June 6, 1944. W. C. SCHEU 2,350,830

DRAFT REGULATOR FOR ORCHARD HEATERS

Filed Nov. 1, 1940 2 Sheets-Sheet 1

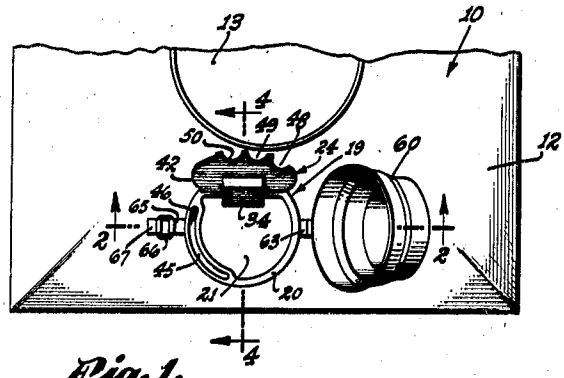


Fig. 1.

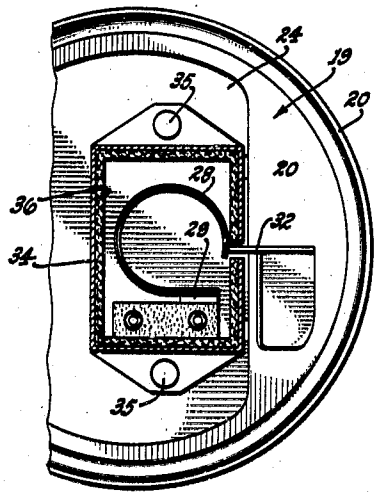


Fig. 5.

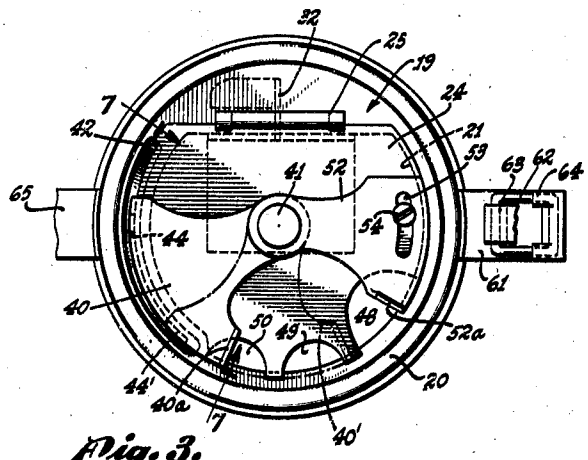


Fig. 3.

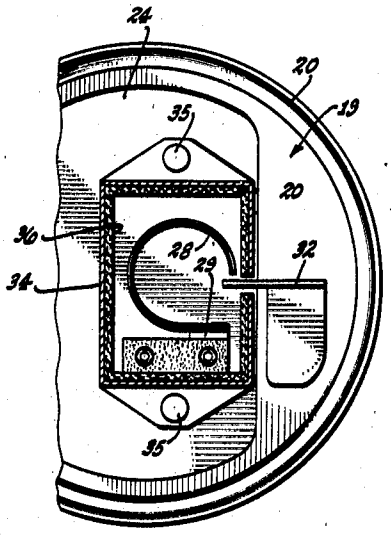


Fig. 6.

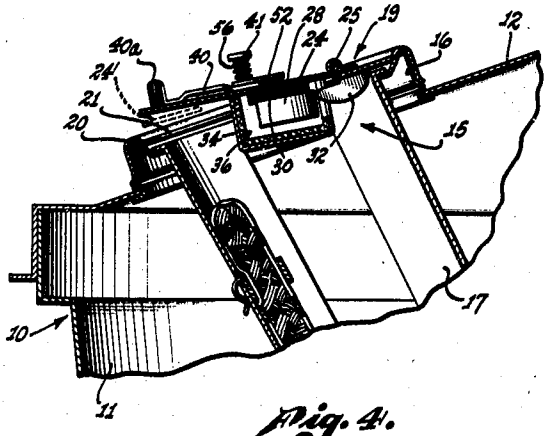


Fig. 4.

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DRAFT REGULATOR FOR ORCHARD HEATERS

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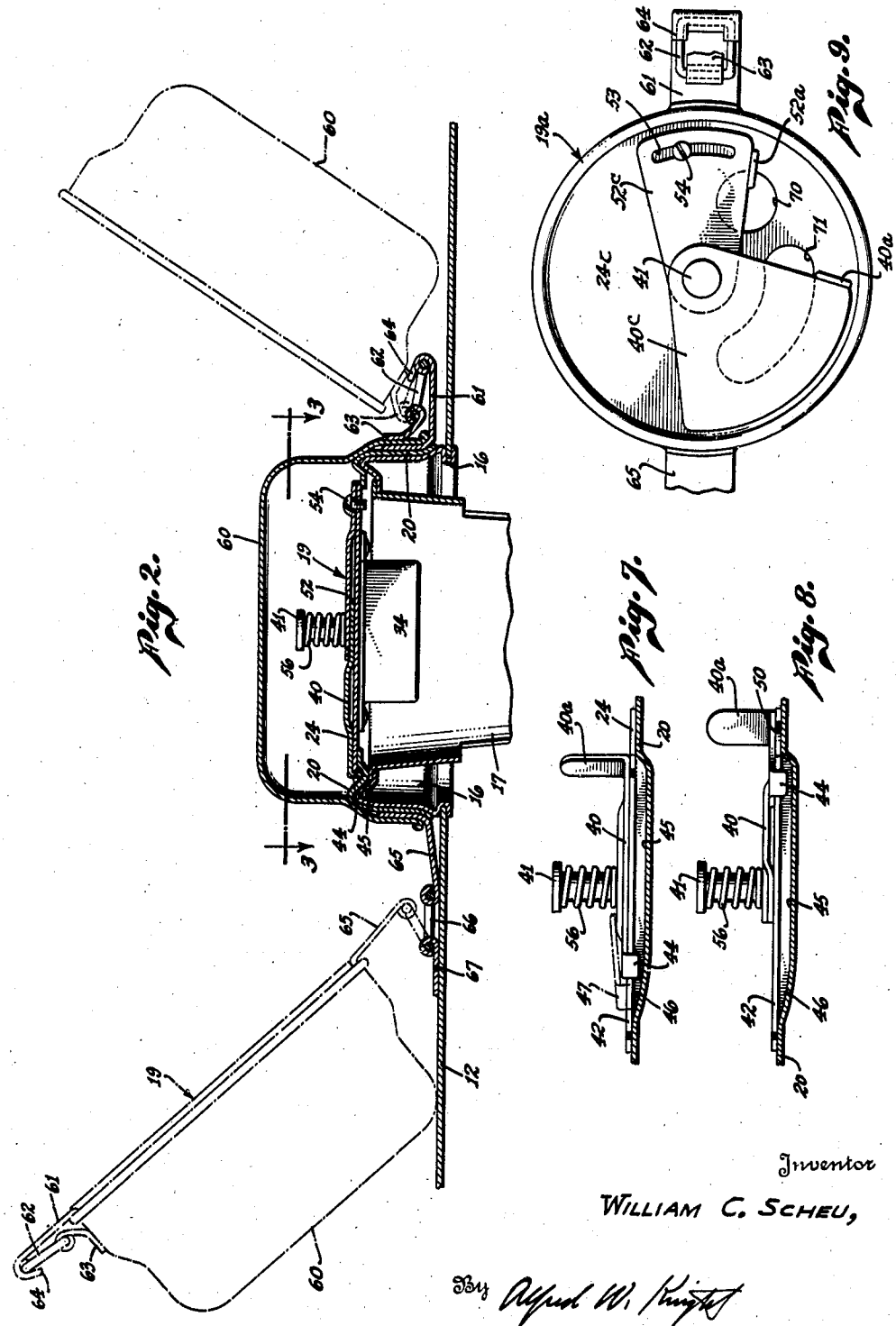


Fig. 2.

Fig. 9.

Fig. 7.

Fig. 8.

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DRAFT REGULATOR FOR ORCHARD HEATERS

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Application November 1, 1940, Serial No. 363,877

5 Claims. (Cl. 158—91)

This invention relates to draft regulators for orchard heaters, and relates particularly to devices for establishing a controlled influx of combustion air to the fuel vaporizing chamber of the heater for continued burning operation thereof following the starting or ignition period of the heater.

The draft regulating device of this invention is particularly suited to automatic, heat-responsive regulators used with vaporizing type, liquid fuel orchard heaters; but the invention is not necessarily limited thereto since it may be employed on heaters using other types of fuel and in connection with manually operated draft regulators as well as with automatic regulators. In heaters of the liquid fuel vaporizing type, a vaporizing flame is maintained at or near the surface of the fuel contained in the heater in order to cause vaporization from the surface of the fuel. The fuel vapors pass upwardly, along with some air, into a stack where additional air is mixed with them to cause substantially complete combustion of the vapors in a main flame at a point removed from the vaporizing flame. A heater of this general type provided with a stack forming the main combustion chamber is shown in my U. S. Patent No. 1,930,863, issued October 17, 1933.

Orchard heaters are usually provided with one or more relatively large air admitting openings in the body to admit air to the vaporizing flame, not only to keep that flame burning but also to help maintain the main flame. With such an arrangement, it is preferable to supply a relatively large quantity of air to the vaporizing chamber for the vaporizing flames when the heater is first ignited and until the vaporizing chamber has become heated. After the vaporizing chamber is well heated and the main combustion flame well established, a smaller amount of heat from the vaporizing flame is required to vaporize the fuel; and if the air supply is not reduced to diminish the flame, there will be a tendency to vaporize an excessive amount of fuel. These relations all depend on the heat generated in the vaporizing chamber and are substantially independent of the temperatures existing where the main combustion takes place in the stack.

In order to obtain proper and satisfactory operation of an orchard heater of this character during the period of normal burning, it is necessary to restrict the flow of air into the vaporizing chamber after the period of initial heating. Restriction of the air flow may be done manually or by automatic heat-responsive means. In either case, it is desirable to provide draft regulating means adequate to obtain the proper flow of air required to maintain the desired rate of combustion in the heater. This is particularly important when the heater is operating with a minimum flame.

When making draft regulating devices for orchard heaters it is highly desirable from a manufacturing standpoint to standardize on one construction which is as simple as possible. At the same time, these regulating devices may be applied to many different kinds and styles of heaters burning different fuels. Under these widely varying conditions which are encountered in actual operation, different amounts of air are required to maintain a given rate of combustion in the heater, that is to generate a given amount of heat. However, this condition is not critical except when it is desired to maintain the lowest possible flame in a heater, since if the air admitted is in excess of the minimum required, fuel is wasted, and if the air admitted is less than the minimum required, the fire dies out.

It has been found that the best results are obtained from a regulator which can be adjusted to admit the minimum amount of air proper for the conditions under which each heater operates. In this way the proper minimum air opening can be adjusted by the operator for his particular heater, and the regulation is not left to unskilled labor ordinarily not competent to properly adjust the heaters. In this way loss either from fuel wastage or inadequate heating is avoided.

It is therefore the principal object of my invention to provide a draft regulating device for orchard heaters which is operable to provide a comparatively unrestricted flow of air into the vaporizing chamber during the preliminary ignition period, and subsequently to restrict admission of air to the vaporizing chamber during the burning period, but which can originally be set to admit air to the vaporizing chamber during the burning period at not less than a predetermined minimum rate.

It is also an object of my invention to provide in a regulator of the above type, means for adjusting the minimum amount of air admitted to suit any conditions encountered, and for maintaining the adjustment constant after once determined.

Another object of my invention is to provide in a regulator of the above type means for establishing a constant minimum flow of air past the regulator, independently of means for adjusting

the regulator to admit air at varying greater rates.

Another object is to provide a simplified heat-responsive draft regulator which may be standardized for manufacturing purposes and which at the same time provides the necessary flexibility of operation to permit its use with many different kinds of heaters and fuels.

Another object of my invention is to provide, in combination with a pivotally mounted draft-regulating plate and heat-responsive means for releasing the plate to effect air restriction, means to regulate air restriction by first cooperating with apertures in the plate and subsequently by positioning the plate.

These objects of my invention have been attained by providing, for an orchard heater having an air-admitting opening, a draft regulating device which comprises a draft regulating cap which is mounted on the heater and provided with aperture means admitting air to the opening in the heater, and adjustable closure means mounted on the cap and associated with the aperture means therein to vary the open areas of separate portions of the aperture means to admit to the heater during the burning operation a selected minimum amount of air or a selected larger amount.

In a preferred form of my invention the draft regulating cap comprises an annular body with an air-admitting opening and a draft regulating plate pivotally mounted adjacent the opening; but in a simplified form the body and plate may be made integrally.

How the above objects and advantages of my invention, as well as others not specifically mentioned, are obtained will be more readily apparent from the following description and the annexed drawings, in which:

Fig. 1 is a fragmentary plan view of a typical orchard heater, showing a draft-regulator constructed in accord with my invention applied thereto;

Fig. 2 is an enlarged vertical section on line 2—2 of Fig. 1, showing alternate positions of the weather cap and the whole regulator in dot-dash lines;

Fig. 3 is a plan view of the regulator with the weather cap open and the draft-regulating plate in full air-restricting position;

Fig. 4 is a fragmentary vertical section on line 4—4 of Fig. 1 with the regulating plate in position to impose comparatively no restriction on air admission;

Figs. 5 and 6 are inverted plan views of the thermostatic means for controlling operation of the plate, Fig. 5 showing the position of the thermostatic element when cold and Fig. 6 showing the position of the element when heated;

Figs. 7 and 8 are fragmentary sections taken along the rim of the draft regulating plate as indicated by line 7—7 in Fig. 3; and

Fig. 9 is a plan view, similar to Fig. 3, of a simplified form of my invention.

There is generally indicated at 10 in Fig. 1 a portion of a common type of vaporizing liquid fuel orchard heater. As shown in Fig. 4, the heater comprises a bowl 11 which provides a base for supporting the upper structure and also provides a fuel reservoir, the space within bowl 11 and above the fuel body being a fuel vaporizing chamber. Bowl 11 is provided with cover 12 on which there is a flanged central opening 13 at which a suitable stack, not shown, is mounted.

Cover 12 is provided with an air-admitting opening 15 around the margin of which is an upstanding flange or collar 16 which is attached at its lower edge to cover 12. Collar 16 is preferably circular in shape and has a depressed central portion which forms a mounting means for a draft tube 17 which is preferably provided to facilitate maintenance of a vaporizing flame above the fuel body. The upper end of the draft tube 17 is provided with an outwardly extending flange which engages the upper surface of collar 16 and is supported thereby. The upper end of draft tube 17 is open for the admission of air; and the open upper end of the draft tube determines the net size of air-admitting opening 15 in the heater.

The draft regulator includes a draft regulating cap, indicated generally at 19, which comprises an annular cap-like body 20 and a draft regulating plate 24 movably mounted on the body which fits snugly down around collar 16. The central portion of body 20 is cut away to provide an air-admitting opening 21 which is above and approximately the same size as the open upper end of draft tube 17. In this way air going through opening 21 in the regulator body enters the heater through opening 15 in the latter. Draft regulating plate 24 is pivotally mounted at 25 adjacent one edge of air-admitting opening 21, in which position the plate is movable about pivot 25 to regulate the passage of air through both openings 15 and 21. Plate 24 is slightly larger in over-all dimensions than opening 21 in order to engage the upper side of body 20 when lowered as in Fig. 3.

On the under side of plate 24 is mounted thermostatic control means which comprises a coiled bimetallic strip 28 attached in any suitable manner at one end to bracket 29, as shown particularly in Figs. 5 and 6. Bracket 29 is attached to plate 24 in any suitable manner, as by bolts or rivets, and is preferably insulated from direct engagement with the plate by a layer of heat insulating material 30 between the plate and bracket, as best shown in Fig. 4, in order to retard heat transfer to the bimetallic element. Bimetal element 28 curves through almost a complete circle when cool, and occupies the position shown in Fig. 5. In this position, it is engaged by the end of a holding member in the form of curved arm 32 which is attached to the under side of body 20. Arm 32 projects downwardly from the body to a position in which the end of the arm engages one side of bimetal strip 28. Engagement of arm 40 with the bimetal element in the manner shown in Figs. 4 and 5 holds draft regulating plate 24 in the first or raised position, illustrated in Fig. 4. In this first position, air can pass between plate 24 and regulator body 20 relatively freely and enter the heater through openings 21 and 15. In this first position, sufficient air to maintain the maximum rate of combustion can enter the heater, and therefore air admission may be said to be comparatively unrestricted. It will be noted that in this first position, plate 24 is biased by gravity towards a lowered position in which the plate restricts the passage of air through opening 21 in a varying degree, according to the amount of movement of plate 24, as will be further described.

Bimetal element 28 is enclosed within a rectangular housing 34 attached to the under side of plate 24 by bolts or rivets at 35. The inside of housing 34 is preferably lined with heat insulating material 36, such as asbestos, to retard the flow of heat to bimetallic element 28. The hous-

ing and insulation are slotted at one side to permit arm 32 to pass through them and into engagement with strip 28.

In response to heat generated within the heater, bimetallic element 28 straightens somewhat and reaches a position illustrated in Fig. 6, in which arm 32 no longer engages element 28. As the end of the bimetal element slips past arm 32, draft regulating plate 24 is released and permitted to fall under the force of gravity to a second or air restricting position in which the passage of air to the heater interior is restricted to a greater or lesser degree. In the extreme lowered position, the rim of plate 24 engages the flat portion of body 20 around air opening 21, and is in the position of maximum restriction.

However, under some circumstances it may be desired that plate 24 not be allowed to reach this extreme lowered position, but that its downward movement be limited to a position in which it restricts the passage of air to a lesser degree and permits the entry of sufficient air to maintain normal burning operations at a moderate flame. In order to limit the downward movement of the plate some type of limiting means may be employed; and I prefer in this form of my invention to combine that limiting means with adjustable closure member 40 which is preferably a plate-like member movably mounted on the upper surface of regulating plate 24, as by means of pivot 41.

As may be seen in Fig. 3, the edge of draft regulating plate 24 is notched at 42 for a portion of its length, and the edge of adjusting member 40 is provided with a depending projection 44, shown in Fig. 7, which is slidable along the length of notch 42. The upper surface of body 20 is provided with an elongated arcuate depression 45 (see Fig. 1) in which projection 44 moves. The end of depression 45 nearer pivot 25 has an inclined surface at 46. When projection 44 is in the main portion of depression 45, plate 24 can drop into engagement with body 20, as shown in Fig. 8. But when adjusting member 40 is rotated clockwise as viewed in Fig. 3 until projection 44 is over the incline 46 as shown in dot-dash lines at 47, engagement of the projection with the incline prevents the regulating plate from coming into contact with body 20 around its margin. When so held up as shown in dotted line position 24' of Fig. 4, the regulating plate is in its second, or air restricting position, and admits air to opening 21 through the space between the plate and body 20. The amount of air so admitted is regulated by the position along incline 46 at which projection 44 engages the incline.

Regulating plate 24 is provided with aperture means admitting air to the heater. Typically, this means may be a pluraiity of air-admitting apertures, as indicated at 48, 49 and 50. These apertures may be holes in the plate completely surrounded by a portion of the plate, but they are preferably notches or indentations in the rim of the plate as shown in Fig. 3. Likewise the aperture means may be but a single opening, though two or more spaced apertures are preferred. Accordingly, in the drawings the aperture means is shown as divided into two spaced aperture means, each of which may comprise but a single aperture or more than one aperture, as shown.

One aperture means is aperture 48. Associated with aperture 48 is adjustable closure member 52 which is rotatably mounted on plate 24 by pivot pin 41, and is in sliding engagement with the upper surface of the plate to vary the open area of aperture 48 by covering as much of aperture 48 as may be desired. Closure member 52 is slotted at 53 and screw 54 passes through this slot. Screw 54 operates as lock means which, when loosened, permits member 52 to be moved into any desired position to cover a selected portion of aperture 48, and when tightened locks the adjusting member in the selected position. Fig. 3 shows adjusting member 52 locked in position to cover approximately one-half of aperture 48.

Apertures 49 and 50 constitute a second aperture means; and associated with them is adjustable closure member 40, so located that when the closure member is moved counterclockwise to the extreme position 40' shown by the dotted lines in Fig. 3, both these apertures are covered by the solid plate-like portion of the adjusting member, thus preventing passage of air through apertures 49 and 50. Such counterclockwise movement of closure member 40 is limited by engagement of projection 44 with stop means comprising the forward end of notch 42 as shown in Fig. 8 and at 44' in Fig. 3. As previously explained, when adjusting member 40 is in this position, plate 24 can be lowered to engage body 20 around the rim of the plate. Since apertures 49 and 50 are closed by member 40, the only air which can enter the air admitting opening 21 is that air which enters through the uncovered area of aperture 48.

Closure members 40 and 52 are provided with upturned tabs 40*a* and 52*a* respectively by which the members may be grasped to move them. Also, spring 56 is placed on pin 41 to press the members against plate 24 to afford frictional resistance to accidental displacement.

With all of one aperture means (apertures 49 and 50) closed by the member 40, and a portion of the other aperture means (aperture 48) closed by the member 42 as shown in Fig. 3, the minimum amount of air which can enter the heater during burning is determined by the size of the open area of aperture 48. The size of this open area can be varied as desired by movement of the closure means and when the closure member is in its selected position it can be locked there by screw 54. This minimum area is set to maintain the minimum flame in the heater under any given set of conditions.

When a higher flame in the heater is desired and it is necessary to admit more air than the minimum as determined in this way, closure member 40 is rotated clockwise from the dotted line position of Fig. 3, thus progressively increasing the open area of the aperture means formed by aperture 49 and aperture 50. In this way, the open area of the second aperture means is varied to admit additional air above the minimum amount in order to maintain a higher rate of combustion during the burning operation, and the range of adjustment in this manner depends upon the total area of the aperture or apertures which can be uncovered by movement of closure member 40.

The relation of the parts is such that after aperture 50 has been fully uncovered, projection 44 on the closure member comes into engagement with incline 46 on body 20, with the result that additional movement of member 40 in the same direction causes engagement of the projection with the incline at some selected point along the length of the incline. As mentioned previously, this engagement limits the downward pivotal movement of draft regulating plate 24 to

stop the plate in a second or air restricting position at some point (see 24' in Fig. 4) short of engagement with body 20 around the margin of the plate. Thus there is left a gap between the plate and the body through which air also may enter opening 21 in order to maintain combustion at a still higher rate. By this last adjustment, the burning rate may be raised as far as desired up to the maximum for that heater.

The regulator is provided with weather cap 60 which is designed to cover draft regulating cap 19, as shown in full lines in Fig. 2. The weather cap fits snugly down around body 20 in order to exclude dust or rain from the regulator and from the heater. Weather cap 60 is mounted on the body of the draft regulating cap by means of a hinge located at one side of body 20. The hinge comprises a bent strap 61 which is attached at one end to the side of body 20 in some suitable manner, preferably by welding. The outer end of the horizontally extending portion of strap 61 is formed with a loop to receive one side of rectangular hinge link 62, the other side of the link being received in a loop of a second strap 63 which is suitably attached to the weather cap, preferably by welding.

As may be seen in Fig. 3, the loop portion of hinge strap 61 which receives link 62 is provided with a pair of stop shoulders 64 against which the two upwardly extending sides of link 62 strike when the weather cap is pivoted about the hinge to the open position shown in dot-dash lines at the right hand side of Fig. 2. Engagement of the hinge link with shoulders 64 stops the swinging motion of the weather cap short of engagement with cover 12 of the heater, as shown. It is preferred that the weather cap not be permitted to come in contact with the heater cover since if it does, the point of engagement forms a fulcrum about which the entire regulator may swing, and an accidental blow against the upper rim of the weather cap tends to dislodge body 20 from its position around body 16. This is avoided by the hinge construction shown since in the extreme open position of the weather cap, it does not contact the heater cover.

The entire regulator assembly, comprising the draft regulating cap and the weather cap, is attached to the heater cover by a second similar hinge. The second hinge is attached to body 20 at a point preferably diametrically opposite, or nearly so, to the point of attachment of the first hinge just described. This second hinge comprises strap 65 attached at one end to body 20 and provided with a loop at the other end to receive hinge link 66, the opposite side of the link being received in a second strap 67 which is attached to cover 12 of the heater. The entire regulator may thus be lifted from collar 16 and swing to the left about the second hinge to the position shown by the dot-dash lines at the left hand side of Fig. 2. In this way collar 16 is exposed to permit refueling the heater and inspection or replacement of draft tube 17. This construction has the advantage that a continuation of the motion which places the regulator over collar 16 on the heater, operates to remove the weather cap from the draft regulating cap, thus leaving the weather cap in the open position as illustrated at the right hand side of Fig. 2. In this position the draft regulating cap is uncovered in order to admit air to the heater and also so that draft regulating plate 24 may be swung back to the position shown in Fig. 1 to allow the insertion of the tip of a lighting torch through opening 21.

Although I have described a preferred form of my invention which includes thermostatic means for releasing a gravity biased regulating plate, thus permitting the plate to drop to an air restricting position at which air is admitted at a predetermined rate to maintain combustion at a desired rate, it is to be understood that my invention is not limited to the inclusion in the regulator of such thermostatic means. Bimetallic element 28, its housing, and holding member 32 may be omitted and the draft plate manually swung from an open position during the original ignition period to its air restricting position which is maintained during normal burning. This change does not, however, effect the operation of the adjustable closure members 40 and 52 or the function and operation of projection 44 in varying the area of the openings through which air is admitted to the heater.

A still further simplification of my invention may be made if desired, by making the draft regulating plate fixed instead of pivoted. In this event, the draft regulating plate and the body of the draft regulating cap may be made integrally in one piece and I show a regulator of this construction in Fig. 9. In the simplified embodiment of my invention, draft regulating cap 19a is shaped the same as body 20 of the form previously described with the top surface of the body not cut away but having a plate portion 24c which operates as the draft regulating plate. This plate portion of the draft regulating cap is provided with two spaced aperture means at 70 and 71 with which are associated respectively adjustable closure members 52c and 40c. These closure members operate to vary the open area of the associated aperture means in the same manner as previously described. The draft regulating cap is provided with a weather cap 60, and the entire regulator is mounted on the heater in the same manner as previously described.

Having described various embodiments of my invention, it is to be understood that there may be made various changes in the shape, location and arrangement of the several parts of my improved regulator without departing from the spirit and scope of my invention; and consequently it is to be understood that the foregoing description is to be construed as illustrative of rather than limitative upon the appended claims.

I claim:

1. In an orchard heater draft regulator, in combination with a cap provided with air-admitting aperture means, a device for regulating admission of air through said aperture means comprising: a first adjustable closure member movably mounted on the cap and movable to selected positions over a portion of the aperture means to vary the open area of the aperture means in said portion; means holding the first closure member in a selected position; and a second adjustable closure member movably mounted on the cap and movable over another portion of the aperture means to vary the open area of the aperture means in said other portion.

2. In an orchard heater draft regulator, in combination with a cap provided with air-admitting aperture means, a device for regulating admission of air through said aperture means, as set forth in claim 1, and comprising in addition stop means associated with the second closure member to prevent movement of the second clo-

sure member over the first mentioned portion of the aperture means.

3. In an orchard heater draft regulator, in combination with a cap provided with two spaced air-admitting aperture means, a device for regulating admission of air through said aperture means comprising: a first adjustable closure member movably mounted on the cap and movable to selected positions over one of said aperture means to vary the open area of that aperture means; means holding the first closure member in a selected position; and a second adjustable closure member movably mounted on a cap and movable over the other of said aperture means to vary the open area of the other aperture means.

4. In an orchard heater draft regulator, in combination with a body member provided with an air-admitting opening, a device for regulating admission of air through said opening comprising: a draft regulating plate pivotally mounted on the body member adjacent said opening and movable to restrict in varying degrees passage of air through said opening, the plate providing air-admitting aperture means communicating with said opening; and an adjustable closure member movably mounted on the plate in sliding engagement therewith and having a depending projection, movement of the closure member in one direction progressively uncovering the aperture means to admit more air therethrough and additional movement of the closure member in the same direction bringing the projection into engagement with the body member and limiting pivotal movement of the regulating plate toward a position of maximum air restriction to limit the restriction imposed by the plate on air passing through the air-admitting opening.

5. In an orchard heater draft regulator, in combination with a body member provided with an air-admitting opening, a device for regulating admission of air through said opening comprising: a draft regulating plate pivotally mounted on the body member adjacent said opening and movable to restrict in varying degrees passage of air through said opening, the plate providing two spaced air-admitting aperture means communicating with said opening; a first adjustable closure member movably mounted on the plate and adjustable to selected positions to vary the open area of one of said aperture means; lock means holding the first closure member in a selected position; and a second adjustable closure member movably mounted on the plate, movement of the second adjusting member in one direction progressively uncovering the other aperture means to admit more air therethrough and additional movement of the second member in the same direction limiting pivotal movement of the regulating plate toward a position of maximum air restriction to limit the restriction imposed by the plate on air passing through the air-admitting opening.

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