Instruction STM-11
April, 1955—5M

SARCOTHERM
SIMPLIFIED
HEAT CONTROL

INSTALLATION AND SERVICE MANUAL

SARCOTHERM TYPE STA-1 AND TYPE STA-1D

MODULATING OUTDOOR-INDOOR CONTROLS

KEEP FOR FUTURE REFERENCE

SARCOTHERM CONTROLS, INC.

EMPIRE STATE BLDG.

NEW YORK 1, N. Y.

GUARANTEE

Sarcotherm products are guaranteed against defective material and workmanship for one year after shipment, and products or parts found defective will be replaced F.O.B. factory, Bethlehem, Pennsylvania. The Company will not be responsible for damages caused by defective material or delays arising in connection with same, and no claims for labor in repairing or replacing such products or parts can be allowed.

Service may be charged on the basis of time, labor and material involved.

Specifications:

SINGLE SEATED VALVE

Size	Type	Connections
¾"	STA-1	Screwed
1"	STA-1	Screwed
1¼"	STA-1	Screwed
1½"	STA-1	Screwed
2"	STA-1	Screwed
2½"	STA-1	Screwed

DOUBLE SEATED VALVE

Size	Type	Connections
3"	STA-1D	Flanged
4"	STA-1D	Flanged
5"	STA-1D	Flanged
6"	STA-1D	Flanged

Standard tubing includes 20 ft. of capillary connecting tubing to outdoor bulb and 6 ft. to auxiliary bulb panel box. Longer tubing must be specified and so ordered.
Electrical characteristics: 110v or 220v, AC or DC.

Operation:

The complete control system consists of the Sarcotherm control, outdoor bulb, auxiliary bulb panel box and room thermostat as shown in Fig. 1. (For correct wiring for your particular job see wiring diagram enclosed).

The temperature of the water circulating through the heating system is controlled by an outdoor bulb D, Fig. 1, which resets the three way mixing valve M, so that hot water from the boiler and cooler return water are mixed in correct proportion to deliver blended water to the radiators or coils at the temperature called for by outdoor conditions.

As long as the room temperature does not exceed the setting of the indoor room thermostat T, the outdoor

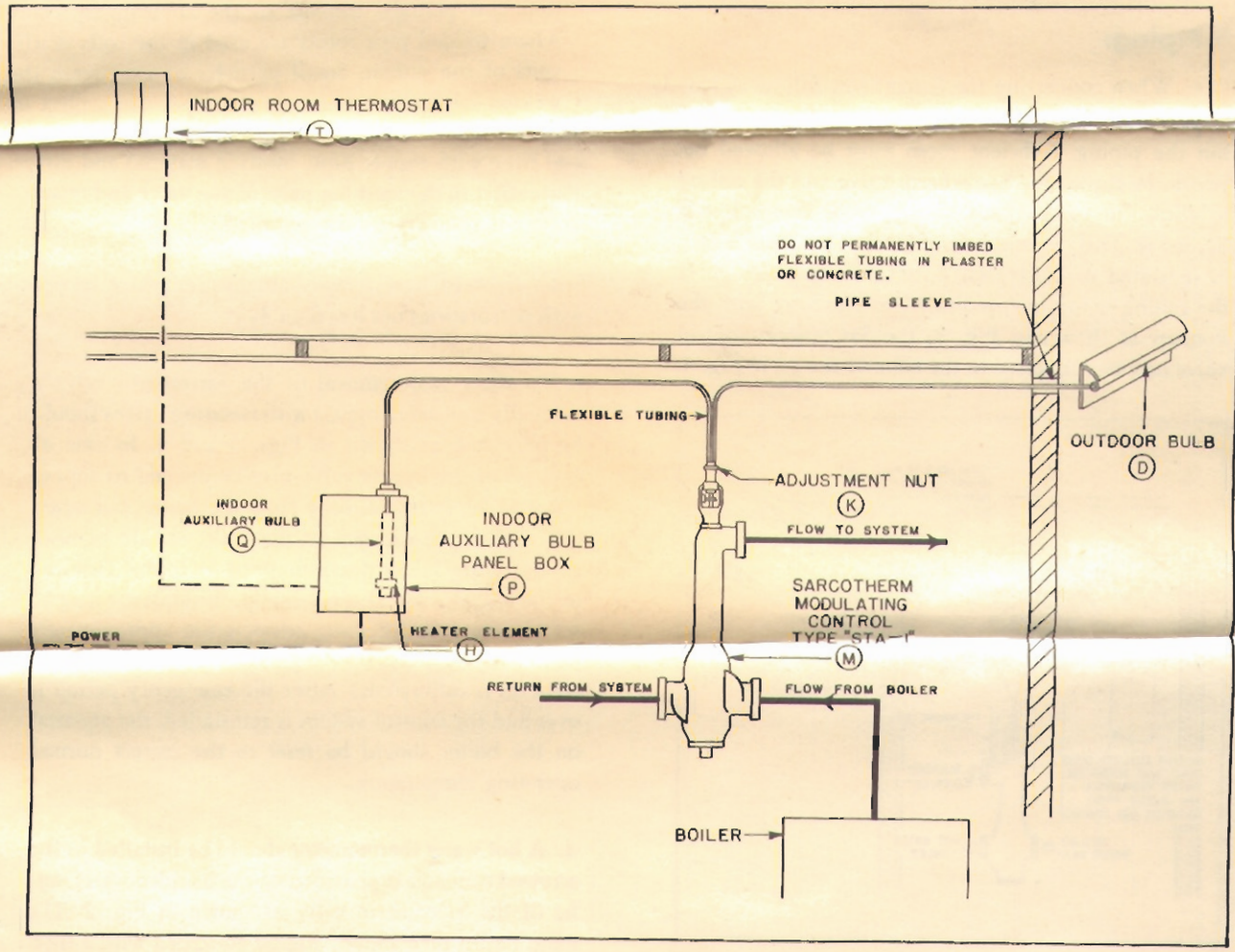

Fig. 1. Schematic Hookup Showing Type STA-1 System.

bulb acts as a master control. As soon as the indoor temperature exceeds the thermostat setting, an indoor auxiliary bulb, located in the panel box P, overrides the outdoor bulb and reduces the circulating water temperature which in turn will cause the room temperature to drop. When the room temperature reaches the thermostat setting, the outdoor bulb again takes over to continue modulating the circulating water temperature in accordance with outdoor temperature changes.

In some cases a room thermostat of the double switch type is furnished which, in addition to reducing the water temperature when overheating takes place, stops the circulating pump when the indoor temperature exceeds the thermostat setting by 3°F.

INSTALLATION

Unpacking:

a. Unpack the control very carefully, taking care not to bend or in any way damage the armored capillary tubing.

b. Remove the outside bulb D, Fig. 2, from the mounting bracket and shield S. To do this simply push the bulb D towards the mounting board and thus force it out of the spring clips C.

Piping:

a. When connecting the Sarcotherm follow as closely as possible the arrangement shown in Fig. 3. In laying out the piping, sufficient room must be allowed between the top of the Sarcotherm valve and the ceiling to allow for the removal of the inside thermostat if necessary. This clearance should be not less than 3 feet, as indicated in the typical layout drawing, Fig. 3. If the ceiling is too low to allow this clearance with the hookup as shown in Fig. 3, the Sarcotherm control valve may be connected in the manner shown in Fig. 4.

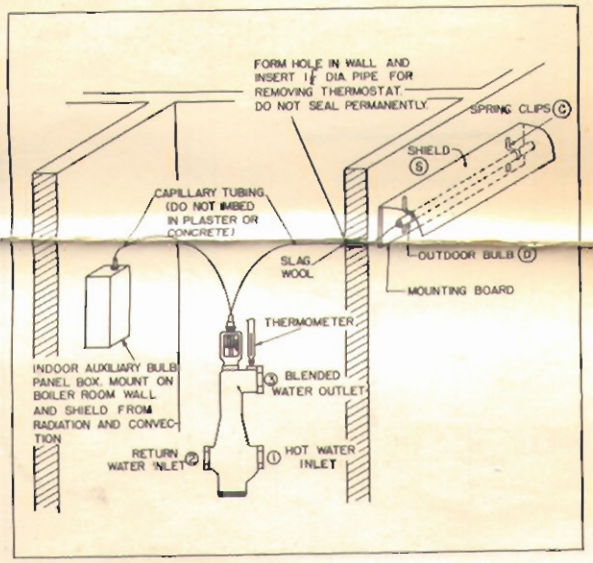

Fig. 2. Type STA-1 Sarcotherm Control.

However, when the hookup is made in accordance with Fig. 4, an automatic air eliminator, type 13-W, must be installed to eliminate the air from the loop. Otherwise air will accumulate at this point and retard the circulation throughout the system.

b. It is imperative to install strainers ahead of the Sarcotherm control on both the supply and return inlet lines whether shown or not in any of the hookup diagrams. Failure to do so may result in improper operation and perhaps damage to the control, especially where welded pipe joints are used in the coils or circuits of the system. Small particles of iron from the welded joints and scale from the pipes may collect in the valve and circulating pump and cause serious damage. Even with copper pipe, jointing material and dirt may collect in the working parts of the valve and cause trouble if strainers are not installed.

Strainers must have screens suitable for water service with perforations not less than $\frac{1}{32}$".

c. To allow easy removal of the Sarcotherm valve a manually controlled bypass with isolating valves should be provided, as shown in Figs. 3 and 4. In case of emergency the bypass valve may be opened to supply water to the system directly from the boiler, but when this is done the aquastat on the boiler should be reset to control the boiler water temperature to that required in the heating system. (Normally, the aquastat may be set to give a boiler water temperature approximately 20°F above the highest temperature for which the Sarcotherm is calibrated.) After the emergency period is over and the control system is reinstalled, the aquastat on the boiler should be reset to the correct normal operating temperature.

d. A hot water thermometer should be installed in the screwed connection provided on the blended water outlet of the Sarcotherm valve as shown in Fig. 2. The main return pipe should also be equipped with a thermometer on the suction side of the pump.

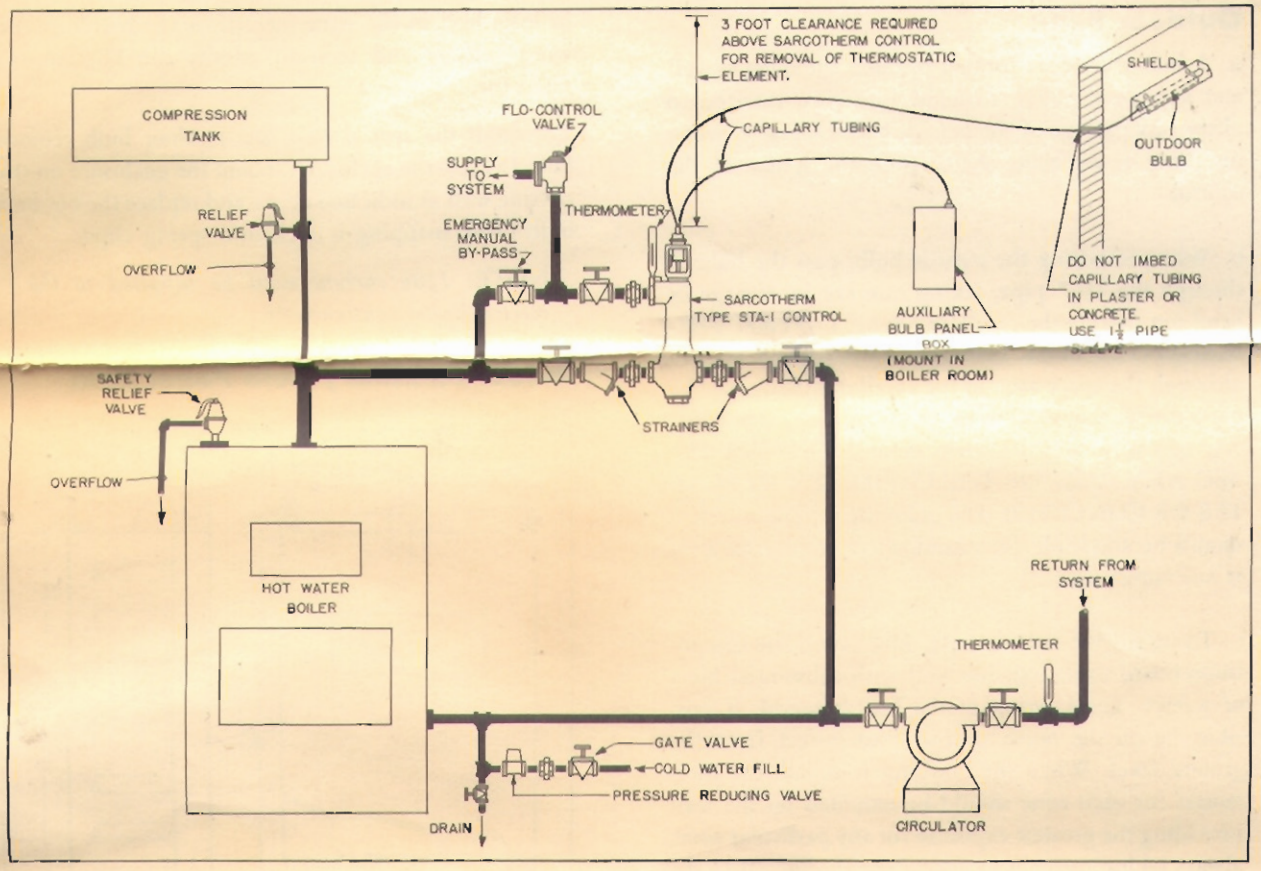

Fig. 3. Typical Sarcotherm Hookup.

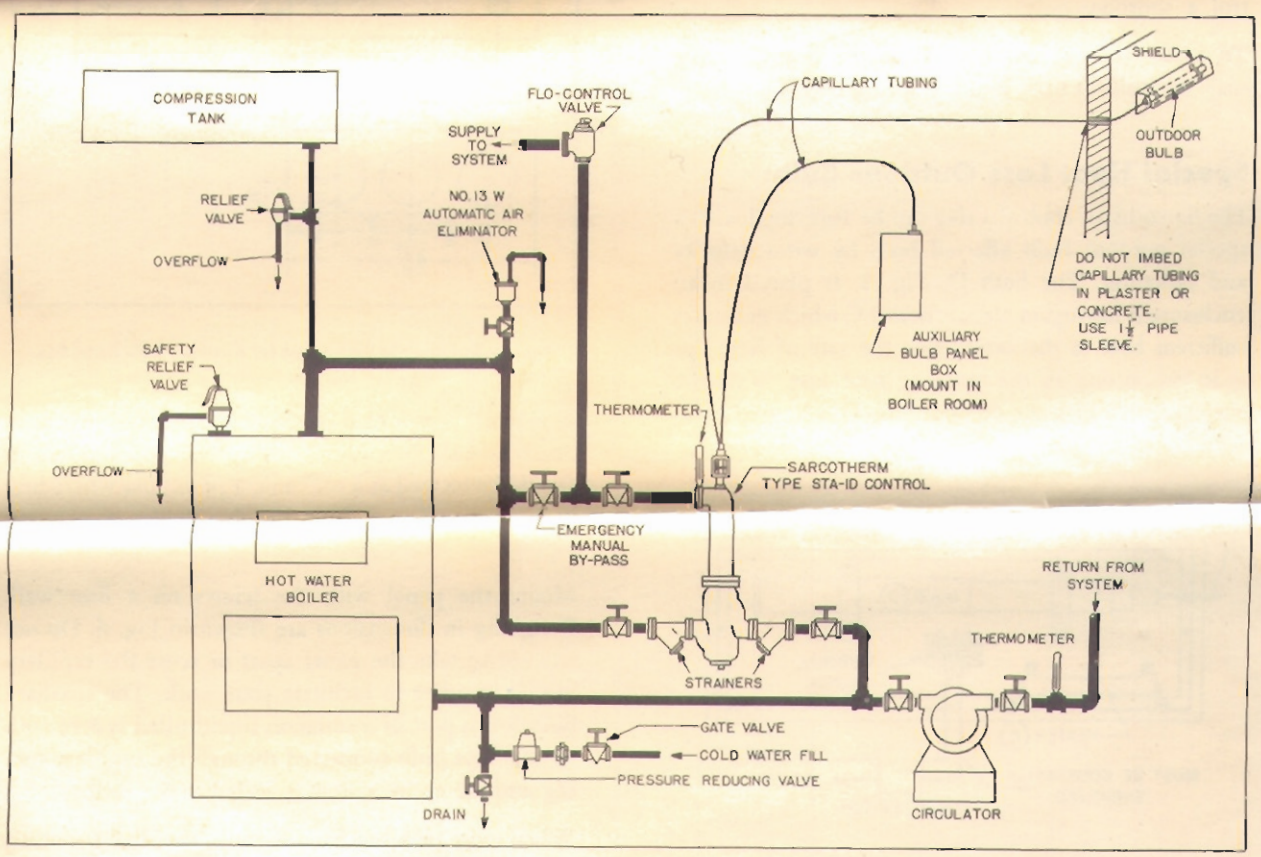

Fig. 4. Hookup of Sarcotherm Control for Low Ceiling.

Outdoor Bulb:

a. A hole should be formed through the outside wall and a piece of 1½" wrought iron pipe inserted to allow easy passage of the outside bulb D, Fig. 2, when installing or replacing the thermostatic system of the control.

b. When installing the outside bulb, pass the bulb D through the 1½" pipe, taking care not to damage or bend too sharply the capillary tubing. DO NOT PERMANENTLY SEAL THE 1½" DIAMETER HOLE, although the space around the capillary tubing may be packed with slag wool or other suitable material which may be easily removed when desired. DO NOT IMBED ANY PART OF THE CAPILLARY IN PLASTER OR CONCRETE. The entire thermostatic system should be accessible for examination or easy removal at any future date.

c. To install the outside bulb, first fasten the composition board to the outside wall with substantial bolts or screws. The location of the board should, if possible, be on the north wall at least 7 feet from the ground level. When the building is zoned, the thermostat for each zone should be mounted on the wall providing the greatest exposure for any particular zone, always taking care not to expose the thermostat to the direct rays of the sun, unless the Sarcotherm is to control a sunroom only.

To secure the outdoor bulb D to the board, simply snap the bulb D back into the spring clips C.

Special Heat Loss Outdoor Bulb:

The Sarcotherm control valve can be furnished with a special outdoor bulb affected both by wind velocity and radiation. The bulb D, Fig. 5, is placed in an enclosure E having an electric heater C which generates sufficient heat to the extent that the rate of heat loss is in proportion to the building heat loss. Since the enclosure in which the outdoor bulb D is housed gains or loses heat in the same manner as the building, the wind velocity and radition activity can be compensated for.

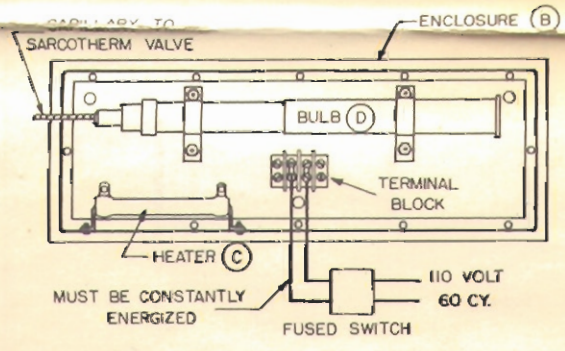

Fig. 5. Special Heat Loss Outdoor Bulb.

To install the special heat loss outdoor bulb remove bulb D from the enclosure, mount the enclosure on the outside wall as indicated above and replace the outdoor bulb D by snapping it back into spring clips.

NOTE: *110v current must be supplied to the electric heater continuously.*

Indoor Auxiliary Bulb Panel Box:

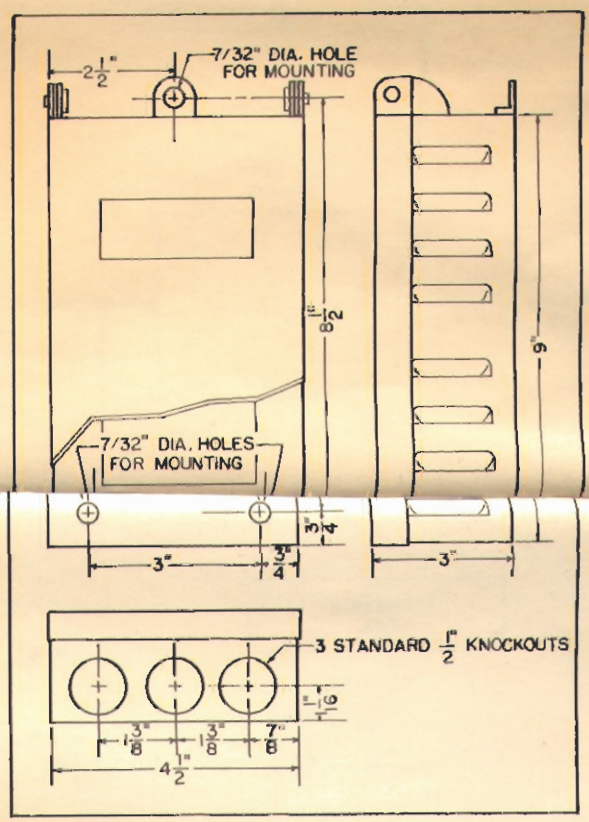

Fig. 6. Roughing In Dimensions for Auxiliary Bulb Panel Box.

This panel is mounted in the boiler room or in a location where the Sarcotherm control valve is installed. It should be located at a convenient point, but where heat is not radiated to it from the flue, boiler or exposed piping.

Mount the panel with the screws on a firm wall. Roughing in dimensions are shown in Fig. 6. Do not attempt to take the panel apart or sever the capillary tubing in order to facilitate your work. The auxiliary bulb forms part of a common liquid filled system with the outdoor bulb connected through the capillary tubing and the entire system is sealed at the factory.

When more than one Sarcotherm is installed tag neatly all panel boxes indicating each zone.

Wiring:

The correct wiring diagram applicable to your installation is included on a separate sheet. Consult it before attempting any wiring.

A schematic diagram of the components in the auxiliary bulb panel box is shown below in Fig. 7. In this drawing circuit D to G includes a variable resistor M for adjustment of the blended water, a full heat switch and the heater element H. This circuit is energized at all times so that the auxiliary bulb is always warm to the touch (unless the full heat switch is in the "Open" position when full heat is required).

Circuit N to G includes a variable resistor P for temperature setback adjustment. It is controlled by the room thermostat and is energized when the thermostat closes on temperature rise generating more heat and depressing the circulating water temperature.

The resistors and heater element require 110v or 220v line voltage depending on specifications. Voltage is stamped on nameplate.

A 5 amp fused switch must be installed in the line to the auxiliary bulb panel box to protect the resistors and heater element.

The boiler temperature control should be independent of the outdoor temperature control system and should not be cross-wired in any manner. It is especially important not to wire the room thermostat to start and stop the burner or stoker.

All electrical wiring must conform to local code.

Electrical rating: 110v AC—0.2 amps
220v AC—0.1 amps

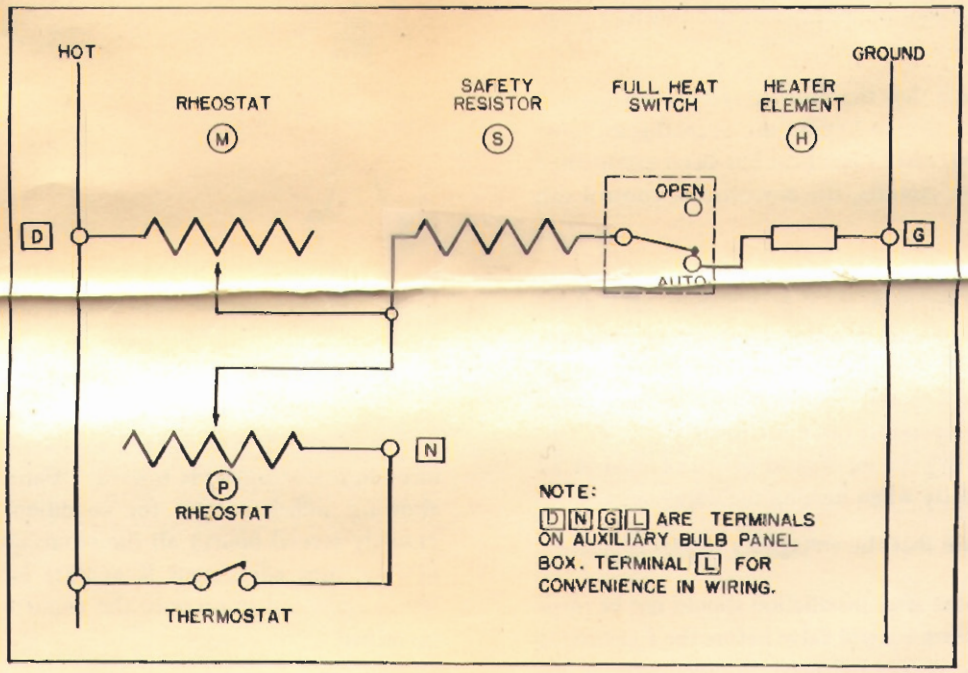

Fig. 7. Circuit Diagram for STA-1 Panel

BEFORE STARTING UP THE HEATING SYSTEM, CHECK OVER THE FOLLOWING POINTS:

1. Are strainers installed on both the hot water and return water connections to the Sarcotherms? If not, they should be installed immediately.

2. Is the capillary tubing so installed that it can be removed at any time without difficulty?

3. Is auxiliary bulb panel box located in a position where it is not affected by radiation or excessive heat?

4. Is the aquastat on boiler (or regulator if a preheater is provided) set for 10°F to 20°F higher than calibration of Sarcotherm control valve?

5. Are room thermostats, Thermorays or other electric controls wired properly according to wiring diagram?

6. Are valves provided for isolating and bypassing the Sarcotherm valve, and is the bypass valve closed with the other three valves wide open?

7. Are automatic air vents provided at all high points on circuit pipes and mains? This is imperative!

8. Have all air taps been tested for the removal of air?

ADJUSTMENT

Before attempting to adjust the Sarcotherm, after installation, the following should be checked very carefully:

a. It is not advisable to adjust the Sarcotherm during mild weather. Outdoor temperatures should be 40°F or below before attempting to make adjustments.

b. Flush all pipe lines to insure that all dirt and foreign material are removed.

c. Clean all strainers thoroughly by removing the screens from the bodies. In a new system it is advisable to flush the lines by pumping water through the strainer with the screen removed. This will often clear a blocked line ahead of the strainer. Make certain to replace the strainer screens.

d. Eliminate all air pockets. If air pockets obstruct circulation, the control system will not function properly.

e. Make certain that the heating system is balanced. It is good practice to bypass the Sarcotherm while doing this and, after even heat has been established in all zones or circuits, the Sarcotherm control can be cut in.

f. The boiler aquastat should be set so as to maintain a boiler water temperature approximately 20°F above the maximum blended water temperature required. For example: If 180°F blended water is required at 0°F, then the aquastat should be set to maintain a boiler water temperature of approximately 200°F. This boiler water temperature should be maintained at all times, particularly when making the adjustment.

g. Make certain that the emergency bypass is closed.

Final adjustment after installation should not be made on the Sarcotherm control valve before the functioning of the heating system has been observed over an extended period with various outside temperatures. This is to give sufficient time for the heat to well saturate the structure. If it is found that inside room temperatures are consistently too low or too high, it is possible to raise or lower the temperature of the blended water to the system by turning the adjustment nut K on top of the Sarcotherm valve towards "Warmer" or "Colder" (see Fig. 8). Follow the procedure below:

1. The circulator must run continuously when making adjustments.

2. Set indoor thermostat to 85°F, allow ten minutes before proceeding and make certain that full heat switch is in "Auto" position (Fig. 9).

3. To raise water temperature turn nut K, Fig. 8, one

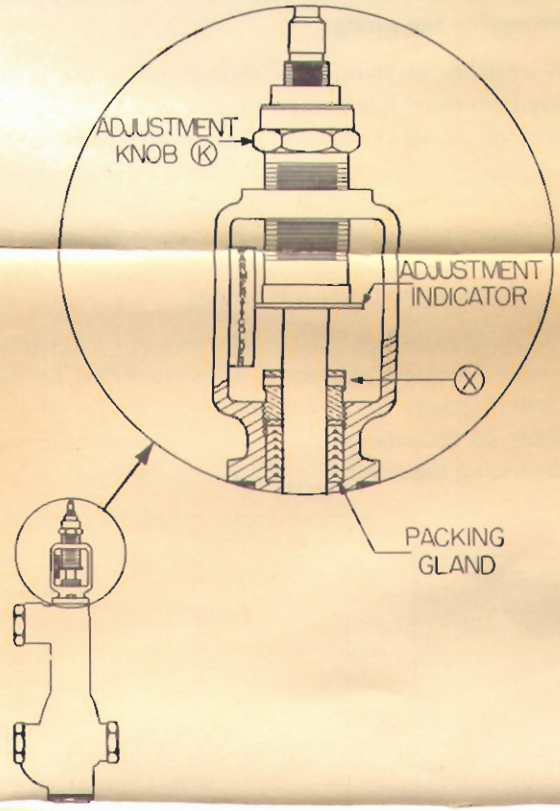

Fig. 8. Adjustment of Sarcotherm.

half turn from left to right. This should raise adjustment indicator upwards toward "Warmer." If, after allowing sufficient time for conditions to stabilize (usually several hours) all the rooms are still underheating, turn adjustment K another half turn from left to right and so on until the required temperature is reached.

Reverse above procedure if it is necessary to lower the water temperature.

Your control is now properly set and should not be disturbed. However, further small adjustments can be made through the blended water temperature adjusting knob on the auxiliary bulb panel box (see A, Fig. 9) as described below.

If no change is observed, after making the above adjustments, it may be assumed that something is wrong with the circulation caused either by airlocks, dirt, or other impediments and it should be checked by the heating contractor.

4. After satisfactory heating is observed, reset the room thermostat to the required setting (usually 70°F).

Blended Water Adjustment:

If, after the initial setting of the Sarcotherm control valve, it is desired to obtain higher or lower water temperatures for any reason, further fine adjustment may be made without manually changing the valve position.

Simply turn the blended water temperature adjusting knob A (Fig. 9) toward "Warmer" or "Colder" as desired. The maximum change will affect the control by about plus or minus 15%. For example. If the Sarcotherm valve is calibrated to deliver 190°F water at the lowest outside design temperature and 90°F at the highest outside temperature, the total range is 100°F. This would mean that 15°F would be the maximum temperature change obtainable with this adjustment toward either "Warmer" or "Colder." Each division on the scale gives about 1/8 of this total change.

NOTE: *Turn room thermostat to its highest setting before changing water temperature.*

Here again, the adjustment should be made in small steps rather than with one setting. If it is found that the dial is at either extreme end after setting, proceed to reset the control manually by means of adjusting the nut K (Fig. 8) and bring pointer back to standard setting at No. 1. After completion of adjustment, set thermostat to its normal position.

The importance of allowing the heating system to regain its equilibrium cannot be emphasized sufficiently. Do not make unnecessary and frequent adjustments.

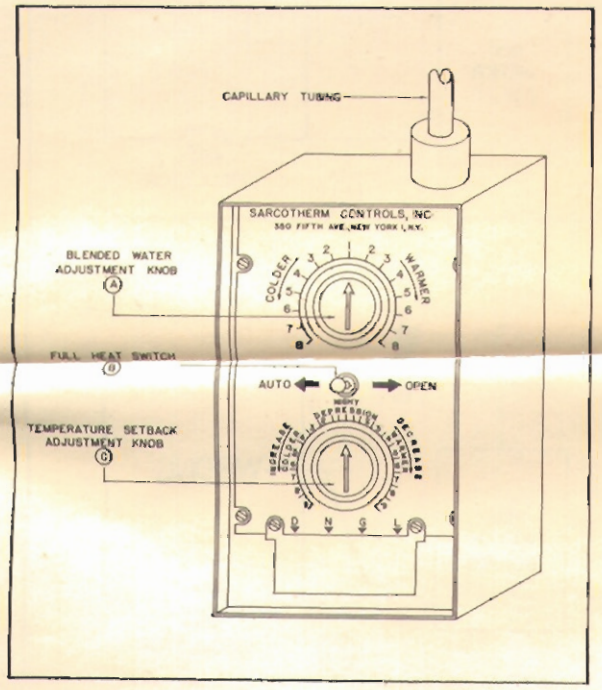

Fig. 9. STA-1 Panel Without Cover.

Temperature Setback Adjustment:

The type STA-1 control is equipped with an auxiliary bulb in the panel box P (Fig. 1) which, when operated by the indoor room control, reduces the delivered heat to the building whenever the room temperature exceeds the indoor thermostat setting. The amount by which the heat delivered is reduced may be reset through the temperature setback adjustment marked "Night Depression" (C, Fig. 9). The procedure is as follows:

1. Turn indoor thermostat to its lowest setting and make certain that circulator is running. If a time switch is used only to give night setback, make certain that switch is in closed position and supplies current to terminal N (Fig. 9).

2. If the amount of temperature depression is not sufficient, *i.e.*, the room does not cool sufficiently, turn the knob toward "Increase-Colder." This will in effect increase the temperature depression and cool the room at a faster rate. If the room cools too rapidly it indicates that temperature depression is too great and the knob should be turned toward "Decrease-Warmer." The maximum range of this adjustment is equivalent to an outdoor temperature change of 30°F and each graduation 1/18 of this value.

3. After completing the adjustment, set thermostat to its original position. (If time switch is used, reset for day or night operation as required.)

Full Heat Switch:

This serves as an *emergency feature only* to provide rapid heat-up should this become necessary. This allows considerably higher water temperature in the system than called for by the outdoor bulb. The control in automatic position should, however, provide sufficient comfort to make this unnecessary.

CAUTION: *In radiant heating systems extreme care should be exercised in the use of the "full heat" switch as great damage can be caused by allowing "full heat" to circulate through the coils embedded in plaster or concrete. A high limit safety aquastat should be placed in the supply line to the radiant coils preventing circulator operation if supply water temperature is excessive.*

To turn system to "full heat" simply turn switch B (Fig. 9) to "Open" position. Remember to return the system to "Auto" at the completion of the rapid heat-up period.

SERVICE SUGGESTIONS

SERVICE SHOULD BE ATTEMPTED ONLY BY A COMPETENT HEATING CONTRACTOR OR SARCOTHERM SERVICE ENGINEER

Blended Water Temperature Too High:

Check to see if manual bypass valves around the controls are closed and if full heat switch B (Fig. 9) is in "Auto" position. If temperature is still high, adjust knob A (Fig. 9) to extreme position toward "Colder." If temperature drops sufficiently it indicates that the Sarcotherm control operates but needs resetting. Proceed to adjust as described on page 8. Reset knob A (Fig. 9) to middle position. If, after adjusting knob A to the extreme cold position no change occurs, set room thermostat to its lowest setting and check wiring by placing a test lamp across terminals D and G and N and G (Fig. 9). In both cases test lamp should light up. If it does not, wiring is incorrect. If it does, and the water temperature still remains the same, test the thermostatic system as described below. Before doing this make certain, however, that the return line strainer is not blocked or the gate valve on the return line is not closed. Note: *If special heat loss outdoor bulb is installed make certain that heater C, Fig. 5, is energized.*

Blended Water Temperature Too Low:

Set room thermostat to its highest setting. If after ten minutes temperature has not changed, adjust knob A (Fig. 9) toward "Warmer" to the extreme position. If the supply water temperature increases, control needs readjusting and proceed as shown on page 8. Do not forget to reset knob A to its middle position. If no appreciable change occurs after adjusting knob A, turn full heat switch B (Fig. 9) to "Open" position (for a short while). There should be a gradual rise in supply water temperature. If this does not occur, the hot water line is blocked or there is an airlock in the system preventing circulation. In any case it is advisable to clean the strainer on the hot water line by removing the strainer screen. Check to see whether a large mesh screen is furnished suitable for water service.

It may be found that while the control system operates satisfactorily in cold weather, only return water is recirculated in mild weather when the outdoor tempera-

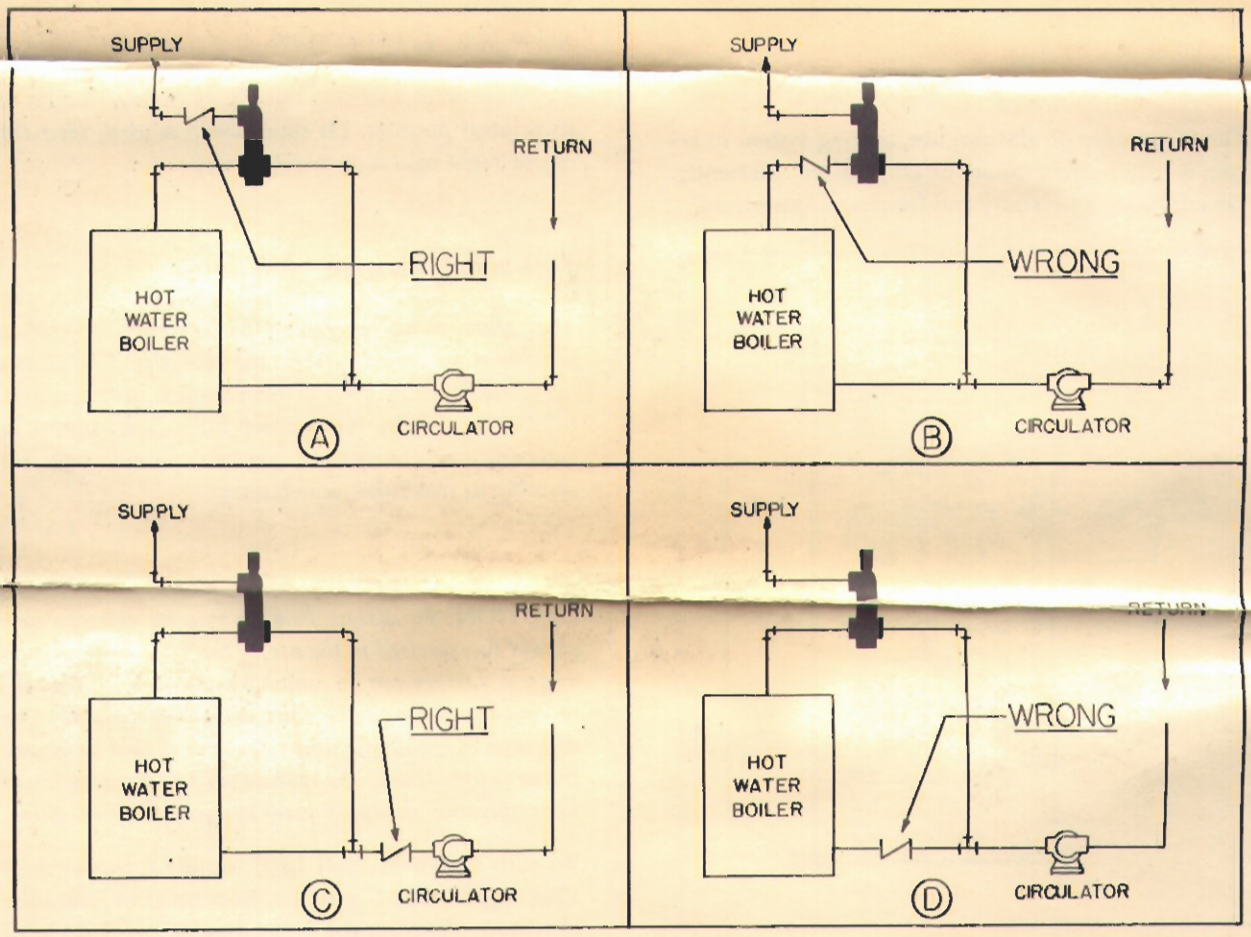

Fig. 10. Flo Control Valve Positions.

ture is around 40°F to 50°F. This might be due to incorrect installation of the flo control valve as shown in Fig. 10. When only a small amount of hot water is required the hot water line is throttled causing the weighted flo control valve to close and consequently only return water will be recirculated. The correct position of the flo control valve is shown in Figs. 10a and 10c.

Blended Water Temperature Fluctuates:

This is caused by the fluctuation of the boiler water supplied to the Sarcotherm valve and can be traced to the boiler operating aquastat having a large (20°F to 30°F) differential. For best results the differential of the boiler aquastat should not exceed 10°F.

Testing the Thermostatic System:

If the blended water temperature leaving the Sarcotherm always approximates the boiler water temperature regardless of outdoor conditions, there is a possibility of thermostatic system failure. In such cases the thermostatic system can be tested as follows:

1. Close all isolating valves around the Sarcotherm.

2. Remove two bolts A, Fig. 11, and lift entire inside thermostatic element T out of valve body.

3. Press piston U against palm of hand. If, after reasonable pressure is applied by hand, the piston U cannot be moved the thermostatic system is "alive" and should function properly. Trouble is caused by other factors.

If piston U moves freely, after pressure is applied, indications are that the thermostatic system may have failed, but to make certain, withdraw the outdoor bulb and immerse it alternately first in ice water then in hot water for a few minutes at a time. If piston U fails to move an appreciable amount (¼"), the system can be assumed to be "dead." Notify Sarcotherm Controls, Inc. immediately.

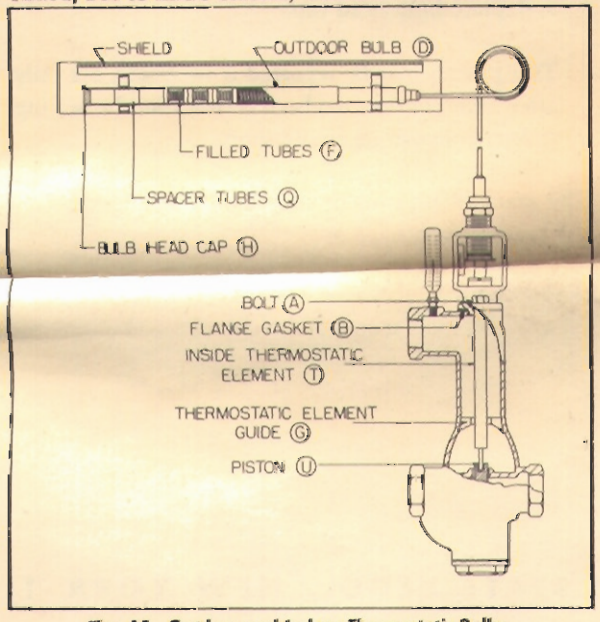

Fig. 11. Outdoor and Indoor Thermostatic Bulbs.

If trouble cannot be corrected following these instructions, write to Service Department, Sarcotherm Controls, Inc., 350 Fifth Avenue, New York 1, New York, *giving all particulars.*

Removing and Replacing Thermostatic System:

1. Close all isolating valves around Sarcotherm.

2. Remove two bolts A holding flange of yoke to body (see Fig. 11).

3. Withdraw thermostatic element T vertically from body.

4. Remove outdoor bulb D from spring clip C and withdraw it through hole formed in wall.

5. To replace thermostatic system, first replace flange gasket B with new gasket received with replacement thermostatic system.

6. Insert thermostat bulb T into opening of body in a vertical position as shown in Fig. 11.

CAUTION: When inserting thermostat be sure that the end of the thermostat enters the guide at G. If the thermostat is entered in a vertical position and in the center of the opening, the bulb will enter into the guide G very easily without applying any pressure. However, when the flange of the yoke is close to the body flange, a slight pressure must be applied to make the flanges meet as the spring tension of the head return spring must be compressed slightly.

7. Screw the two bolts A in place and tighten down with suitable wrench.

8. Remount outdoor bulb D.

9. Open all isolating valves but make certain that bypass is closed.

10. Return defective thermostatic system to Sarcotherm Manufacturing Corporation, Clewell and Itaska Streets, Bethlehem, Pennsylvania and advise Sarcotherm Controls, Inc., 350 Fifth Avenue, New York 1, New York.

Tightening Packing Gland:

At times a small amount of water might leak through the packing gland. This can be stopped by tightening the packing gland. Insert a piece of 3/16" drill rod at X, Fig. 8, and slowly turn clockwise. DO NOT TIGHTEN TOO MUCH TO AVOID DISINTEGRATION OF PACKING GLAND.

Gradient Adjustment of Calibration Curve:

The adjustment described on page 8 lowers or raises the entire calibration range as shown in Fig. 12. In almost every case this is sufficient to provide proper field adjustment. It may occasionally be necessary to change the slope of the calibration curve (see Fig. 12) to meet special field conditions. Usually one of the following two conditions exists:

a. Blended water too high in cold weather but satisfactory in mild weather.

b. Blended water too low in cold weather but satisfactory in mild weather.

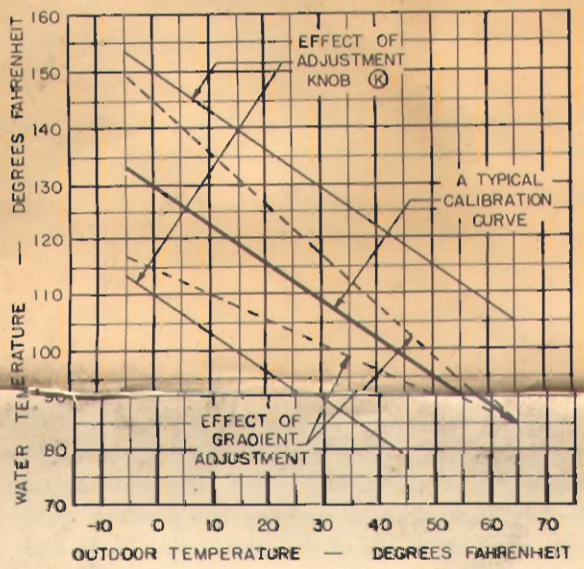

Fig. 12. Effect of Gradient Adjustment.

Changing the slope of the calibration curve requires the addition or removal of thermostatic oil from the system which is accomplished by adding or removing a number of filled tubes F, Fig. 11, from the outdoor bulb D. The outdoor bulb is so constructed that it usually contains three oil-filled tubes F which are flexible and three spacer tubes Q which are rigid.

The effect of the addition or removal of a single filled tube F on the calibration curve varies with the range of the calibration curve but it is approximately 5°F to 8°F at the coldest outdoor temperature.

Follow the procedure below BUT KEEP IN MIND THAT THIS ADJUSTMENT SHOULD ONLY BE MADE AFTER THE HEATING SYSTEM HAS BEEN OBSERVED FOR AN EXTENDED PERIOD (PREFERABLY A FULL HEATING SEASON) UNDER ALL OUTDOOR CONDITIONS:

a. To Raise Blended Water Temperature in Cold Weather *ONLY*:

1. Withdraw outdoor bulb D and place in ice water for a few minutes.
2. Unscrew bulb head cap H, Fig. 11.
3. Remove all spacer tubes Q.
4. Add one filled tube to replace one spacer tube.
5. Replace bulb head cap.

This process may be repeated if necessary, but only after sufficient time has been allowed for the heating system to regain its equilibrium.

b. To Lower Blended Water Temperature in Cold Weather *ONLY*:

1. Withdraw outdoor bulb and place in ice water for a few minutes.
2. Unscrew bulb head cap H, Fig. 11.
3. Remove all spacer tubes Q and *one* filled tube F.
4. Replace all spacer tubes plus one additional
5. Replace bulb head cap.

This process may be repeated if necessary, but only after sufficient time has been allowed for the heating system to regain its equilibrium.

The gradient adjustment should only be attempted by the heating contractor or Sarcotherm service engineer. Filled tubes and spacer tubes are available from Sarcotherm Controls, Inc., 350 Fifth Avenue, New York 1, New York upon request.

SARCOTHERM CONTROLS, INC., EMPIRE STATE BLDG., NEW YORK 1, N. Y.

Branches in Principal Cities—Factory in Bethlehem, Pa.
Sarco Canada, Ltd., 611 Gerrard St. E., Toronto 5, Ontario

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5M-April 1955