Sept. 1, 1942. B. W. TULLIS 2,294,615

SELF-HEATING FLAT-IRON

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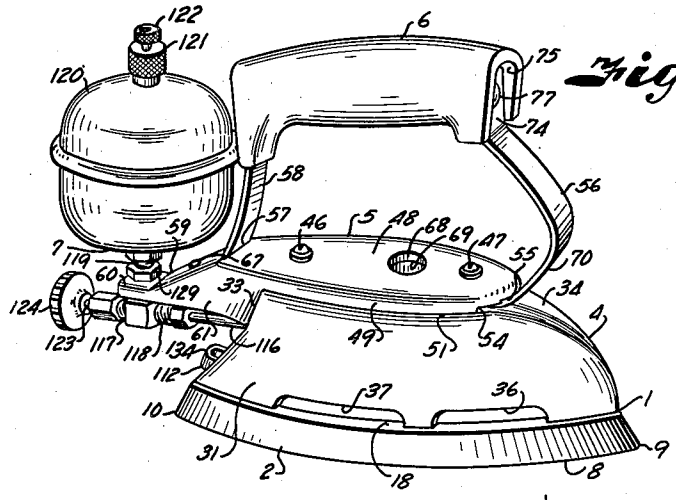

Fig. 1.

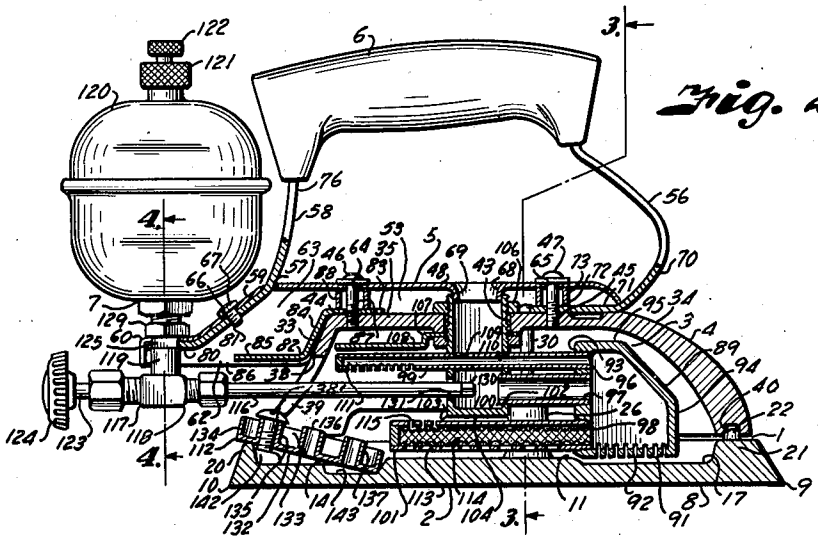

Fig. 2.

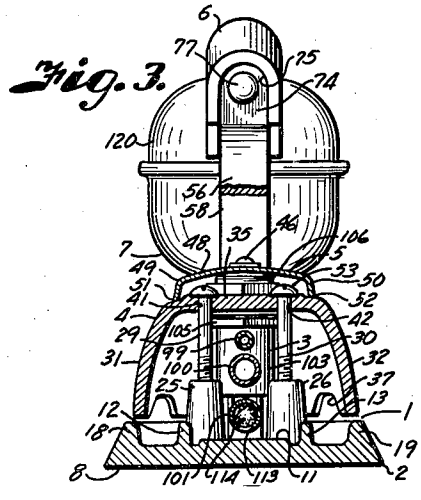

Fig. 3.

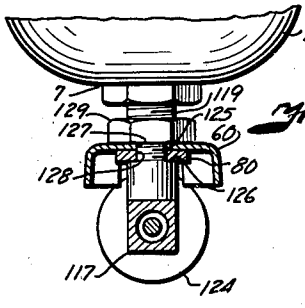

Fig. 4.

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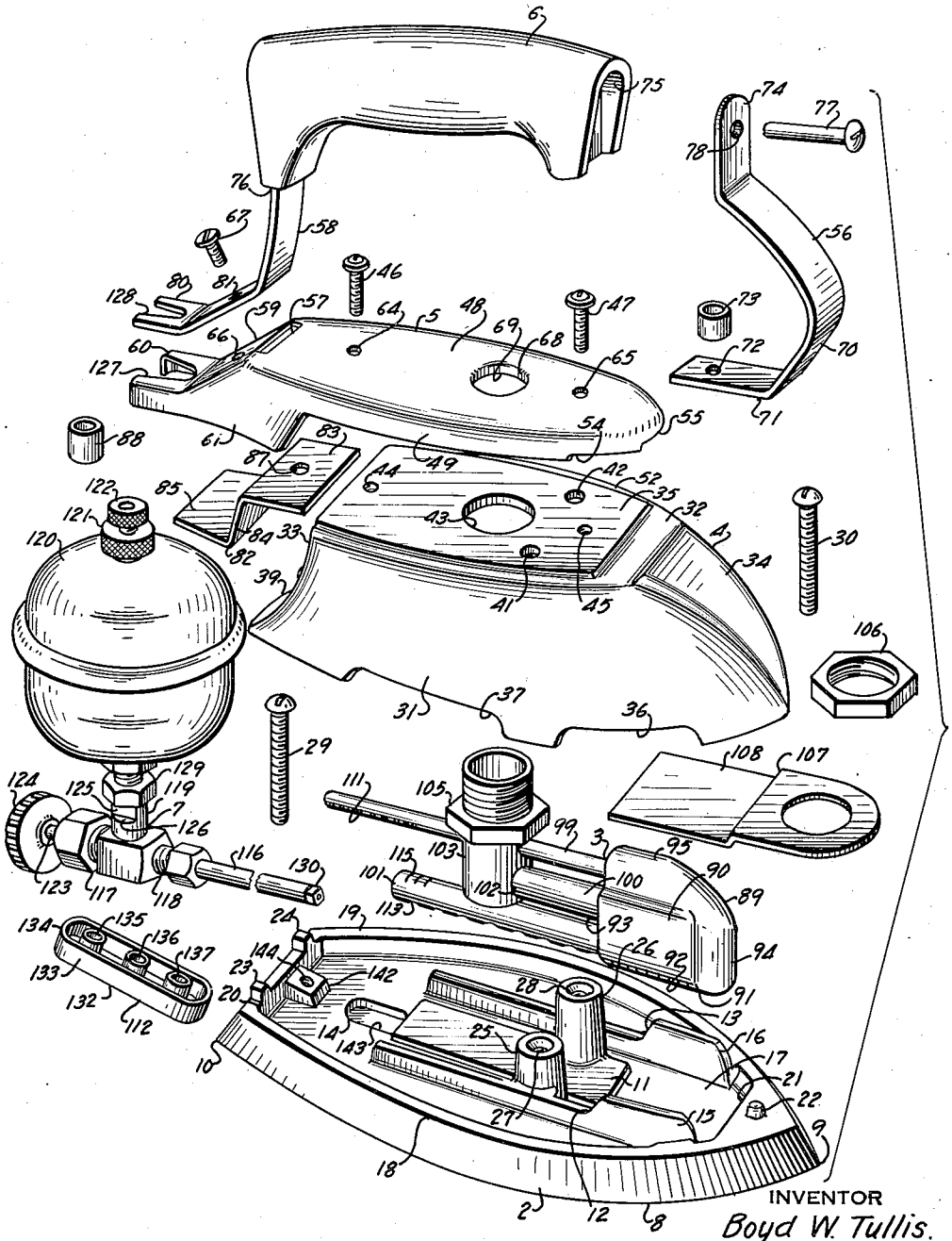
Fig. 5.



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SELF-HEATING FLAT-IRON

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Fig. 6

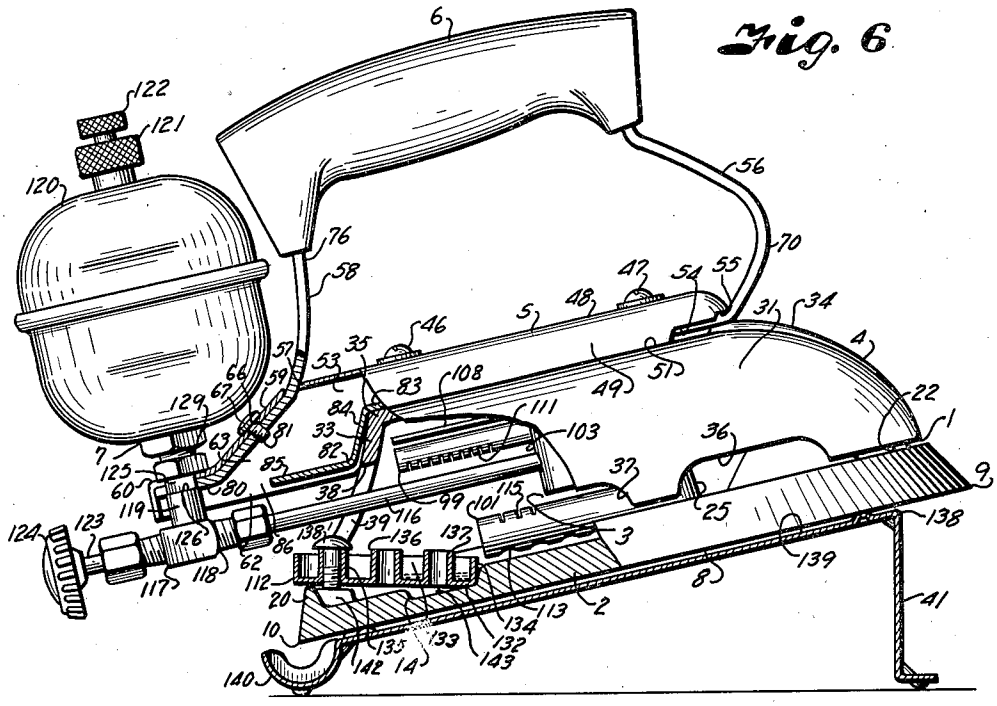



Fig. 7.

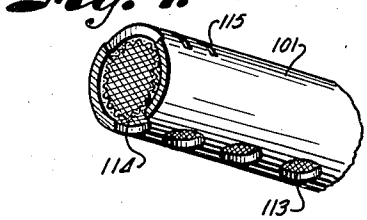
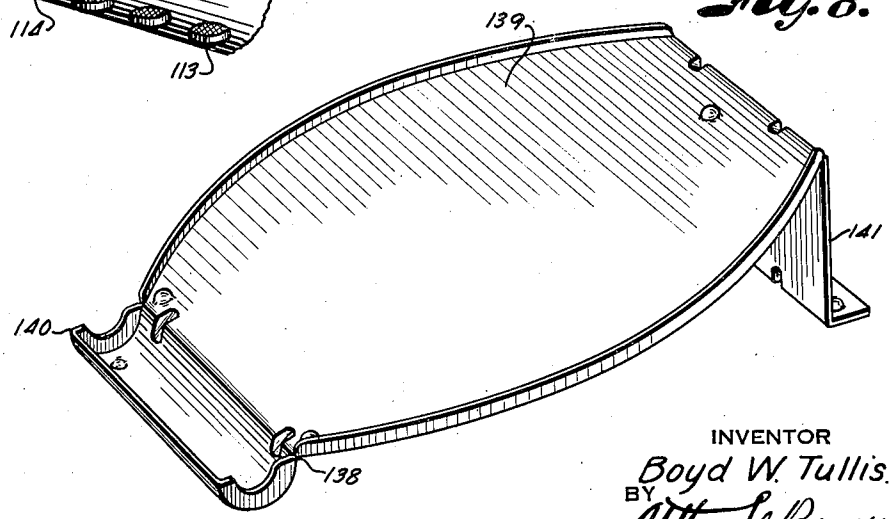



Fig. 8.

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# UNITED STATES PATENT OFFICE

2,294,615

## SELF-HEATING FLATIRON

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Application August 17, 1940, Serial No. 353,077

12 Claims. (Cl. 158—23.2)

This invention relates to self-heating flatirons using liquid hydrocarbon fuels, particularly one having a relatively high boiling point such as kerosene, and has for its principal object to provide an iron designed for successful operation with this type of fuel.

Other objects of the invention are to provide an iron construction wherein the burner parts are kept at a high heat, but so controlled as to avoid preignition within the burner assembly.

Further objects of the invention are to provide a simple and efficient preheating device wherewith the generator is quickly brought to working temperatures; to provide a preheating device for automatically lighting the burner; to provide the iron with a primary burner for heating the sole plate, and upper and lower secondary burners for heating the generator, with the burners constructed as a single unit and supplied from a common mixing chamber; to provide for controlled absorption of the heat by the sole plate of the iron; and to provide means for preventing the burner flame from playing through the air openings of the iron.

Further objects of the invention are to provide a simple iron construction which facilitates assembly in that the air intake connection locates and aligns the parts; to provide a simple construction for aligning the shell of the iron relatively to the sole; and to provide a simple handle and shell attachment requiring a minimum of machining operations.

In accomplishing these and other objects of the invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of an iron embodying the features of the present invention.

Fig. 2 is a longitudinal section through the iron, the fuel supply tank, control valve, generator, and handle, being shown in elevation.

Fig. 3 is a cross-section through the iron on the line 3—3 of Fig. 2.

Fig. 4 is a detail section on the line 4—4 of Fig. 2.

Fig. 5 is a perspective view of the parts of the iron shown in disassembled spaced relation to better illustrate the construction thereof.

Fig. 6 is a side elevational view of the iron, partly in section, showing the position of the iron on the supporting stand during preheating of the generator.

Fig. 7 is a detail perspective view of a part of the main burner tube, particularly illustrating the screen insert.

Fig. 8 is a detail perspective view of the iron stand.

Referring more in detail to the drawings:

1 designates an iron constructed in accordance with the present invention, including a sole plate 2, a burner unit 3, a burner enclosing shell 4, a handle connecting plate 5, a handle 6, and a fuel supply and generator assembly 7.

The sole plate 2 includes a metal body having an ironing face 8 terminating at the front in a pointed toe 9 and at the rear in a narrowing heel 10. The sole plate is of proper thickness to provide the necessary metal in retaining and conducting the heat, but the top thereof is provided directly below the burner with a thicker pad-like portion 11 to prevent overheating of the center of the iron. Located on opposite sides of the pad 11 are baffles 12 and 13 extending substantially parallel, rearwardly from the toe portion of the iron, but terminating short of the heel portion to accommodate a priming cup receiving space 14. The front end of the baffles have upward, wing-like extensions 15 and 16 to catch the larger flame of the burner, as later described, and to cooperate with the other portions of the baffles in shielding the flame and preventing it from playing through the air inlet openings required for controlling movement of air through the iron. The portion 17 of the sole plate between the wing-like extensions of the baffles is relatively thin so as to increase the heat at the point of the iron. Extending along the sides of the sole plate are flanges 18 and 19 extending from the pointed end of the iron to the heel, where they are connected by a transverse flange 20 to seat the shell 4. Projecting upwardly from a web 21 connecting the flanges 18 and 19 at the point of the iron, is a dowel 22 cooperating with spaced lugs 23 and 24 on the transverse flange 20 to align the shell 4 on the seat of the flanges. Extending upwardly from the sole plate at the respective sides of the pad 11 and having integral connection with the flanges 12 and 13, are post-like bosses 25 and 26 having threaded, axial bores 27 and 28 to receive screws 29 and 30 for anchoring the shell 4.

The shell 4 conforms in general shape to that of the sole plate, and includes sides 31 and 32 connected by a rear wall 33 and a front wall 34 rounding rearwardly into a flat top 35. The lower edges of the shell sides 31 and 32 have notches 36 and 37 substantially coextensive with baffles 12 and 13 to provide air inlet openings through which secondary air is supplied to the burner. The rear wall 33 curves forwardly and is pro-

vided with a substantially inverted, V-shaped opening 33 of a size so that the side edges 39 engage the lugs 23 and 24 and of sufficient height to pass the generator assembly later described. The nose of the shell has a recess 40 to receive the dowel 22 so that when the shell is placed upon the sole plate, the dowel 22 and lugs 23—24 prevent shifting thereof and the shell is readily aligned for attachment by the screws 29 and 30 which extend through spaced openings 41 and 42 in the top 35 and into the threaded bores 27—28 of the posts 25—26. The top 35 is further provided with a substantially centrally located opening 43, of sufficient diameter to receive the primary air inlet tube of the burner, later described. The top of the shell also has threaded openings 44 and 45 to receive the fastening devices 46 and 47 which retain the handle plate 5 on the shell.

The handle plate 5 has a cupped body portion conforming generally to the shell top 35, and includes a slightly rounding top 48 having depending sides 49 and 50 that seat upon shoulders 51 and 52 formed in the top 35 so that when the handle plate is applied to the shell it is retained from lateral movement thereby and the top 48 is spaced from the shell top 35 to provide an air passageway 53 therebetween. The front lower edges of the sides 49 and 50 are notched, as at 54, to form air outlet openings from the space 53 at the front of the iron. The front of the handle plate is provided between the notches 54 with a deeper notch 55 to accommodate the front handle bracket 56, later described. The rear portion of the handle plate projects beyond the rear end of the shell and has a slot 57 to pass a part of the rear handle bracket 58. From the slot 57, the top of the handle plate slopes downwardly, as shown at 59, and terminates in a bifurcated horizontal portion 60. The side flanges 49 and 50 terminate at their rear ends in depending wings 61 and 62 integrally connected with the portion 59 to form an air chamber 63 having connection with the air passageway 53. The top of the handle plate is further provided with openings 64 and 65 registering with the threaded openings 44 and 45 to pass the threaded shanks of the fastening devices 46 and 47. The downwardly sloping portion 59 is provided with a similar opening 66 to pass a fastening device 67 for attaching the rear handle bracket 58.

Formed in the handle plate, in axial alignment with the opening 43, is an opening 68 having a depending annular flange 69, the flange 69 being of smaller circumference than the opening 43 so that it enters the primary air inlet tube for a purpose later described. The front handle bracket 56 includes a forwardly curved portion 70 terminating at its lower end in a rearwardly extending foot 71 which passes through the notch 55 and has an opening 72 therein to pass the fastening device 47 so that the handle bracket is secured thereby, the foot 71 being clamped to the top of the shell by a spacing sleeve 73 with its upper end engaging the under side of the handle plate and its lower end engaging against the foot 71 when the fastening device 47 is tightened. The upper end of the handle bracket terminates in a vertical ear 74 engaging in an end recess 75 in the end of the handle 6. The rear bracket 58 also has a similar ear 76 engageable in a similar recess at the opposite end of the handle and the handle is connected to both brackets by a bolt 77 extending through openings 78 in the ears and through a bore in the handle. The portion of the rear bracket which extends through the slot 57 terminates in a bifurcated end 80 to engage under the bifurcated portion 60 of the handle attaching plate, as clearly shown in Fig. 2, the bracket being secured to the shell plate by the fastening device 67 which is threaded in an opening 81 thereof. Attached to the handle plate by the fastening device 46 is a guard plate 82 substantially conforming in width to the width of the handle plate and having a horizontal portion 83 adapted to overlap the top 35 of the shell 4. The plate 82 also includes a downwardly inclined portion 84 adapted to bridge the space between the wings 61 and 62 and which terminates in a rearwardly extending horizontal portion 85, the side edges of which engage the edges of the depending wings 61 and 62 to form a baffle which prevents heat from the generating pan from heating the handle plate. The rear edge of the portion 85 terminates short of the bifurcated portion of the handle plate to provide an air inlet opening 86 therebetween so that air is admitted therethrough for circulation under the handle plate to carry away the heat radiating from the shell of the iron, the heated air being discharged through the notches 54. Attention is directed to the fact that this air moves over the attaching point of the handle so as to maintain a relatively lower temperature of the handle brackets. The member 82 has an opening 87 therein to pass the shank of the fastening device 46 and the portion 83 thereof is clamped against the top of the shell by a spacing sleeve 88 similar to the spacing sleeve 73.

The burner unit includes a mixing chamber 89 formed of relatively heavy heat resistant material, and includes parallel side walls 90 connected at their lower edges by a substantially semicylindrical bottom 91 having transversely arranged, spaced slots 92 facing the relatively thin portion 17 of the sole plate, as later described. The side walls are further connected by a flat end wall 93 and a rounded end wall 94, curving upwardly and emerging into a substantially semicylindrical top 95. The wall 93 is provided with vertically spaced openings 96, 97 and 98, which are internally threaded to receive tubes 99, 100 and 101 respectively. The opposite end of the tube 100 is threaded into an opening 102 of a vertically arranged cylindrical tube 103 closed at the lower end by a plate 104. The tube 103 has an outer diameter to pass freely through the opening 43, and has an inner diameter to receive the inturned flange 69 of the air inlet opening 68 as clearly shown in Fig. 2, the upper end of the tube 103 being externally threaded to mount nuts 105 and 106 for respectively engaging the upper face of the shell and a baffle plate 107, as shown in Fig. 2. The baffle plate has a rearwardly extending portion 108 offset downwardly in spaced relation with the top of the shell to protect the shell from the heat of the upper burner element, later described. The tube 103 is provided with transverse openings 109 and 110 registering with the opening 97 to pass the tube 99 therethrough so that the tube extends through the air passageway within the tube 103. The tube 99 is of sufficient length to extend substantially to the rear end of the shell 4 and has a plurality of downwardly facing transverse slots 111 to form fuel outlets from the mixing chamber. The tube 101 extends under the closed end of the tube 103 toward the heel of the iron but terminates a suffi-

cient distance therefrom to accommodate a priming pan 112. The portion of the tube 101 facing the sole plate 2 of the iron is provided with a series of openings 113 which are covered on the interior of the top with a heat resistant wire screen 114 to form a plurality of jets for the outlet of the fuel from the mixing chamber, which jets cooperate with the slots 92 to form the main burner for heating the sole plate of the iron. The upper portion of the top at the terminal end thereof is provided with a series of transverse slots 115 to cooperate with the slots 111 in the upper tube to heat a generator tube 116.

The generator tube is carried by the fuel tank assembly 7 which includes a valve 117 having an axial branch 118 to which the generator tube is connected and a vertical branch 119 carrying a fuel supply tank 120 that is adapted to be filled with fuel, such as kerosene, through a fill opening closed by a threaded cap 121. The cap also includes an air inlet fitting 122 wherethrough air is pumped into the tank for discharging the fuel through the valve and generator tube into the mixing chamber.

The valve 117 also includes a regulating stem 123 which is manipulated by a hand-wheel 124. The branch 119 of the valve has flattened sides 125 forming shoulders 126, the flattened sides extending parallel with the generator tube to engage within the notches 127 and 128 of the bifurcated portions 60 and 80, previously referred to. The portion of the branch above the shoulders 126 is threaded and mounted on the thread is a jam-nut 129 to draw the shoulders against the bifurcated terminal of the rear handle bracket and the bifurcated portion thereof against the bifurcated portion of the handle plate, as best shown in Fig. 6. The generator tube is thus kept in axial alignment with the iron, and the nozzle end 130 thereof in coaxial relation with the air tube 100, the nozzle extending through an opening 131 in the tube 103. The generator tube is thus located intermediate the jets 111 and 113 of the tubes 99 and 101 and in the path of the flames issuing therefrom.

The priming pan is of elongated shape and includes a bottom 132, side walls 133, and rounded end walls 134. Carried within the priming cup are collars 135, 136 and 137 forming air inlet openings and an opening for passing a screw 138' to secure the priming cup in position on the wall plate.

In order that the burner may be of sufficient length to properly heat the sole plate, the space left for the priming cup is relatively limited and the flame of the fuel burned therein would ordinarily contact the rear portion of the generator tube and little of the flame would come in contact with the burner tube. For this reason the priming cup is arranged at an angle relatively to the sole plate, as shown in Fig. 2, and when the iron is to be started, it is mounted upon a stand 138 having a sloping top 139 carried at one end on a trough-like member 140 and its opposite end on a leg 141, the leg 141 being higher than the trough so that the slope of the plate is in the direction of the trough with the angle being such that when the iron is supported on the plate, as shown in Fig. 6, the priming pan slightly slopes toward the burner. To retain the pan in this position, the rear end thereof is supported on a boss 142 adjacent the end wall 20, and its forward end is received in a recess 143 of the sole plate, the pan being secured to the boss by a fastening device 138 extending through the opening 144.

In assembling the parts of the iron, the baffle plate 107 is applied so that the apertured end thereof engages over the threaded end of the air tube 103. The burner unit is then applied within the shell 4 so that the threaded portion of the tube 103 projects through the opening 43, the nut 105 having been applied on the tube prior to insertion of the tube in the opening, after which the nut 106 is threaded on the projecting end of the tube. The burner is then adjusted for proper spacing with respect to the sole plate of the iron by means of a gauge (not shown), placed across the walls of the shell, and the burner is adjusted relatively thereto by slacking off and tightening the nuts 105 and 106 until the burner is supported in its required position. The shell, carrying the burner, is then applied over the sole plate so that the shell rests upon the flanges thereof with the recess 40 receiving the dowel 22 and the side edges 39 of the notch 37 engaging the lugs 23 and 24. In this position, the shell, including the burner, is aligned in a fore and aft direction with respect to the sole plate. The shell is then secured to the sole plate by inserting the screws 29 and 30 through the openings 41 and 42 and threading them into the threaded bores of the posts 25 and 26. The rear handle bracket 58 is inserted through the slot 57 so that the bifurcated end thereof registers with the bifurcated end 60 of the handle plate 5. In this position the screw 67 may be applied to secure the handle bracket. The plate 82 is then applied in position under the handle plate, and the spacing sleeve 88 is registered with the openings 64 and 87, after which the fastening device 46 is passed therethrough. The foot 71 of the front bracket 55 is inserted through the notch 55 so that the opening 72 registers with the opening 65. The spacing collar 73 is then inserted between the shell and the foot 71 and the fastening device 47 is passed therethrough.

The handle parts thus assembled are placed over the shell of the iron so that the screws 46 and 47 will enter the openings 44 and 45. Then when these screws are tightened, the parts are secured firmly to the shell of the iron. The handle 6 may then be applied between the ears 74 and 76 and the bolt 78 is passed therethrough to complete the handle attachment.

The fuel tank assembly 7 including the generator tube 116 is then applied in position so that the generator tube passes through the V-shaped opening 38 of the shell 4 and the nozzle 130 thereof enters the opening 131 of the air tube. In this position the branch 119 enters between the bifurcated portions of the handle bracket 58 and handle attaching plate 5. When the fuel tank assembly is in position, the nut 129 is tightened to draw the shoulders 126 against the bifurcated end of the rear handle bracket and the handle bracket in tight engagement with the handle portion of the handle plate.

In using the iron, kerosene is poured into the fuel tank through the fill opening and after closing the opening, pressure is injected into the tank by means of a pump or the like (not shown), to place the fuel under pressure. The iron is then placed upon the stand 138 so that the priming pan 112 slopes slightly toward the burner unit. The priming pan is then filled with a readily burnable liquid fuel, such as alcohol, and ignited. The flame resulting from the burning alcohol plays over the generating tube 116 and upper and lower

burner tubes 99 and 101 which are in tilted position, so that the flame plays therealong toward the mounted ends thereof, aided by the draft through the V-shaped opening at the rear and the side openings 36 and 37. After the priming liquid burns down, the last remaining particle burns at the inner end of the pan in close proximity to the burner tubes. At this time the control valve 117 is opened and liquid fuel is delivered through the heated generating tube 116 and discharged as a vapor from the nozzle thereof for mixture with the air drawn through the air tube 103, the air and vapor forming a combustible mixture which passes through the tube 109 into the mixing chamber 89 of the burner and is distributed through the burner tubes 99 and 101 to the burner jets. The combustible vapor discharged through the burner jets 111, 113 and 115 is readily ignited so that the iron is heated by the fuel from the tank 7, the flame spreading along the openings 113 of the main burner tube and across the slots 92 of the mixing chamber 89. The flames issuing through the slotted jets 111 and 115 continue to heat the generator tube when the priming fuel burns out. The unitary structure of the burner parts allows for quick heating thereof and the parts are kept in very hot condition so as to burn the heavy fuel efficiently. Overheating of the upper tube is prevented by the air passing thereover through the air tube 103. The main burner tube is not overheated for the reason that the screen 114 causes the flame to burn away from the edges of the jet openings 113. The parts are, therefore, kept below red heat and there is no danger of burning the combustible mixture within the burner. The flame is directed against the sole plate and the inner faces of the baffles 12 and 13 so that the heat is conducted therefrom substantially uniformly over the plate with the exception that the point portion 17, being thinner, is heated to a higher temperature. This is desirable because it is the point of the iron that first contacts the moistened surface of an article being pressed. The baffles 12 and 13, besides aiding in the conduction of heat, prevent escape of flames through the openings 36 and 37. The flame of the upper burner tube is prevented from contacting the upper portion of the shell by the baffle plate 107. Air is also free to circulate through the handle attaching plate 6 so that the handle and fuel tank are kept in cool condition.

From the foregoing, it is obvious that I have provided an iron structure well adapted for burning heavy fuels such as kerosene, and that the required parts are of simple construction and readily assembled with a minimum of operations.

What I claim and desire to secure by Letters Patent is:

1. In a flat-iron, a burner unit including an air inlet tube, a mixing chamber, a burner tube projecting transversely through the air inlet tube to be cooled by air passing through the air inlet tube, said burner tube being connected with the mixing chamber on one side of the air inlet tube and having downwardly facing jets on the opposite side of the air inlet tube, and an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube to supply the mixing chamber.

2. In a flat-iron, a burner unit including an air inlet tube, a mixing chamber, a burner tube projecting transversely through the air inlet tube for cooling contact with the air moving through the inlet tube, said burner tube being connected with the mixing chamber on one side of the air inlet tube and having downwardly facing jets on the other side of the air inlet tube, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube, and a main burner tube connected with the mixing chamber below said air inlet tube and having downwardly facing jet openings.

3. In a flat-iron, a burner unit including an air inlet tube, a mixing chamber, a burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and having downwardly facing jet openings on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube, a main burner tube connected with the mixing chamber below said air inlet tube and having downwardly facing jet openings and jet openings facing the jet openings of the first-named tube, and a generator disposed between said facing jet openings and discharging across the air inlet tube and through the air tube into the mixing chamber.

4. In a flat-iron, a burner unit including an air inlet tube, a mixing chamber, a burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and having downwardly facing jet openings on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube, and a main burner tube connected with the mixing chamber below said air inlet tube and having downwardly facing jet openings, said mixing chamber having transverse slots forming a continuation of the main burner tube.

5. A flat-iron including, a sole plate, a shell cooperating with the sole plate to form a burner chamber and having an opening in the top thereof, a burner unit in said chamber including an air inlet tube supported in said opening, a mixing chamber, a burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and having downwardly facing jets on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube, a main burner tube connected with the mixing chamber below said air inlet tube and having jet openings facing said sole plate, and a generator tube supported below the jet openings of the first named burner tube and discharging into the air tube, said mixing chamber also having openings facing said sole plate.

6. In a flat-iron, a sole plate, a shell cooperating with the sole plate to form a burner chamber, spaced baffles on the sole plate, a burner unit in said chamber including an air inlet tube supported by the shell, a mixing chamber, a burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and having downwardly facing jets on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube, a generator tube under said jets and discharging into the mixing chamber, and a main burner tube located between said baffles and connected with the mixing chamber below said air inlet tube and having downwardly facing jet openings, said mixing chamber also having downwardly facing jet openings between said baffles.

7. In a flat-iron, a burner unit including an air inlet tube, a mixing chamber, a burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and

having downwardly facing jets on the outer end thereof, an air tube connecting the air inlet tube of the mixing chamber at a point below the burner tube, a main burner tube connected with the mixing chamber below said air inlet tube and having downwardly facing jet openings, said mixing chamber having transverse slots forming a continuation of the main burner tube, said main burner tube having upwardly facing slots forming burner jets facing the downwardly facing jet openings of the first named tube, and a generator tube coaxial with the air tube and located in the flame issuing from said facing jets.

8. In a flat-iron, a sole plate, a shell carried on the sole plate and cooperating therewith to form a burner chamber, a burner unit suspended within said chamber including an upper secondary burner and a lower main burner, a generator tube for supplying fuel to the burner unit and extending between said main and secondary burners, and a priming pan supported in inclined position on the sole plate so that when the iron is placed on an incline the pan is substantially level whereby the flame resulting from burning fuel in the priming pan plays along the generator tube and against the burners of the burner unit.

9. A flat-iron including, a sole plate, a shell cooperating with the sole plate to form a burner chamber and having an opening in the top thereof, a burner unit in said chamber including an air inlet tube supported in said opening, a mixing chamber, a secondary burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and having downwardly facing burner openings on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the secondary burner tube, a main burner tube connected with the mixing chamber below said air inlet tube and having jet openings facing the sole plate, a generator tube supported below the burner openings of the secondary tube and discharging into the air tube, and a downwardly sloping priming pan carried on the sole plate below the generator tube and said secondary burner tube, said main burner tube terminating short of the secondary burner tube to accommodate said priming pan, said priming pan being arranged to slope downwardly in the direction of the main burner tube when the iron is placed on an inclined support to direct burning fuel therein into heating contact with the main burner tube.

10. A flat-iron including a sole plate, a shell cooperating with the sole plate to form a burner chamber and having an opening in the top thereof, a burner unit in said chamber including an air inlet tube supported in said opening, a mixing chamber, a secondary burner tube projecting transversely through the air inlet tube and connected with the mixing chamber and having downwardly facing burner openings on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the secondary burner tube, a main burner tube connected with the mixing chamber below said air inlet tube and having jet openings facing the sole plate, said main burner tube being of shorter length than the secondary burner tube to accommodate a priming pan under the secondary burner tube, said main burner tube having upwardly facing jet openings, a generator tube supported between said burner tubes, and a priming pan supported at an inclined angle under the generator and secondary tubes and in substantially end registry with the main burner tube.

11. A flat-iron including a sole plate, a shell cooperating with the sole plate to form a burner chamber having an opening in the top thereof, a burner unit in said chamber including an air inlet tube supported in said opening, a mixing chamber, a burner tube projecting transversely through the air inlet tube and having one end connected with the mixing chamber and having downwardly facing jets on the outer end thereof to form a burner, said portion of the burner tube extending through the air inlet tube being cooled by air moving through the air inlet tube to reduce the amount of heat conducted through the burner tube to the mixing chamber, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube, a main burner tube connected with the mixing chamber below said air inlet tube and having jet openings facing said sole plate, and a generator tube supported below the jet openings of the first-named burner tube and discharging into the air tube.

12. In a flat-iron, a sole plate, a shell cooperating with the sole plate to form a burner chamber, spaced baffles on the sole plate spaced inwardly from the sides of said shell, a burner unit in said chamber including an air inlet tube supported by the shell, a mixing chamber, a burner tube projecting transversely through the air inlet tube and connected with the mixing chamber at one end and having downwardly facing jets on the outer end thereof, an air tube connecting the air inlet tube with the mixing chamber at a point below the burner tube whereby the air passing through the inlet tube is caused to move in heat exchange relation with the portion of the burner tube extending through the air inlet tube to reduce the heat conducted by the burner tube to the mixing chamber, a generator tube under said jets and discharging into the mixing chamber, and a main burner tube located between said baffles and connected with the mixing chamber below said air inlet tube and having downwardly facing jet openings.

BOYD W. TULLIS.