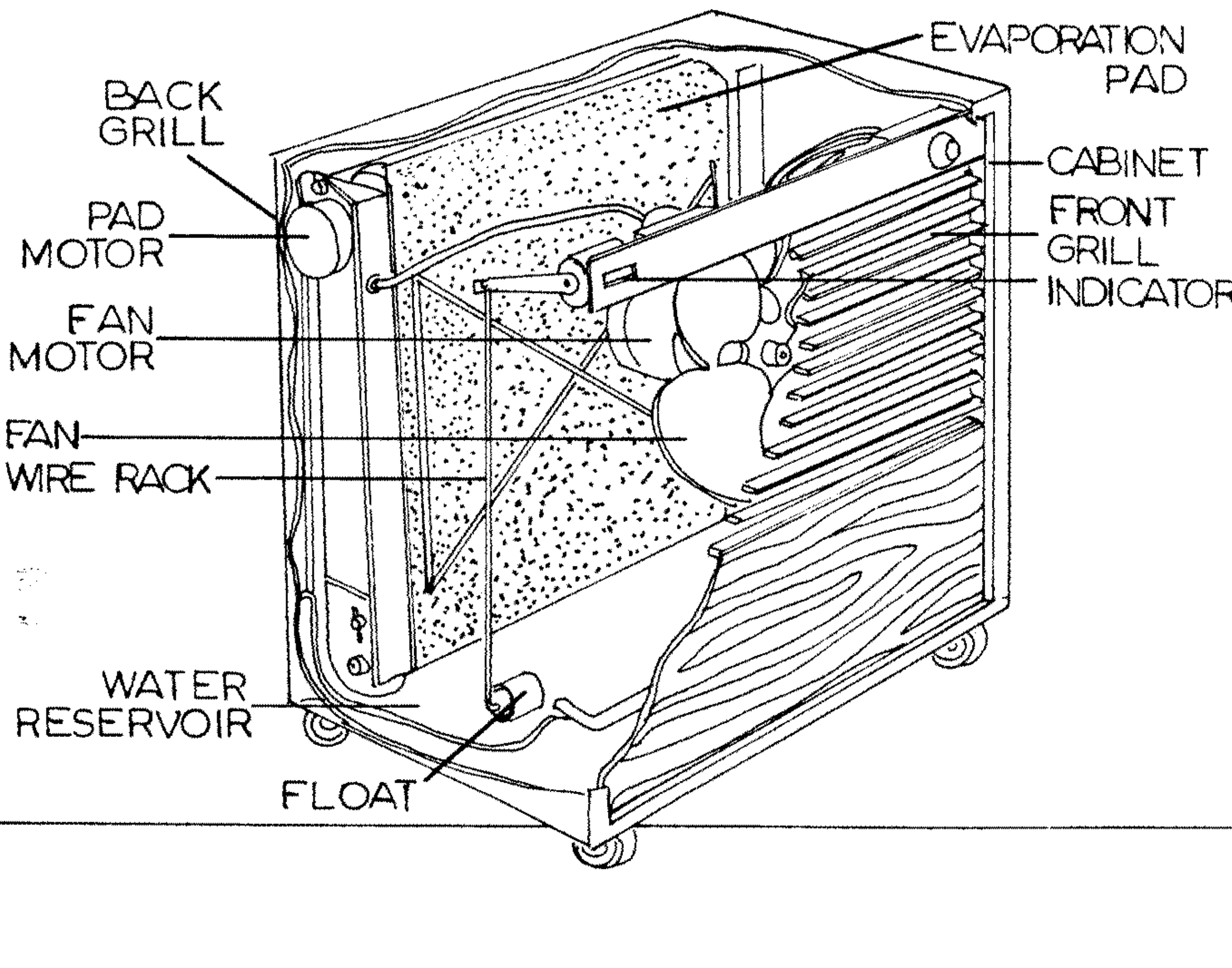
Even though your heating system is operating properly, in winter you may feel cold and have a dry throat. The reason is simple: heated air will absorb moisture from the objects it surrounds. A humidifier adds moisture to the air, and is a simple cure. You can install a humidifier in the central forced air heating system. With electric, hot-water, or steam heat, you use a portable humidifier. The humidifier pulls air through a wet pad, increasing the amount of water vapor in a room by evaporation.

With the portable humidifiers you have a choice of two types: a moving-pad or a stationary-pad humidifier.

To moisten dry air, a moving-pad humidifier uses an absorbent, sponge-like plastic that is stretched over two rollers in a belt-like arrangement. The bottom section of the pad passes through a water reservoir. The top roller is powered by a small motor to turn the pad and keep it wet. The fan pulls dry air into the humidifier through a back grille, and forces it through the wet pad into the room through the front grille. The reservoir is equipped with a float connected to an indicator which will show when the reservoir needs refilling.

In a stationary-pad humidifier, a pump forces water through a hose up to a trough, which allows it to trickle down over the pad, keeping it moist. A blower in this type of humidifier pulls dry room air through the back grille, and forces it through the wet pad into the room. This type is also equipped with a float and indicator. The evaporation pad, if it becomes clogged with hard water mineral deposits, and the hose, which may become clogged or cracked due to age, can easily be replaced with new ones. The evaporation pad is just removed and replaced with a new one, and the hose is simply pulled from the metal fittings. Most manufacturers recommend you pour a disinfectant into the reservoir once a month to prevent any bacteria buildup or to eliminate bad odors, and that you clean the reservoir every two months with soap and water.


TROUGH
EVAPORATION PAD
HOSE
BACKGRILL
CABINET
FRONT GRILL
BLOWER WHEEL
MOTOR
INDICATOR
FLOAT
WATER RESERVOIR
PUMP
RESERVOIR PAN

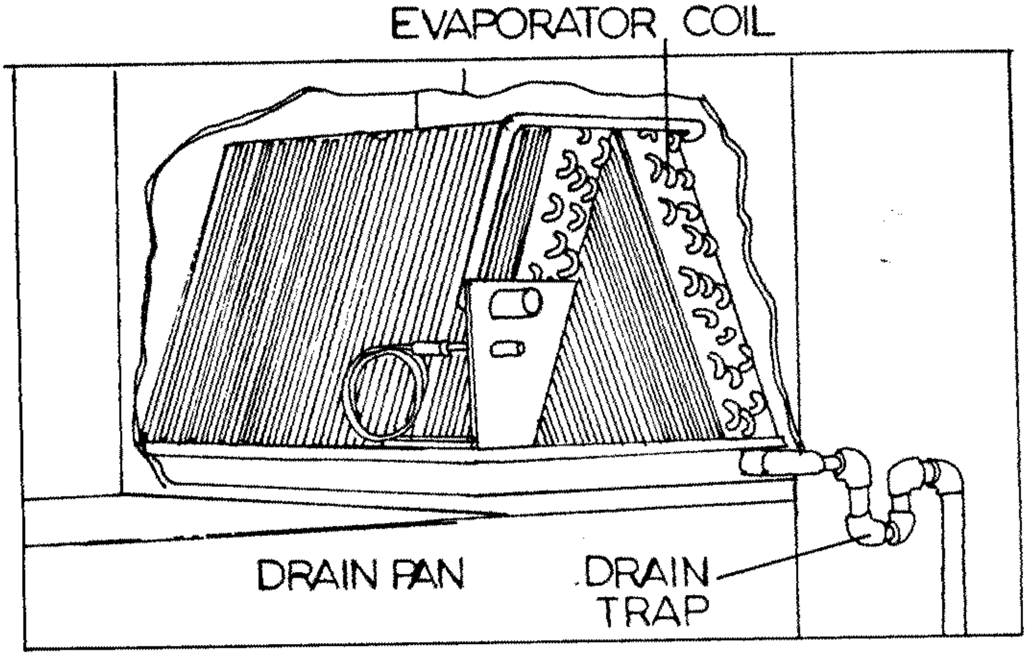

EVAPORATION PAD
BACK GRILL
CABINET
PAD MOTOR
FRONT GRILL
INDICATOR
FAN MOTOR
FAN
WIRE RACK
WATER RESERVOIR
FLOAT

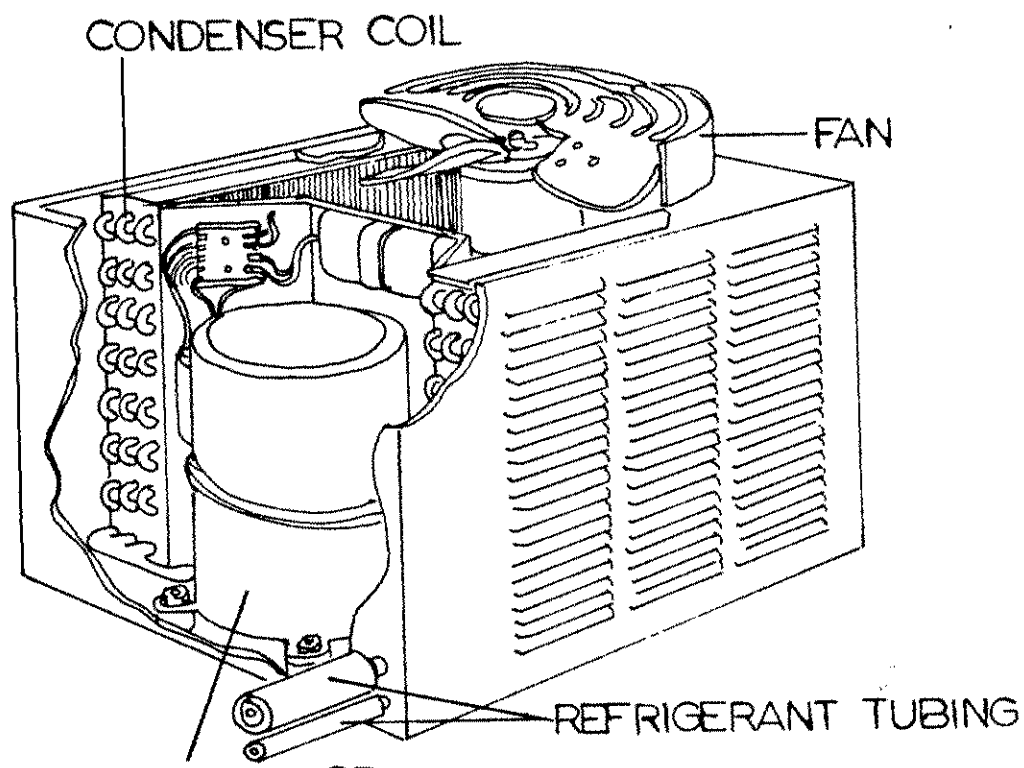
THE "A" COIL

The most common evaporator coil in use with the central air conditioning system is called an A-coil from its shape. It is a two-section design, which will crowd the greatest amount of cooling coil into your available space. The water that condenses on the coil is collected in a drain pan. From the drain pan, the pipe goes through a trap, designed to prevent insects from crawling up to the coil and to insulate the coil from the warm, humid air of the exterior.

THE OUTDOOR CONDENSER UNIT

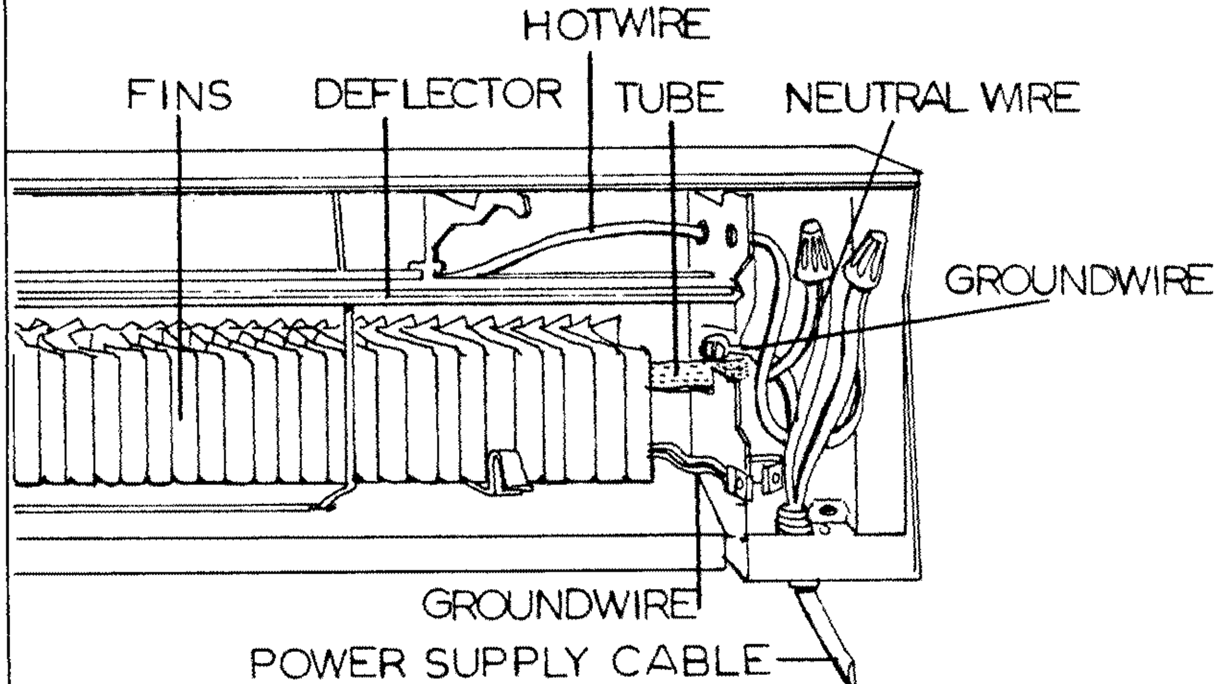
When you install your compressor and condenser in a separate outdoor unit, you accomplish two things: you remove heat and reduce indoor noise. The only connections you have then are two tubing lines and a thermostat wire to the central thermostat. One tubing run will carry cold refrigerant liquid to the evaporator coil; the other run will bring warmed refrigerant gas to be pressurized by the compressor and liquefied as it releases its heat into the condenser. The outside air will enter the unit through louvers and absorb heat from the condenser coil; then the fan will force the heated air out.


EVAPORATOR COIL
DRAIN PAN
DRAIN
TRAP


CONDENSER COIL
FAN
REFRIGERANT TUBING
COMPRESSOR

ELECTRIC BASEBOARD HEATERS

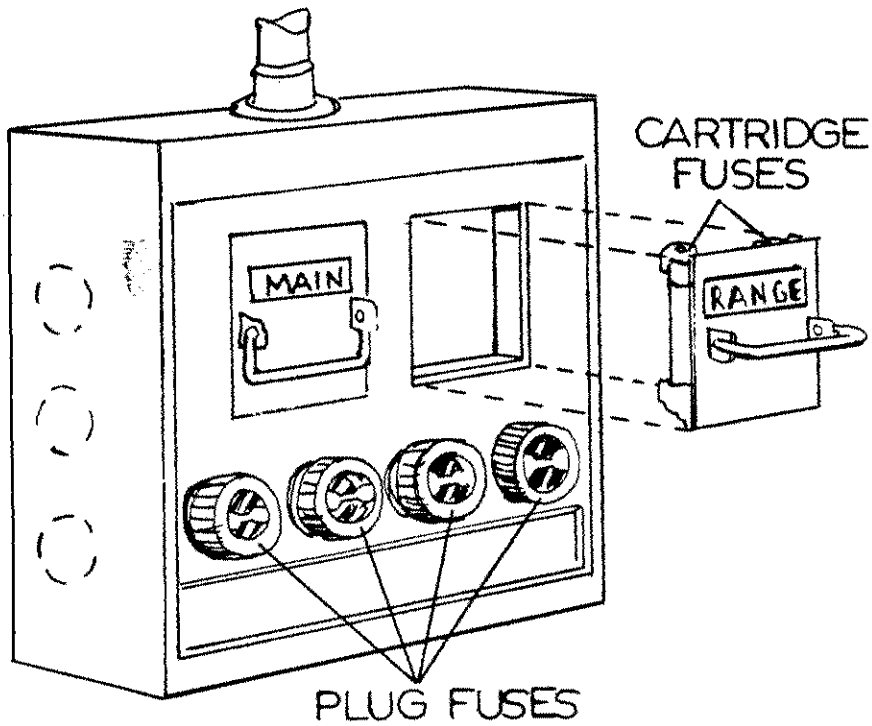
In the 120-volt unit, current goes from the hot wire (black) in the power supply cable through the resistance wire, encased in a metal and ceramic tube and surrounded by the heat-spreading fins. After the current passes through the protective thermal cutout, current then returns through the neutral wire (white). Cold air enters through an opening at the bottom of the front panel of the unit and is warmed by the heating tube and fins. Guided by a deflector, the warmed air rises and, by convection, displaces the colder air.

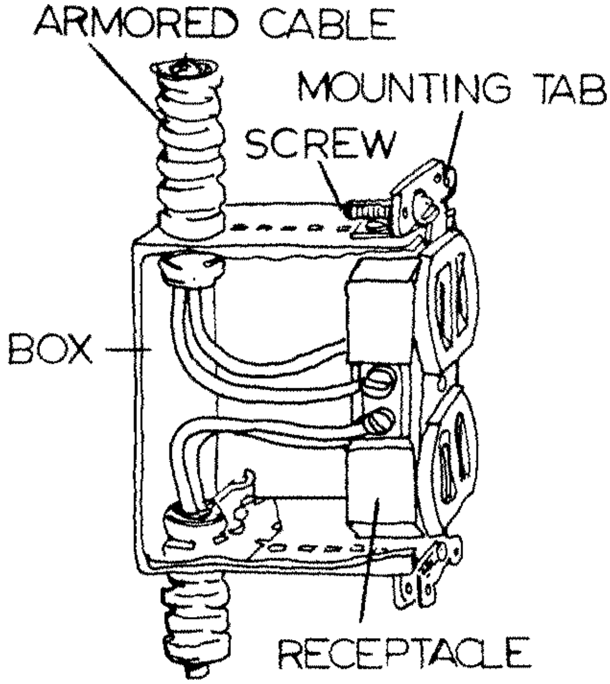

HOTWIRE
FINS
DEFLECTOR
TUBE
NEUTRAL WIRE
GROUNDWIRE
GROUNDWIRE
POWER SUPPLY CABLE

HOUSE CABLE WIRING

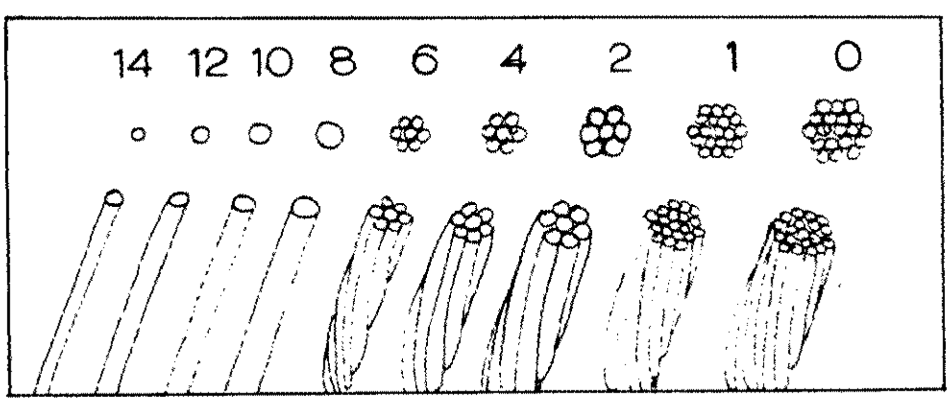
The wire diameters, shown here approximate size, are referred to by gauge numbers--the larger the number, the smaller the wire. Strange as it seems that's how you refer to wire size.

The smallest wire that you use in house wiring, per electrical codes, is a number 14, which is used in circuit wiring for wall outlets and built-in lighting fixtures. Electrical codes in newer homes call for wall outlets to be placed in certain areas, and limit the number of outlets per circuit. The code calls for number 12, number 10, or number 8 wire in the laundry and kitchen circuits. These wire sizes are all solid, single-wire conductors. The service entrance, which is usually the line from the power pole to your service panel, is larger, twisted wires.





OLD STYLE GROUNDING



COMMON ELECTRICAL RECEPTACLES

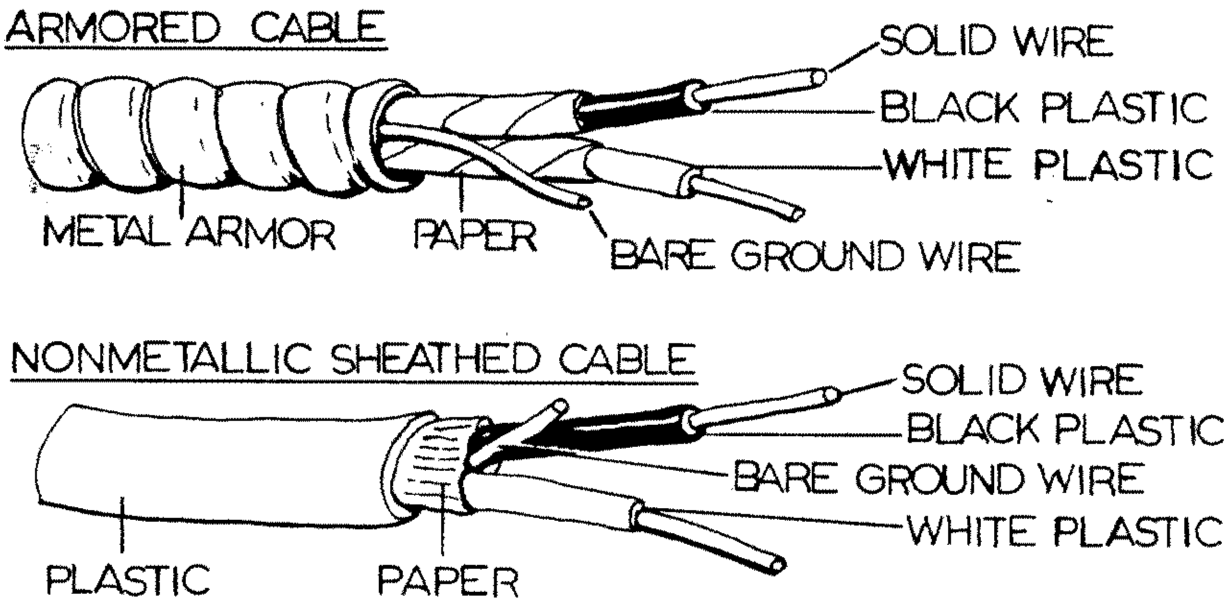
There are five common receptacles, or outlets, all with different plug or slot arrangements. The common standard 120-volt outlet has three slots, with a separate one for ground, but older ones may not have a ground slot and if possible, should be replaced. Also, there are 240-volt outlets for general use, and outlets for electric ranges and dryers, all with different slot arrangements to prevent their misuse.

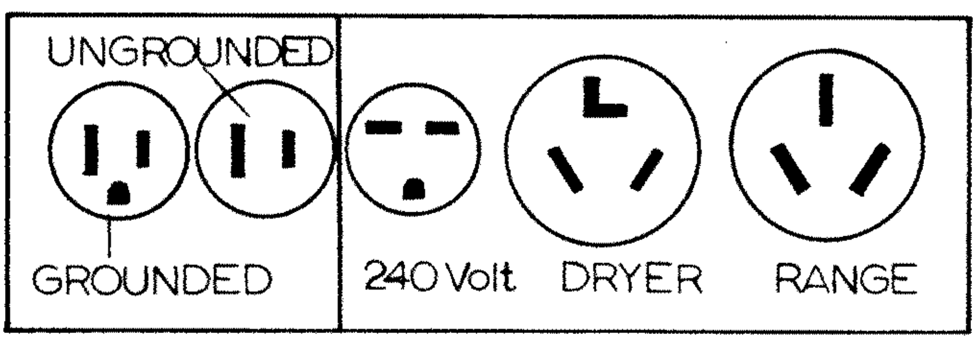
CABLE TYPES

With "armored" cable, two insulated wires are covered with paper and put into a spirally wound, interlocking flexible steel cable that provides for protection and strength. Usually called BX cable, this is the type you will find in some older homes, and in some areas, it is still a code requirement. For proper identification, the plastic insulation on the two wires is colored either black or white, so you can connect them to the right terminal. A bare wire, which is the ground, is also run through the cable, although you may find some of the older cable lacking this ground. To cut through the "armored" sheathing of the cable, you must use a hacksaw.

The non-metallic covered cable, which is easier to install and less expensive, is now the most widely used cable in homes. In lieu of an armored cable, the insulated black and white wires, along with the bare ground wire, are usually covered with a braided fabric cover or encased in plastic. For outdoor use where the wire is to be buried in the ground under damp or corrosive conditions, a stronger type without the paper interliner is used.

TYPES OF CABLE





RECEPTACLE TESTING

1. Testing for Receptacle Voltage:

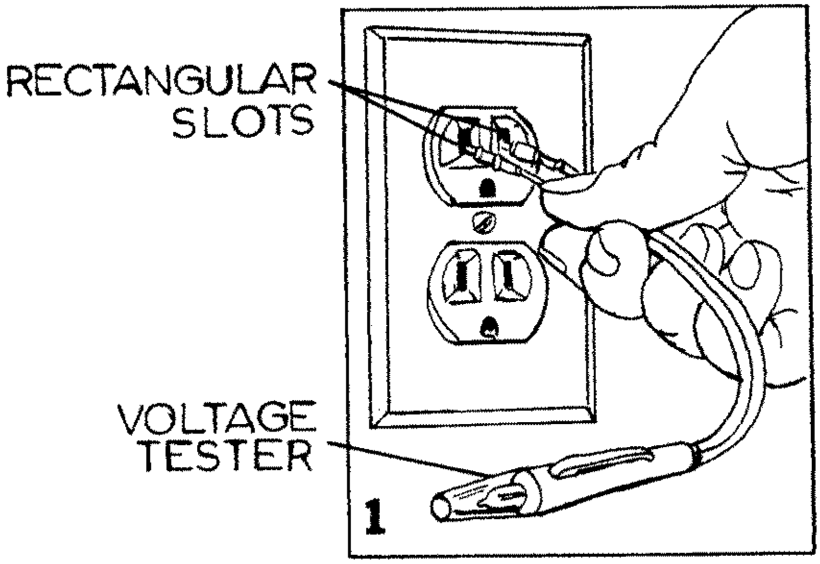
   This test will show if a receptacle is correctly wired. First, insert the leads of a voltage tester into the rectangular slots as shown. If the current is on, the neon bulb will glow.

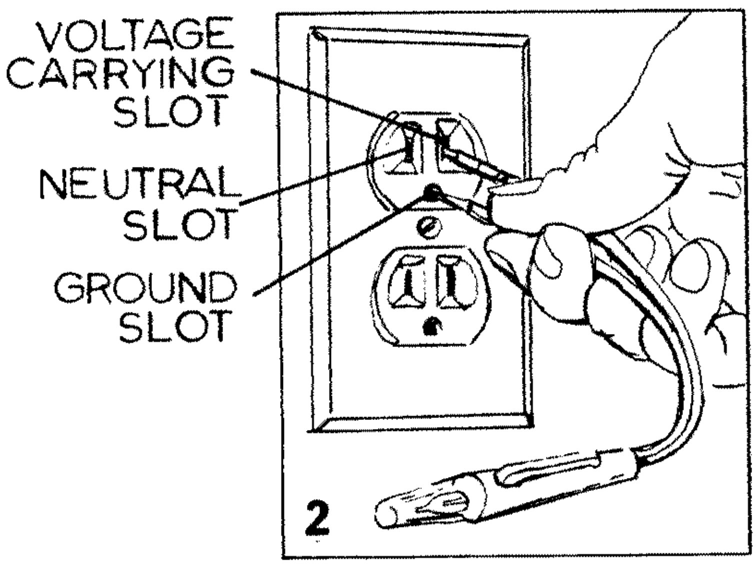
2. Ground Slot Testing:

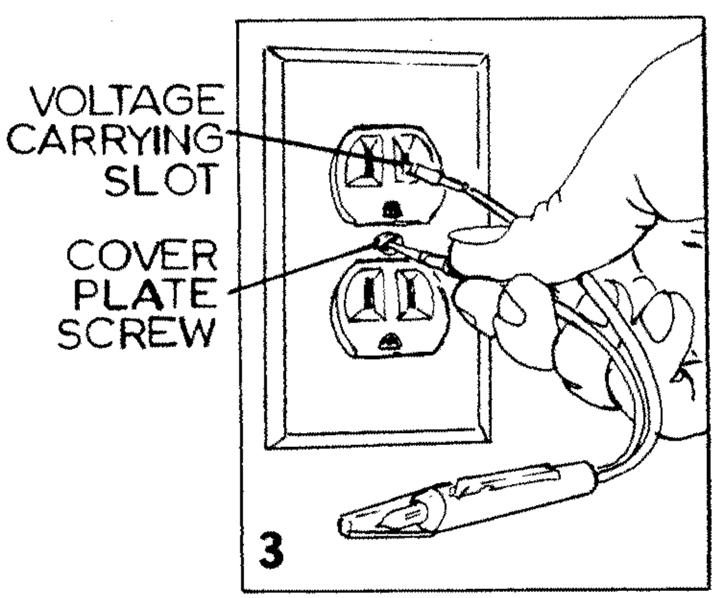
   Connect one of the tester probes to the arched ground slot and to each of the other rectangular slots in turn. When the tester probe is in one of the rectangular slots (in modern receptacles it's the smallest one), the tester will glow if the receptacle is properly grounded.

3. Cover Plate Grounding:

   Connect your voltage tester between the cover plate screw and the rectangular slot carrying the voltage found in step 2. If the cover plate is properly grounded, the tester will glow.


RECTANGULAR SLOTS
VOLTAGE TESTER
1


VOLTAGE CARRYING SLOT
NEUTRAL SLOT
GROUND SLOT
2


VOLTAGE CARRYING SLOT
COVER PLATE SCREW
3

HOW AN ELECTRIC RANGE HEATS

When a switch for one of the top heating elements is turned on, the switch control behind it supplies electricity to the element at the selected rate.

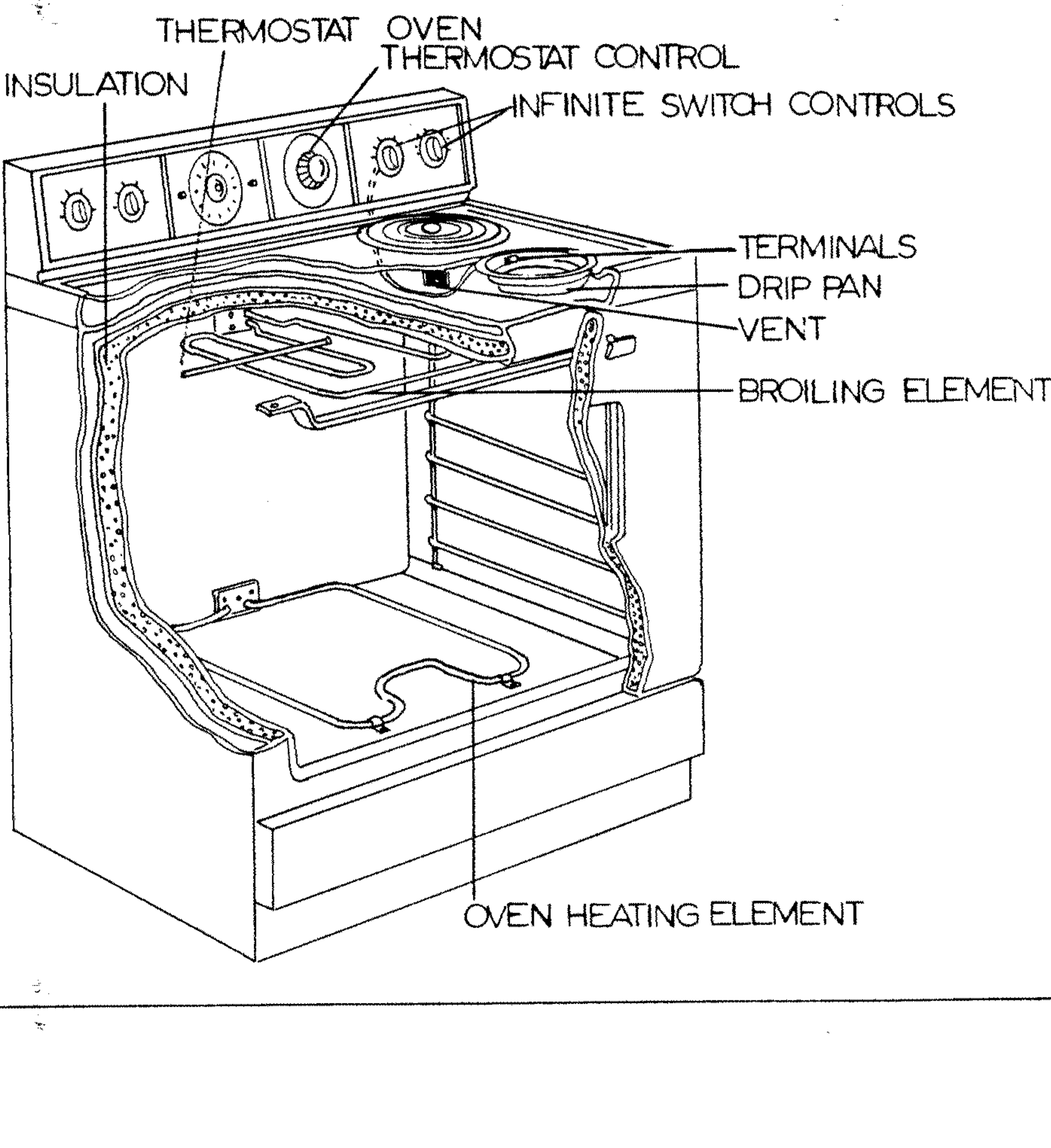
All of the elements are generally constructed of nichrome-alloy resistance wire sealed inside stainless steel sheaths.

The top heating elements are flat and tightly coiled, to provide the maximum heated area to the cooking utensil.

Most ranges provide three top heating elements that are approximately six inches in diameter, and a fourth heating element, for large pots, that is approximately eight inches in diameter.

The oven has two heating elements: a lower element used for baking, and an upper element used for broiling.

They utilize widely looped heating elements to cover as wide an area as possible, to ensure even heating throughout the oven. The temperature is generally regulated by the same type of termostat that is used in a gas-range oven.

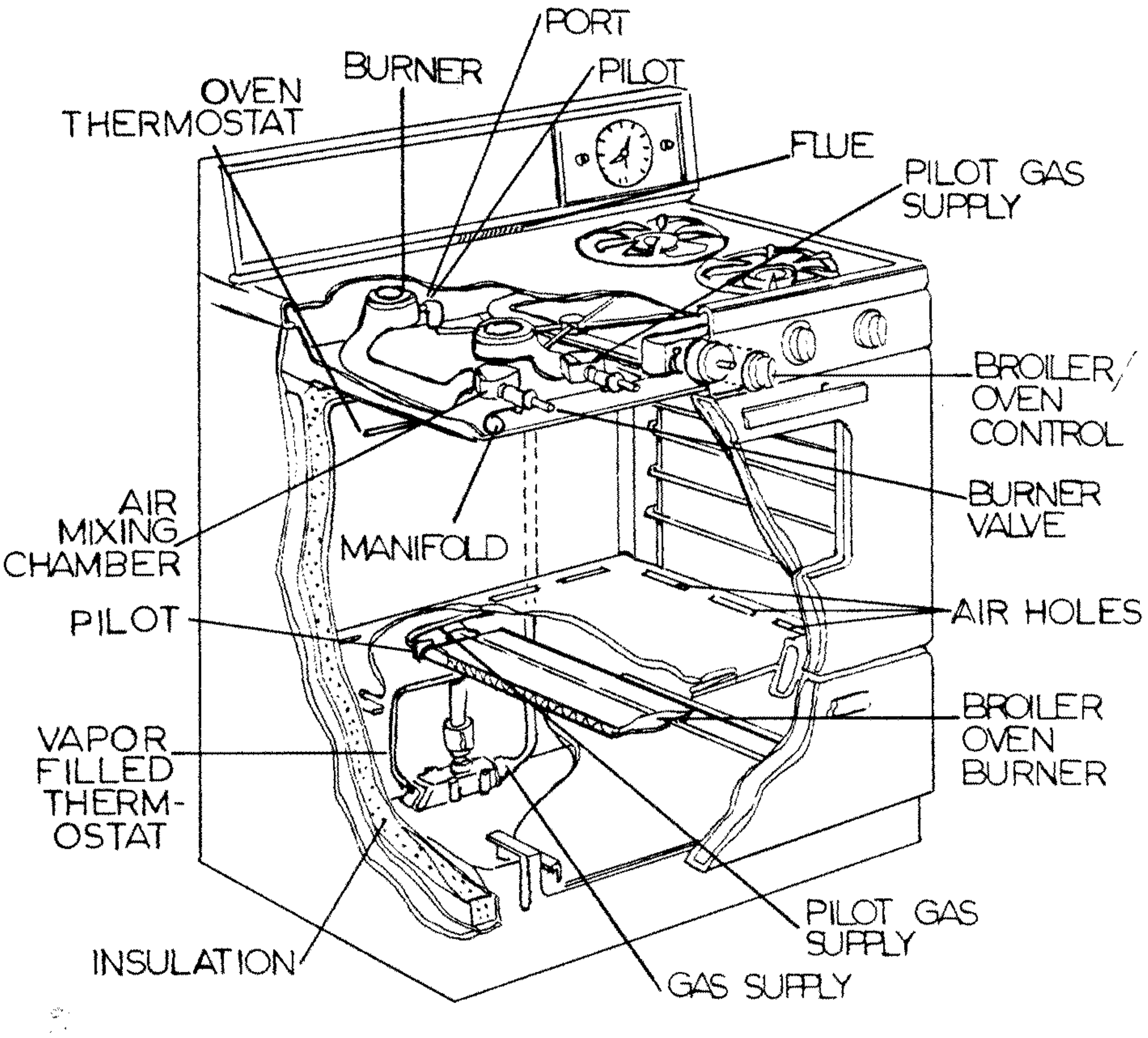

THERMOSTAT
OVEN THERMOSTAT CONTROL
INSULATION
INFINITE SWITCH CONTROLS
TERMINALS
DRIP PAN
VENT
BROILING ELEMENT
OVEN HEATING ELEMENT

THE GAS RANGE

Natural or bottled gas flows under pressure into the manifold pipe, which has the valves for the pilot lights, the burners, and the oven attached. When you open a valve for the burner, gas flows through the manifold into the mixing chamber. The incoming gas draws air into the chamber and mixes the proper amount with the gas, and then it flows to the burner. As the mixture enters the burner, a small amount goes through a port in the side, where your pilot will ignite it.

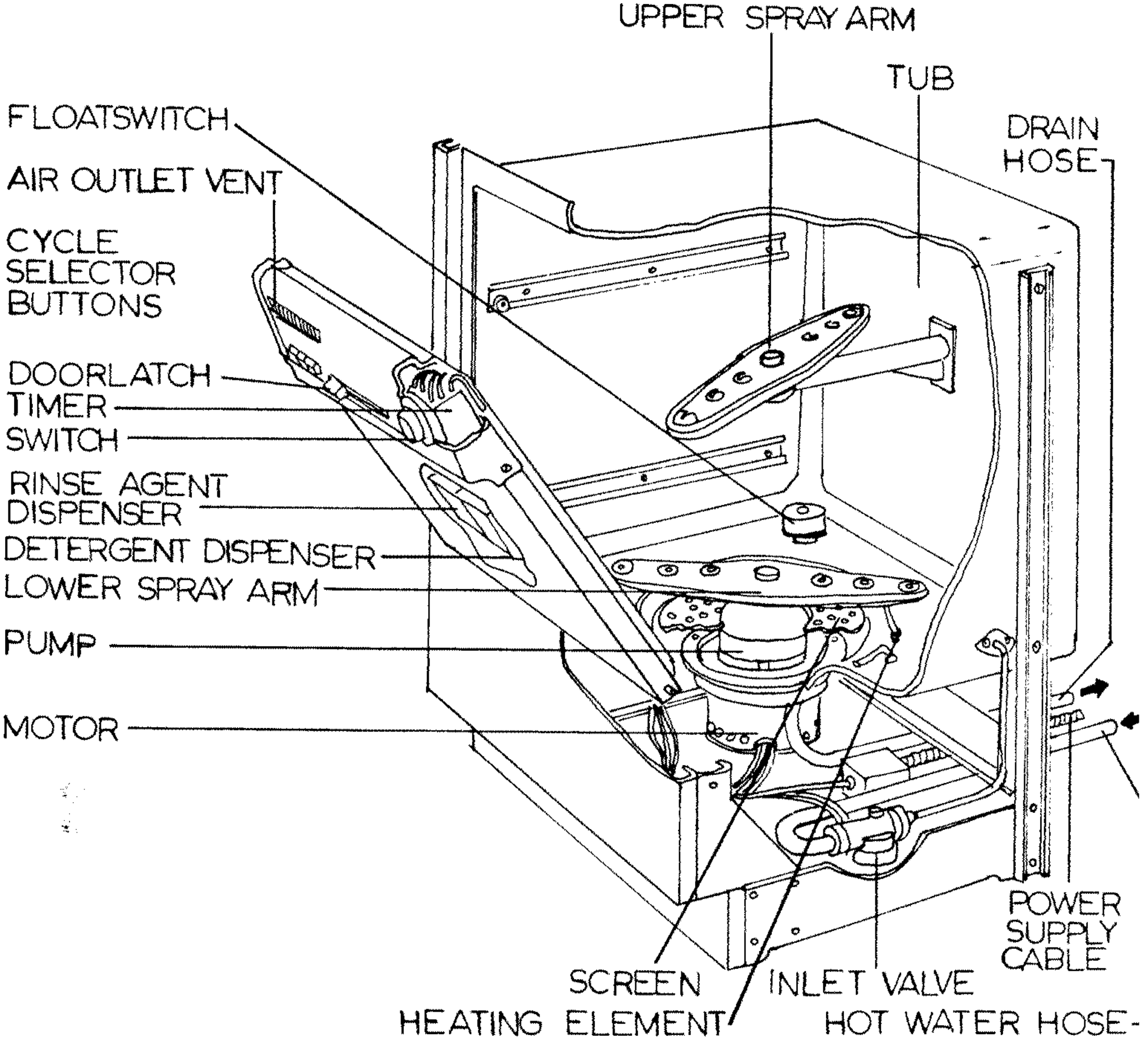
On most of your gas ranges, your broiler and oven have a burner which is controlled by two thermostats, top and bottom, and a pilot light with a flame of varying size. With the oven turned off, the pilot flame is small; but when the oven valve is turned on, a valve is opened that allows more gas to reach the pilot. This in turn heats the vapor-filled thermostat that controls the safety, or shutoff, valve. When the vapor is heated, it expands and forces open a bellows-operated valve which allows gas to enter the oven burner. The pilot will then light the burner. After the burner is burning, the main oven thermostat takes over, also using an expanding vapor to control a valve with bellows. This valve turns the gas flow on or off to maintain your preset temperature.

The air holes around the oven allow the heated air to circulate for even cooking, and lets fresh air reach the burner. There is a vent flue at the rear of the oven to vent the burned gases.


PORT
BURNER
PILOT
OVEN THERMOSTAT
FLUE
PILOT GAS SUPPLY
BROILER/ OVEN CONTROL
AIR MIXING CHAMBER
MANIFOLD
BURNER VALVE
AIR HOLES
PILOT
BROILER OVEN BURNER
VAPOR FILLED THERM-OSTAT
PILOT GAS SUPPLY
INSULATION
GAS SUPPLY

HOW THE DISHWASHER WORKS

After you load the racks, put your soap in the dispenser, shut and latch the door, push the proper cycle-selector buttons and turn the switch--then an electric clock that activates the controls in a sequence, called a timer, takes over. It is the brain center of the machine, as it controls the hot water inlet valve, the pump that sends water to the spray arms or pumps out the water through the drain hose, the detergent and rinse-agent dispensers, the dish drier heating element, and the air-outlet vent, which speeds drying. Finally, at the end of the cycle, it shuts the unit off. There are only two parts that are independent of the timer. One is a safety device called a float valve that shuts off the incoming water and prevents overflowing if the inlet valve doesn't close. The other is a screen over the pump to prevent clogging.



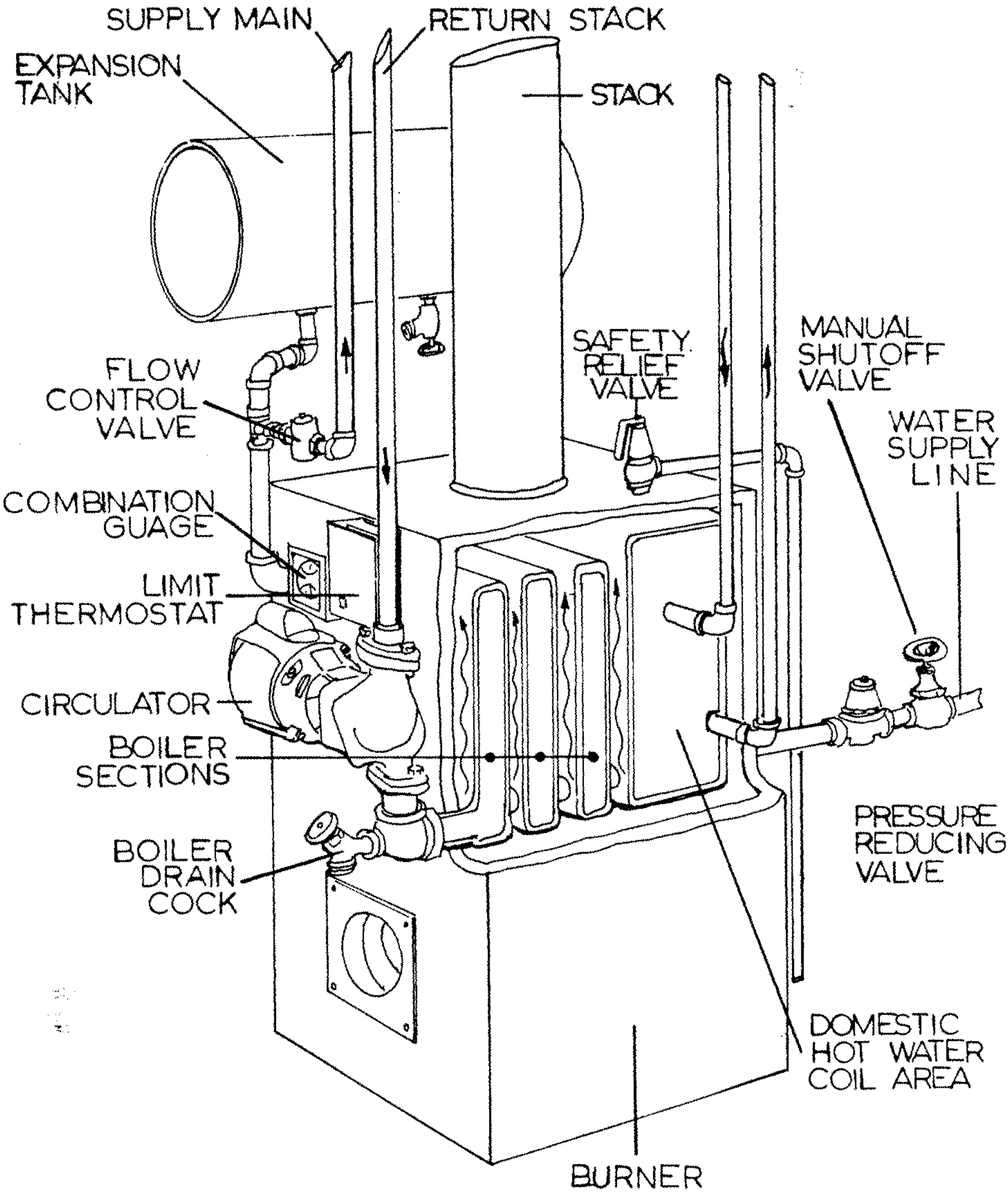
UPPER SPRAY ARM
TUB
FLOATSWITCH
DRAIN HOSE
AIR OUTLET VENT
CYCLE SELECTOR BUTTONS
DOORLATCH
TIMER
SWITCH
RINSE AGENT DISPENSER
DETERGENT DISPENSER
LOWER SPRAY ARM
PUMP
MOTOR
POWER SUPPLY CABLE
SCREEN
INLET VALVE
HEATING ELEMENT
HOT WATER HOSE

THE HOT WATER BOILER

The boiler provides a supply of hot water for heating and other domestic needs. The pressure reducing valve lets water into the boiler from the supply line, and keeps it from back-flowing if water pressure in the line drops. The burner produces the hot combustion gases that flow past water filled sections of the boiler. The gases heat the sections and then vent through the stack to the exterior. In each zone is a house thermostat which controls the zone valves, and also the circulator's starting and stopping.

A flow control valve in the supply main will stay shut, unless the circulator is on, preventing hot water from rising and carrying heat to rooms already warm. The valve also lets the boiler heat water in separate coils for domestic use without heating the house in summer.

The water is heated well above boiling, for efficiency, but doesn't turn to steam because the expansion tank and the pressure reducing valve keep it under pressure. The safety relief valve will open if the pressure becomes too high, and the limit thermostat turns off the burner if the water exceeds safe operating temperature. The combination gauge indicates the temperature, pressure, and water level in the system.


SUPPLY MAIN
RETURN STACK
EXPANSION TANK
STACK
SAFETY RELIEF VALVE
MANUAL SHUTOFF VALVE
FLOW CONTROL VALVE
WATER SUPPLY LINE
COMBINATION GUAGE
LIMIT THERMOSTAT
CIRCULATOR
BOILER SECTIONS
PRESSURE REDUCING VALVE
BOILER DRAIN COCK
DOMESTIC HOT WATER COIL AREA
BURNER

WATER HEATERS

Once a reservoir on the kitchen stove, the water heater has become a self-contained, efficient appliance. A typical gas-fired water heater will heat about 100 gallons of water per day to about 170° F. to provide for the average family's laundry, bathing, and cleaning purposes. If it is overdrawn by a heavy demand, it will provide a fresh supply of hot water in a few minutes.

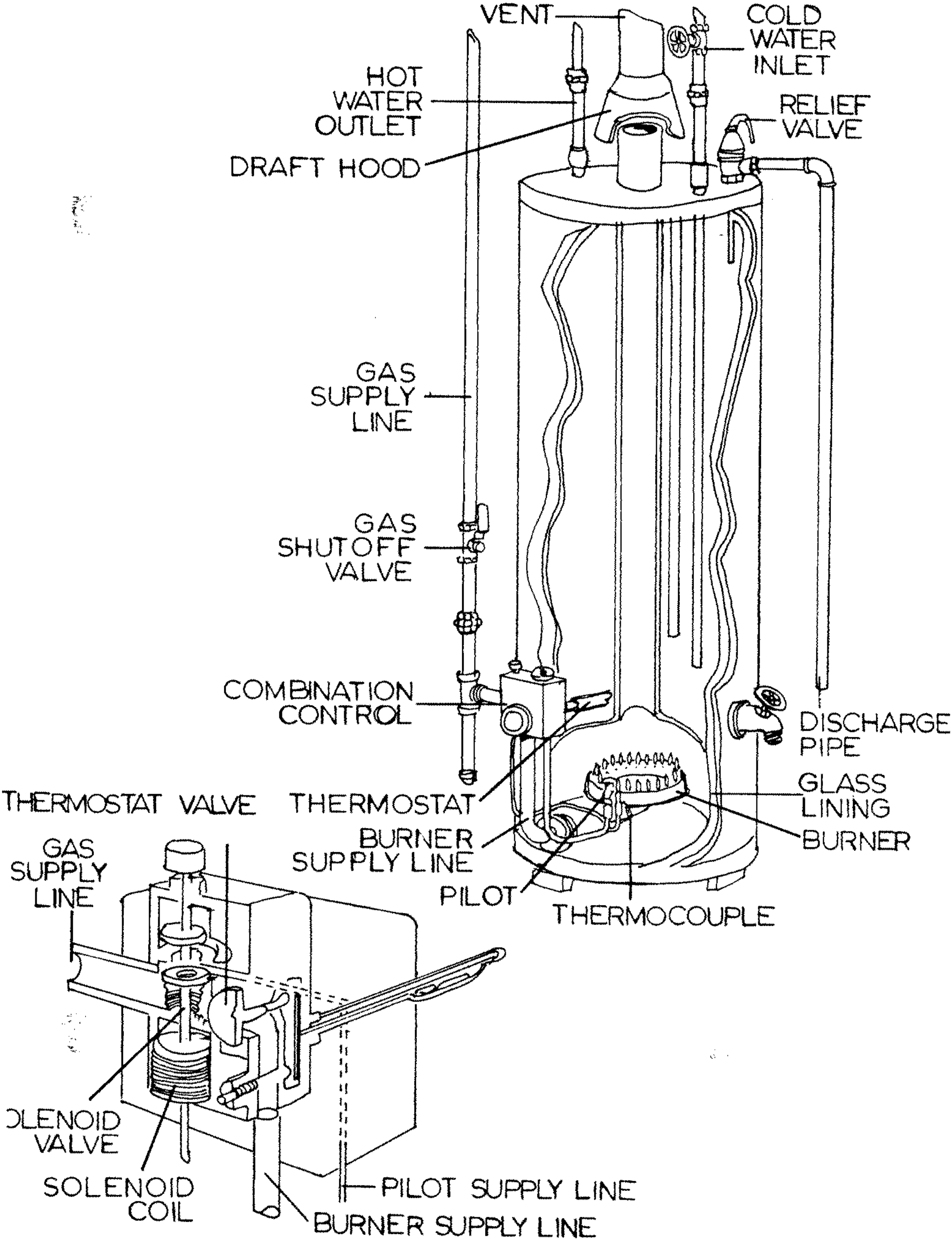
Heaters will do their work automatically with the help of various controls. These controls range from the thermocouple, which converts heat into electricity for the electromagnetic safety valve, to a "sacrificial" anode, a magnesium rod suspended inside the tank which exists simply to be eaten away by corrosion that otherwise would attack the exposed metal of the tank.

COMBINATION CONTROL

The gas flow to the pilot and burner supply lines is regulated by the movement of two valves. One of them is connected to the thermostat, and the other controls the solenoid, thermocouple, and reset button.

WATER HEATER OPERATION

Whenever a hot water faucet is turned on, hot water is pushed up in the heater into the hot water outlet by the cold water entering and flowing down the dip tube. The thermostat will then react to water temperature. drop by opening the valve that sends gas to the burner, where it is ignited by a pilot light. The hot exhaust gases are vented through the flue and the heat-retaining baffle, to the draft hood, and into the vent pipe to the exterior of the house. A temperature and pressure valve (relief valve) prevents excessive pressures or temperatures in the hot water heater. By use of the sacrificial anode and a glass lining, the manufacturers prevent corrosion of the tank walls.

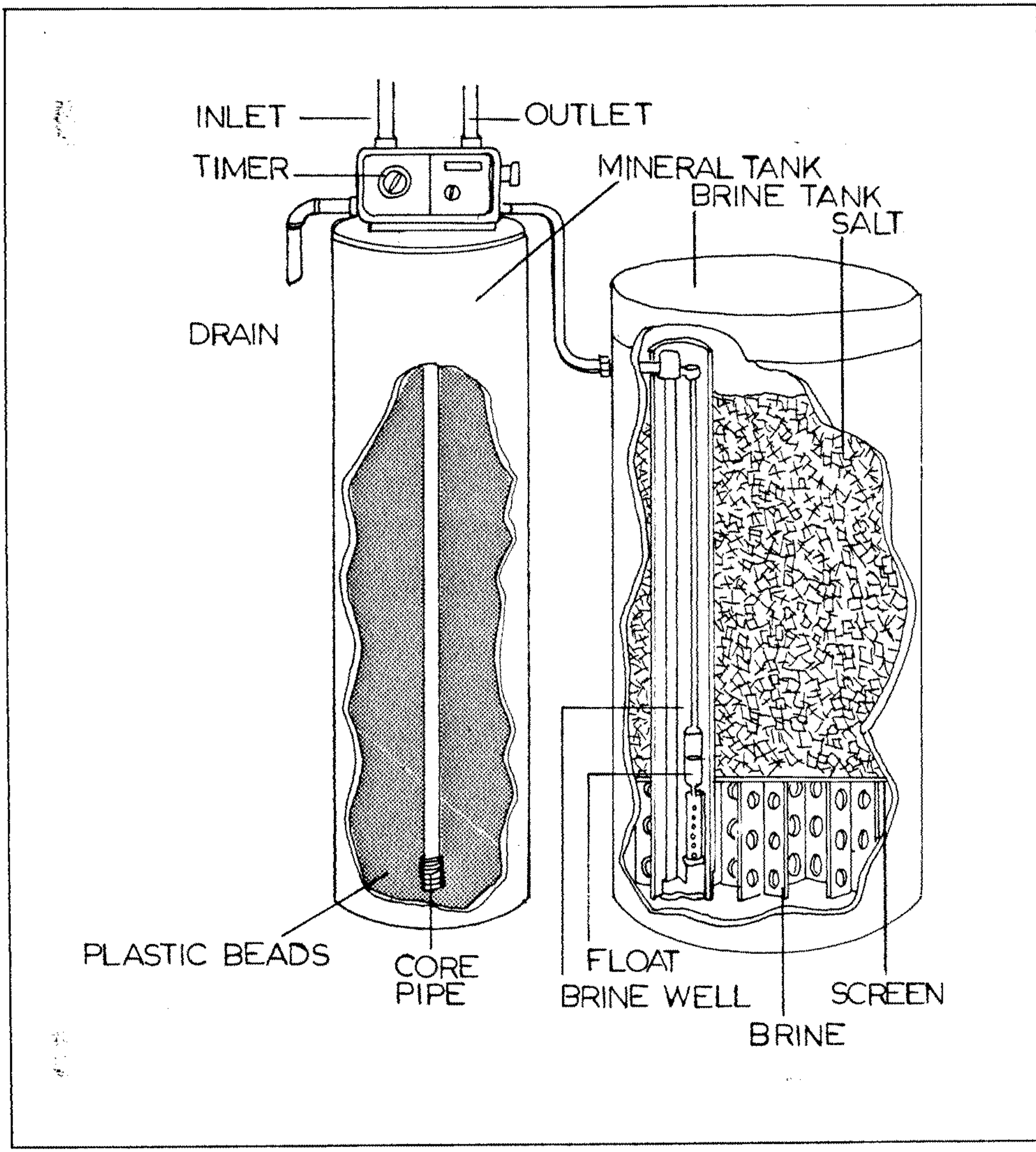


VENT
COLD WATER INLET
HOT WATER OUTLET
RELIEF VALVE
DRAFT HOOD
GAS SUPPLY LINE
GAS SHUTOFF VALVE
COMBINATION CONTROL
DISCHARGE PIPE
THERMOSTAT VALVE
THERMOSTAT
GLASS LINING
BURNER
GAS SUPPLY LINE
BURNER SUPPLY LINE
PILOT
THERMOCOUPLE
OLENOID VALVE
SOLENOID COIL
PILOT SUPPLY LINE
BURNER SUPPLY LINE

HARD WATER SOFTENING

Normally, water will only flow through the water softener's mineral tank, and never enter the brine tank. From the main supply line inlet connection, water will flow over a tank of plastic beads that react with hardness minerals by replacing their magnesium and calcium with the plastic beads' sodium. The water now containing sodium minerals instead of magnesium and calcium, flows into the core pipe to the outlet and into the house water lines.

When the plastic beads build up magnesium and calcium, and lose their supply of sodium, their activity must be regenerated. At this time, the timer will temporarily disconnect the water softener from the house supply and start the process of washing the plastic beads in a sodium solution, which is the beginning of the recharge cycle.


INLET
OUTLET
TIMER
MINERAL TANK
BRINE TANK
SALT
DRAIN
PLASTIC BEADS
CORE PIPE
FLOAT
BRINE WELL
SCREEN
BRINE

THE THREE CYCLES OF WATER SOFTENING

1. Reverse Flow Backwash

   The regeneration cycle begins with water going down the core pipe and up through the plastic beads in the backwash process that flushes dirt out through the drain line.

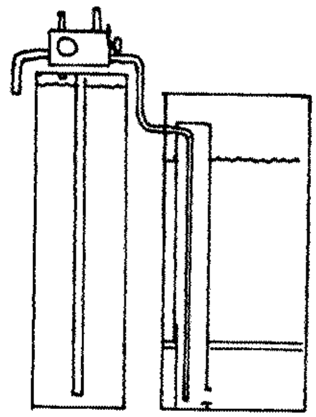
2. Recharge Cycle

   The salt water from the brine tank then flows down through the plastic beads, removing their accumulated magnesium and calcium, and at the same time deposits sodium on them. The salt water solution with the magnesium and calcium then goes up the core pipe and into the drain line.

3. Rinse Cycle

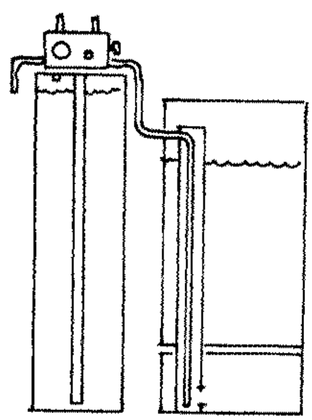
   Finally, fresh water from the main supply line washes the unused brine out of the mineral tank and flows through the brine well to dissolve salt in the brine tank for the next cycle.

1



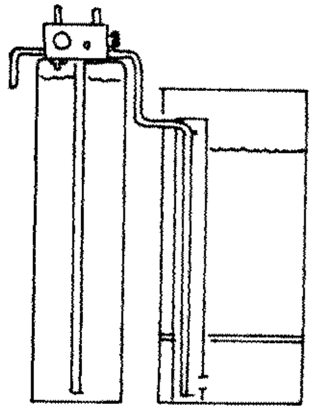
BACKWASH

2



RECHARGE

3



RINSE

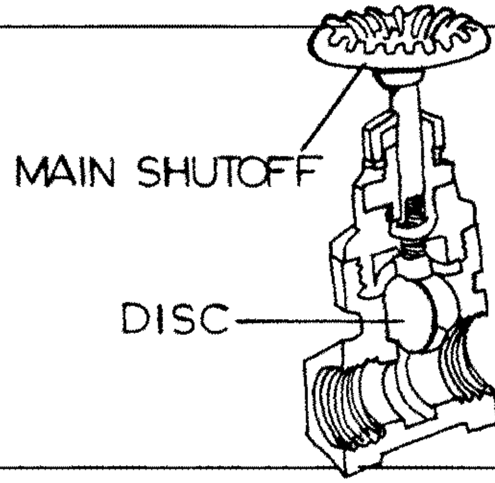
BASIC VALVES

The gate valve is used where you desire a full flow of water, and is normally used as the main shutoff valve, because in the full open position it provides the full flow needed by the house. The gate valve should always be either fully opened or closed, because in the half-open position, the gate, or disc, will vibrate and chatter.

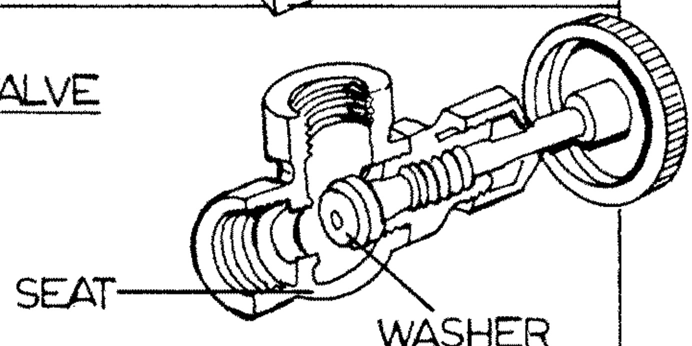
The globe valve operates smoothly even when only partially opened. There are two basic types--the angle globe valve and the straight globe valve, although there are special globe valves made, such as a T-globe valve, or dishwasher valve. The angle globe valve causes the water to make a right angle turn, and the straight globe valve allows the water to follow a straight path. With both types, the water will pass through the globe, or spherical section and will determine your flow of water that gives the valve its name, depending on how far the valve is opened. These are usually found beneath all the plumbing fixtures.

The check valve prevents the backflow of the supply or drain water. This valve is only controlled by a water flow, and must be installed correctly. Water will flow through the valve as indicated by an arrow on the exterior of the body, and a flow in the opposite direction will force the swing check to close. For cleaning or repair, you simply remove the access plug.

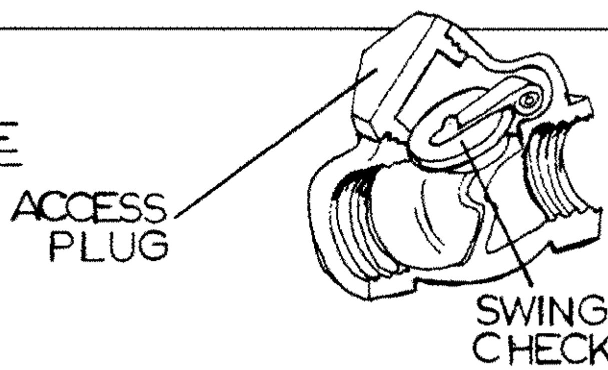
GATE VALVE



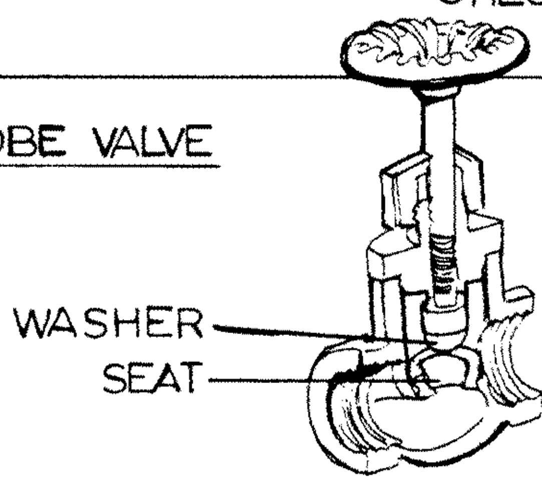
ANGLE GLOBE VALVE



CHECK VALVE



STRAIGHT GLOBE VALVE



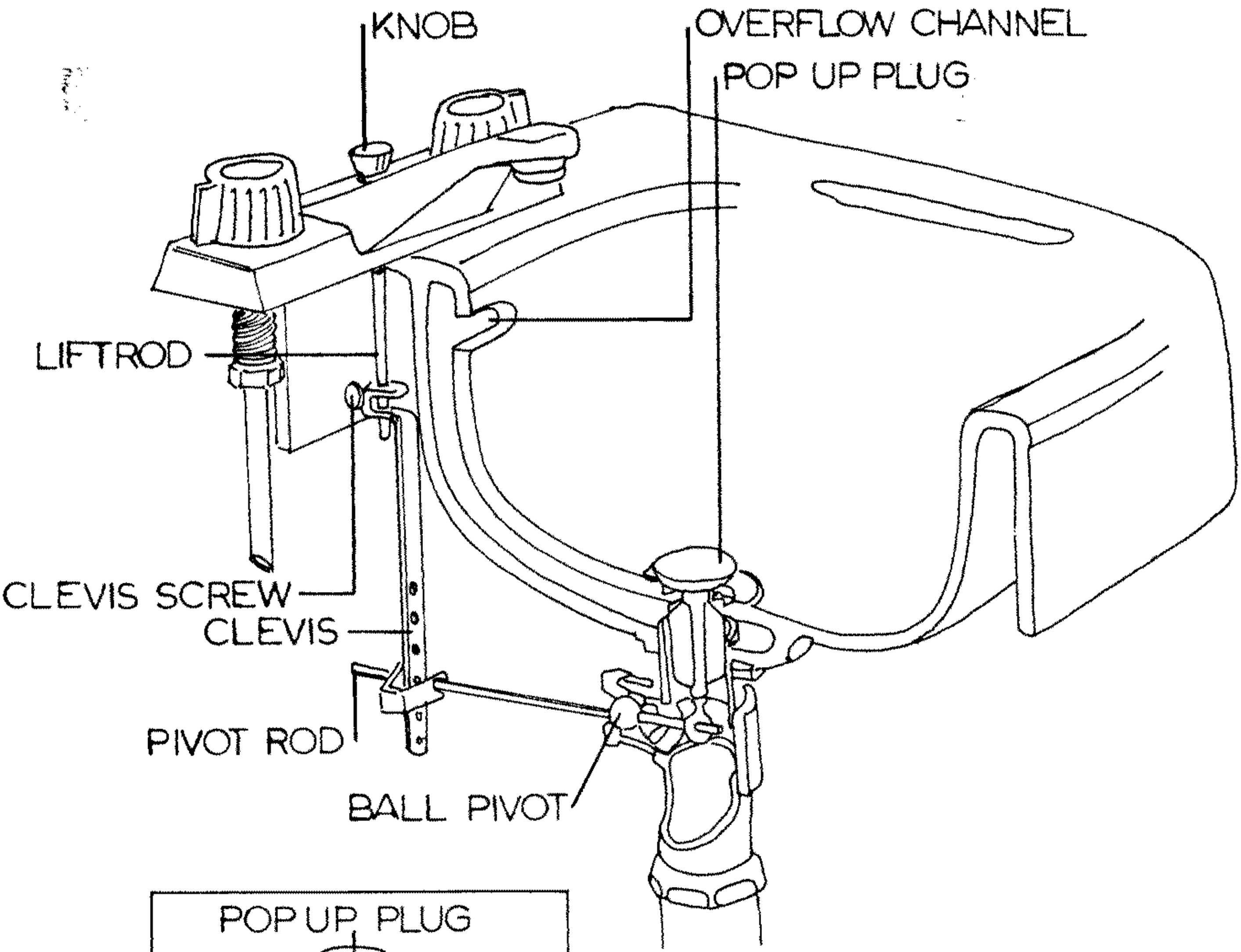
POP-UP DRAIN

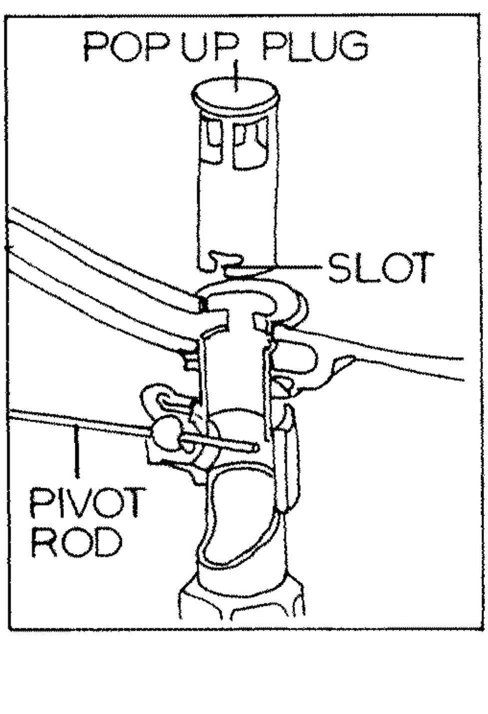
The pop-up drain on the modern lavatory is nicer than the old-fashioned rubber plug stopper, but it doesn't allow the drain to open as much, and it doesn't make a completely watertight seal. However, it does work better than most people think, and proper adjustment requires few tools. Keeping it clean is of prime concern. All mechanical drains do not look alike, but they all work in the same way, and the basic parts are very similar. Once you know how, even the types that don't seem to come apart for cleaning actually do.

POP-UP DRAIN MECHANISM

When you pull up on the knob to close the drain, a mechanical linkage, composed of the lift rod and the adjustable clevis, in turn raises one end of the pivot rod. The ball pivot is the fulcrum causing the pivot rod to lower the pop-up plug, which seals the drain opening in the basin. However, it does not seal the overflow channel from the drain line. Pushing down on the knob will reverse the operation and open up the drain.

If the pop-up plug does not seat tightly, you simply loosen the clevis screw, push the pop-up plug down for a good seal, and retighten the clevis screw. If this adjustment alters the pivot rod angle to a point where it restricts the plug from opening, disassemble the linkage mechanism and move the pivot rod up to a higher hole in the clevis, and then check the seal again.

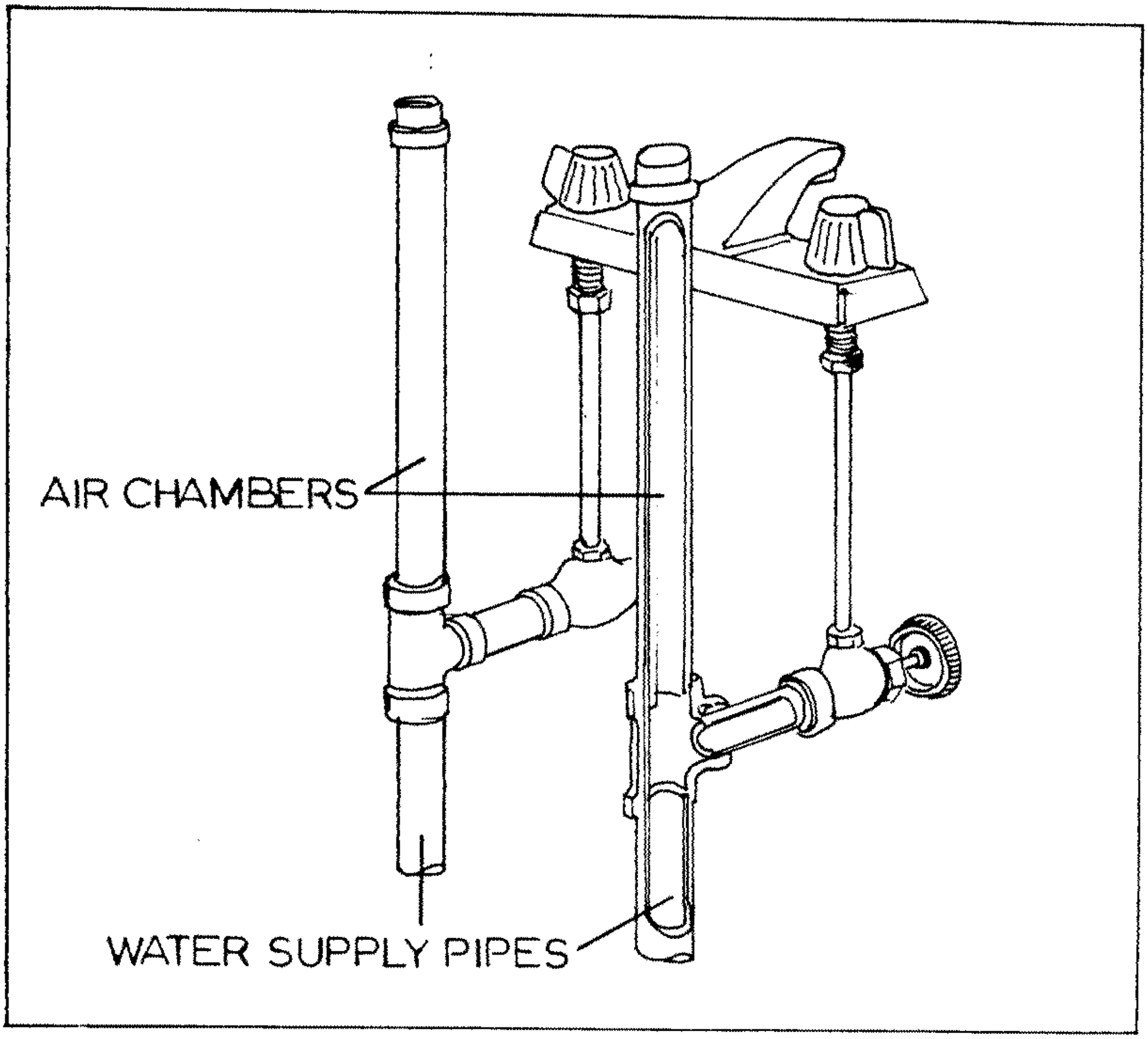

KNOB
OVERFLOW CHANNEL
POP UP PLUG
LIFTROD
CLEVIS SCREW
CLEVIS
PIVOT ROD
BALL PIVOT


POP UP PLUG
SLOT
PIVOT
ROD

AIR CHAMBERS

To prevent noise and water hammer, pipes leading to faucets and other fixtures are sometimes equipped with an air chamber, a capped piece of pipe, or special water-hammer arresters. Air trapped in these dead-end devices provides a cushion for the water shut-off at the fixture. Without these, the water could rattle, and loosen the pipes and fittings.

Over a period of time, the water level will rise in the air chamber as the water slowly absorbs the trapped air. When this happens, you should drain the entire system. The opened faucets, in draining the system, will then admit a fresh supply of air to the chambers.


AIR CHAMBERS
WATER SUPPLY PIPES

PRESSURE FLUSH VALVES

Toilets in many apartment houses have pressure flush valves instead of flush tanks. Connected between a water supply line and the toilet bowl, the valve will send water under pressure rushing from the supply into the bowl. The control stop regulates the water pressure and volume between the supply line and valve.

There are two basic types of flush valves, the diaphragm and the piston. The diaphragm valve is simple and easy to service. The piston valve is rather complex, but it will function even with water that has lots of sediments or minerals. Both take up very little space and will use less water than the toilet tank type, but they tend to be noisy and have to be supplied by at least a 1" diameter water supply line. Most single family homes don't have or need lines that large, so therefore they are not widely used in single family homes.

FLUSH VALVE OPERATION

The upper and lower chambers in a flush valve are separated by a diaphragm and a relief valve. Water will enter the upper chamber through the bypass valve on the diaphragm, where the water pressure holds the diaphragm and relief valve firmly in place over the valve barrel opening. By pushing the handle, you activate a plunger that moves the relief-valve stem, tilting the relief-valve and letting water leave the upper chamber through the valve barrel. While the upper chamber empties, water pressure in the lower chamber forces the diaphragm and relief-valve up, opening the barrel so that the water will flow directly from the supply inlet through the barrel and into the toilet bowl, bypassing the upper chamber. Some water will then seep through the bypass valve into the upper chamber and build up enough pressure to depress the diaphragm and close the barrel opening, ready now for the next flush cycle.