

Feb. 18, 1936.

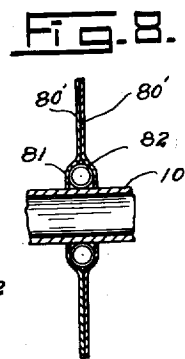
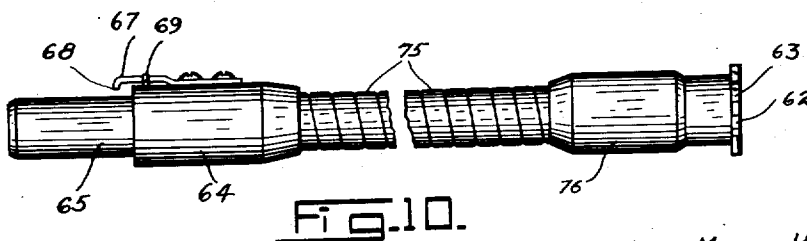
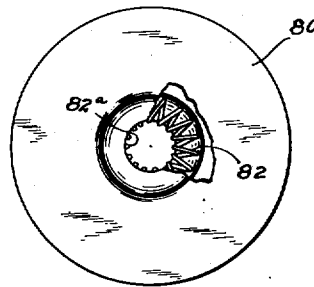
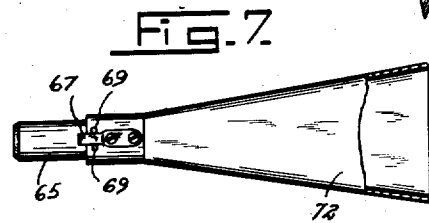
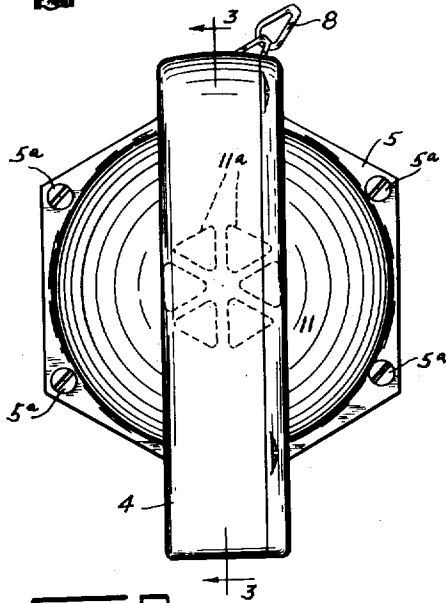
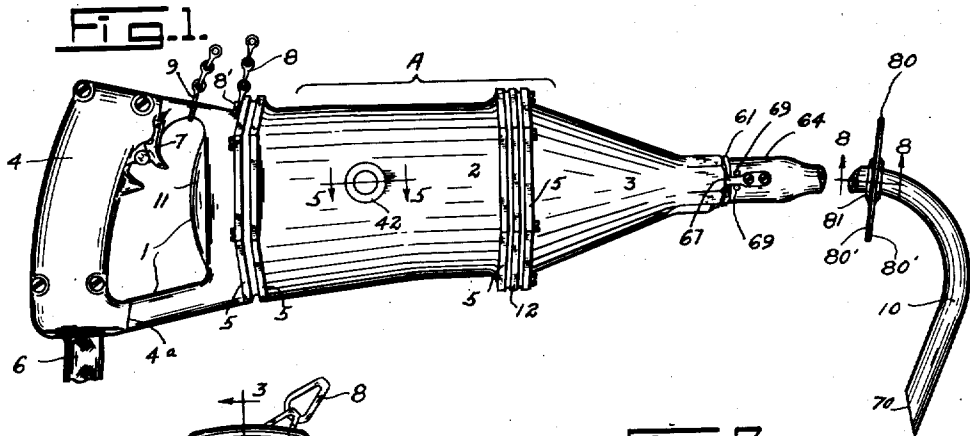
M. H. SPIELMAN

2,031,391

HEAT GUN

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2 Sheets-Sheet 1



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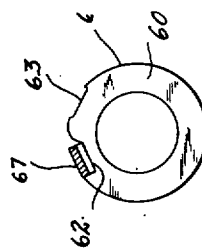
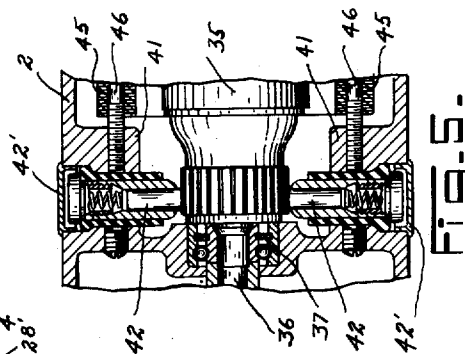
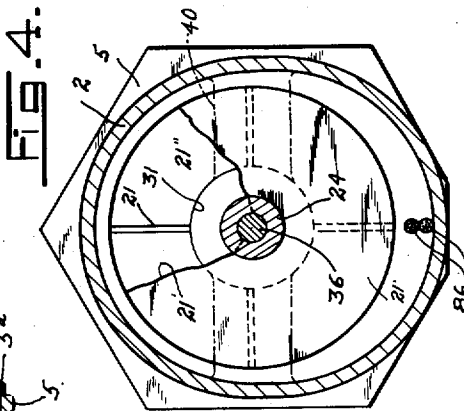
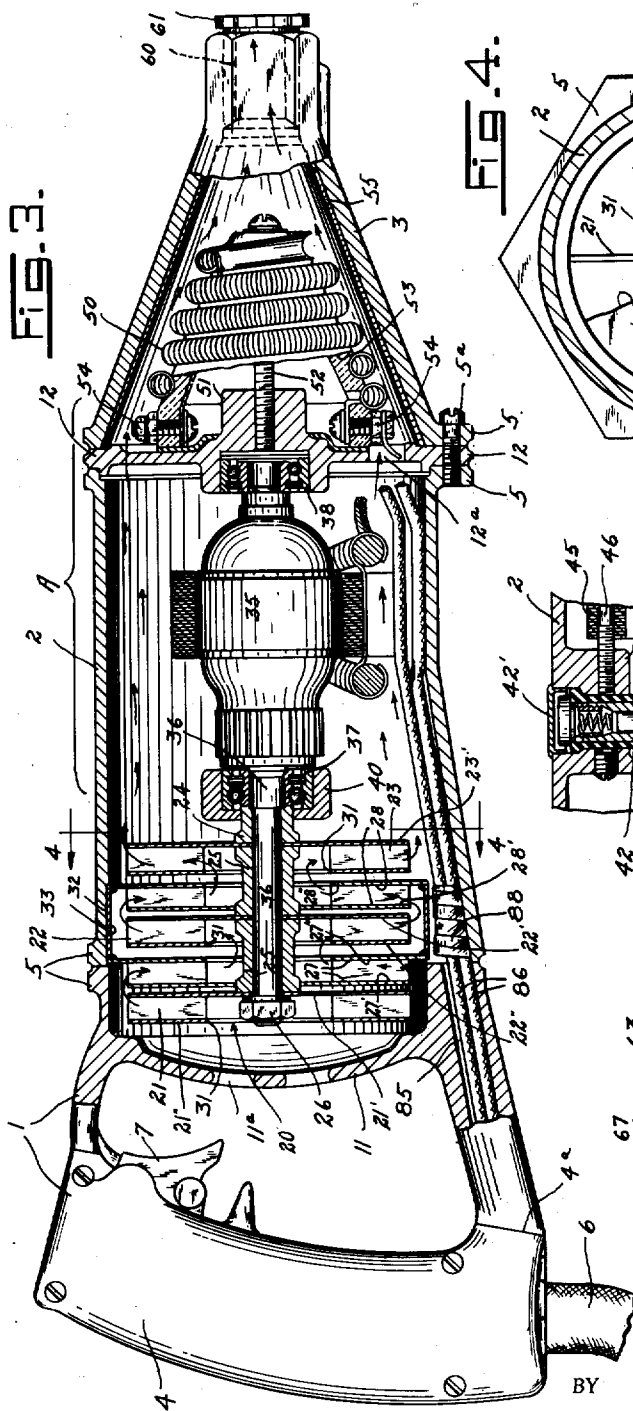
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HEAT GUN

Filed Feb. 18, 1935

2 Sheets-Sheet 2



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2,031,391

HEAT GUN

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13 Claims. (Cl. 219—39)

This invention relates to a heat gun unit adapted to serve as a thawing apparatus for frozen oil or water pipes and passages in automobiles, e. g. The principal problem involved is to provide such a unit which will quickly generate the proper degree of heat and air flow and which may be readily and effectively handled to direct the stream of hot air to more or less inaccessible points and spaces in machines likely to require thawing in extremely cold weather, or, for further example, drying in wet weather. The crank case, clutch or gear housing and differential casing of automobiles are examples of spaces requiring thawing. Various parts of the ignition system frequently require drying. Frozen water pipes and passages in the cooling system present well known thawing problems.

The principal object of the invention is to provide a compact, simple and efficient heat gun unit, by which air may be quickly heated and effectively directed to the part or parts requiring the application of heat.

Another object is to provide a heat gun including a power driven blower in a suitable casing, so arranged as to secure continuous uniform rapid flow of air in a constant direction through the casing, with substantially minimum "slippage".

A further object is to provide an electrically driven heat gun having an electric heating element, so arranged with respect to the cooperating parts that air passing through the gun will necessarily become intimately associated with the heating element, but without restricting the flow of air to such an extent that the motor has to work against excessive back pressure.

Another object is to provide an electric heat gun in which the heating element operates with greater efficiency and is more effectively located with respect to the point of air discharge from the gun.

A further object is to provide a heat gun for the above described purposes, which shall be extremely compact and in which the motor fan unit and heating unit shall be so related that air is passed through the machine with comparatively little resistance and rapidly delivered at a comparatively high degree of temperature, say as high as four or five hundred degrees Fahrenheit, all without excessive consumption of electric power and without incurring the hazards incident to overheating.

A further object is to provide a portable electric heat gun having a supporting handle arrangement, wherein the main body is balanced about, and is bilaterally symmetrical with respect to the vertical plane of the handle, so that it is not necessary for the operator to use more than one hand to effectively support the gun, leaving his other hand free for other work.

Another object is to provide a heat gun all parts of which likely to be touched by the operator's hands in using the gun, will be comparatively cool, but without requiring use or extensive use of insulation and obtain this result.

A specific object is to provide a novel and more effective apparatus for directing the heated air to the spaces or parts to be dried or thawed, and particularly a set of hot air nozzle devices interchangeably arranged with relation to the heat gun proper so that shifting from one type of nozzle to another may be accomplished very easily and quickly.

A still more specific object is to provide an applicator nozzle, which will be particularly well adapted to thaw oil or water pipes and tubes, as well as adapted to be effectively used between the forwardly disposed grill bars of automobile radiators.

Other objects and features of the invention will become apparent from the following description relating to the accompanying drawings, showing a preferred embodiment. The essential characteristics are summarized in the claims.

In the drawings, Fig. 1 is a side view of the present heat gun, slightly in perspective, with one form of nozzle or heat applicator; Fig. 2 is an end elevation of the entire device on a larger scale viewed from the handle end; Fig. 3 is a substantially central cross-sectional assembly view in the scale of Fig. 2, taken substantially as indicated by the line 3—3 on Fig. 2; Figs. 4 and 5 are, respectively, transverse and longitudinal sectional detail views as indicated at 4—4 and 5—5 on Figs. 3 and 1, respectively; Fig. 6 is an end view of the nozzle adapter or mounting element of the gun, also showing in cross-section a cooperating (latching) part of one of the nozzles; Fig. 7 is a side view, showing another modification of nozzle; Fig. 8 is a sectional view, as indicated on Fig. 1, showing a suitable splash guard adapted for association with the various nozzles; Fig. 9 is an end view of the splash guard and Fig. 10 is a fragmentary side view of a flexible extension usable interchangeably with the various nozzles.

Referring to the drawings, Figs. 1 to 3, the gun proper is shown at A, having a three-part casing, (sections 1, 2 and 3) the part 1 including a handle formation 4 extending in a vertical plane and transversely of the axis of the casing as a balanced support. 4a indicates a detachable cover plate for the handle section, the handle section being made hollow to receive suitable switch parts and conductors which may be conventional. The section 2 is substantially a hollow cylinder. The section 3 is conical and the base portion or larger end is secured to the section 2, there being, however, a plate or spider element 12 interposed between the casing sec-

tions 2 and 3, which plate is apertured to pass air from one section to another and which supports a heating element 50 and one end of the motor shaft, as will be later described. The small end of the conical section 3 forms the muzzle of the gun proper and is fashioned as will be hereinafter shown to form a support for detachably receiving various types of applicators or nozzle attachments, an example of one type being shown in place at 10 in Fig. 1.

Electric current, as from the usual service outlet, is supplied to the gun through a suitable flexible insulated cable or cord 6 entering the hollow handle from below as shown in Figs. 1 and 3. The current so supplied is controlled so as to simultaneously turn the heat and motor "on" and "off" by means of a suitable trigger type switch 7, not shown in detail but of such construction that each time the trigger is pulled the current remains either "on" or "off" until the trigger is pulled again. The motor and heating element are connected in parallel and the switch controls the line to both at the same time.

With the above mentioned type of switch the gun may be left in operation at the desired location as long as necessary and with this purpose in view a suitable supporting chain 8 may be secured to the handle section 1 as at 8', the chain having a hook 9 at one end adapted to detachably engage the upper bar of the handle so that the chain may be used to support the gun as from a shaft or projection on the machine being operated upon, freeing the operator for other work on such machine e. g.

Fig. 2 shows the relative proportions of the handle and the casing generally and also the general disposition of the handle with respect to the casing. It will be noted that the casing is bisymmetrical about the vertical central plane of the handle, whereby the gun under ordinary conditions may be properly supported and directed by the use of but one of the operator's hands.

The casing sections may comprise metal castings,—say aluminum,—each having an end flange 5 (all hexagonal, as shown) by which the adjacent sections may be secured together as by screws 5a.

Referring again to the handle section, it will be noted that the somewhat convex wall portion 11 of disc member, on said section, forms an end closure for the casing part 2, the wall 11 having a centrally disposed series of apertures 11a, forming a suitable central air inlet to the casing in proper relationship to the centrifugal fan indicated generally at 20. The air so admitted is caught by the endmost rotary element of the fan and thrown outwardly, the air then being operated upon by several fixed and rotary fan assemblies which cause the air to flow as indicated by the arrows to progressively move the air toward the muzzle of the gun. The fan may be described as a "multiple stage fan" and as shown there are three stages. The fan construction will be presently described more in detail.

The fan motor 35 has an armature shaft 36 carried in suitable anti-friction bearings 37 and 38. The motor is disposed between the fan and the heating element 50, to be later described, the latter being disposed in the conical casing section 3, the heating element proper being mounted on the disc-like element 12 above mentioned and which forms an important part of the casing. The motor, heating element and supports therefor will be later more fully described.

Referring again to the fan 20, this comprises a rotary impeller, assemblies 21, 22 and 23, all substantially identical in form and which are coaxially mounted on the end portion of the armature shaft 36, which projects rearwardly from the bearing 37. The rotary assemblies are supported and secured by sleeves 24 and 25, fitting the shaft, in cooperation with a nut 26, on the end of the shaft, clamping all the sleeves together onto central portions of the fan assemblies, the nut clamping the fan assemblies and sleeves together into a substantially rigid unit, thereby drivingly securing all of the assemblies to the shaft. Cooperating with the rotary fan elements 21—23 are fixed fan assemblies or elements 27 and 28, which force the air, driven outwardly by the respective rotary fan assemblies 21 and 22, back towards the fan axis, each passing the air to the next rotary fan element. This is the "stage" action referred to above by which continuous air movement is secured.

In construction the fixed and rotary fan elements are (or may be) very similar, (see Figs. 3 and 4). As shown, each rotary element comprises two discs 21' and 21'' for the unit 21, (marked 22', 22'' and 23', 23'' respectively, on the fans 22 and 23) and interposed fan blades 30, see particularly Fig. 4. The discs 21', 22' and 23' have small central openings and the discs are clamped by the nut 26 and sleeve arrangement described above while the discs 21'', 22'' and 23'' have larger central openings 31, receiving the air as indicated by the arrows the blades 30 throwing the air outwardly.

The stationary fan assemblies 27 and 28 comprise discs 27', 27'', etc., with interposed blades (shape not shown but which may be radial or in whorl effect) which discs receive between them the air from one rotary fan assembly and direct the air inwardly and to the next rotary assembly, the discs 27'' and 28'' both having central openings which clear the rotating sleeves 24 and 25 by a wide margin to provide central air passage from each fixed to the adjacent rotary fan assembly.

The stationary fan assemblies may be supported in the casing part 2 in a counterbore effect at 32, which the stationary discs 27'' and 28'' substantially fit, the discs being axially positioned by a sheet metal ring 33 in a manner obvious from the drawings, Fig. 3.

Referring now to the motor support partly described above, the bearing 37 is carried on a bracket 40 forming a cross-bar connected with opposite side walls of the casing part 2, the shape of the bracket being, for example, as indicated by broken lines in Fig. 4. Portions 41 of the bracket adjacent the casing wall are enlarged to form brush supports for brush assemblies 42 of the motor, including dust caps 42'. The brush assemblies may be conventional in construction.

Fig. 5 shows the manner in which the field laminations 45 of the motor may be supported in spaced relation to the casing on all sides, as by two screws 46, one being shown engaging threaded openings in the enlarged portion 41 of the bracket 40. Thus, the air delivered by the fan may pass freely between the motor and casing walls on all sides of the motor, cooling the field, and also along the armature and between it and the surrounding field for further cooling. The type of motor shown is principally by way of example. Other types may, of course, be used.

On the outer side of the apertured plate or spider 12, which carries the bearing 38, there is an

enlarged hub 51 centrally bored and threaded to receive a suitable screw 52 passing axially through and securing an insulating cone 53 for the resistance heating element 50. The insulating cone is preferably lava or similar tough refractory substance for durability and is helically grooved to receive the heating coils, the termini of the coils being connecting respectively with suitable binding posts 54 near the base of the insulating cone 53. The screw 52 clamps the cone 53 against a suitable asbestos washer underlying the rim of the cone adjacent the disc 12. It will be noted that the coils forming the heating element 50 are disposed in substantially uniformly spaced relationship to the rearwardly converging conical walls of the casing section 3, which casing has a suitable insulating lining 55, such as asbestos cemented in place in the section 3.

The air flowing rearwardly in the casing about the motor is admitted to the space surrounding the heating coils through a suitable series of closely spaced openings, 12a, the radial position of which is indicated by the single opening shown in Fig. 3. The heated air is finally discharged through the muzzle of the gun and specifically through the axial bore of the metal bushing 60, pressed into the small end of the cone section 3, and which, as will now be described, has provisions for detachably securing the various nozzle or applicator attachments to the gun proper.

Referring particularly to Figs. 1, 6 and 7, it will be noted that the bushing 60 has an annular flange effect 61, which has two circumferentially spaced notches at 62, and 63, of different depths. It will be noted that each attachment has a head 64 adapted to abut the bushing 60 and a reduced tube portion 65 for slidably entering and substantially sealing against the central bore of the bushing 60. As shown in Figs. 7 and 10, the head 64 has secured thereto, as by suitable screws, a spring element 67 having a radially inwardly projecting end 68, forming a hook adapted to engage the flange 61 of the bushing 60 in the following manner: The hook end of the spring element, which element incidentally may be laterally supported by a pair of pins 69, freely enters the deeper notch 62 when the tube portion 65 of the attachment is inserted into the bushing 60 and the hook is aligned with the notch. After the full insertion of the tube carries the bent end 68 of the spring beyond the bushing flange, the attachment may then be turned to a degree sufficient to force the spring out of the notch 62 and cause it to enter the notch 63 in which latter notch the hook lies behind the flange holding the nozzle firmly in place against direct withdrawal from the gun. The attachment, obviously, must now be turned back to initial position with respect to the bushing against the detaining force of the spring before the attachment can be removed from the gun.

The particular applicator or attachment shown in Fig. 1, in place on the gun is for spaces such as the differential or transmission casings and like parts of automobiles, the nozzle portion of the applicator being hook-shaped so that the gun may be simply hung from the filler or drain hole of such casing as a partial support for the gun while applying heat to thaw the oil or grease inside. The manner in which the chain 8 and hook 9 may be used to augment this support is obvious from the drawings. In order to prevent plugging the end of the nozzle, as by a heavy body of grease, the end is bevelled, as at 70, so that the operator will know when the nozzle end encounters the body of grease before said grease has

become embedded therein and will stop moving the nozzle toward such body.

Fig. 7 shows the preferred form of applicator for projecting the heated air properly for drying say the distributor points or spark plugs of an ignition system or for thawing long pipes and radiators, e. g. The thin fan-shaped discharge end 72 of this form of applicator spreads the discharged hot air in one direction while narrowly confining it in another. This applicator may be used to great advantage, for example, between the grill bars of an automobile radiator.

The flexible hose attachment of Fig. 10 comprises, at one end, counter-parts of the hollow head etc. parts 64—68, previously described, the parts being identified the same as the corresponding parts of Fig. 6. A suitable length of flexible metal e. g. hose 75 is secured, as by welding the same into the bore of the member 64 and the opposite end of the hose has similarly secured thereto a hollow sleeve 76, having its end portions fashioned operatively identical with the flanged end of the bushing 60 in the muzzle of the gun. Thus, one end of the flexible hose may be secured to the muzzle of the gun in the manner of securing the various attachments, say those of Figs. 1 or 7, may be secured to the opposite end of the flexible hose, as will be obvious from the drawings.

Since the air is blown with considerable force from the ends of the respective nozzles (8 cu. ft. per minute in the embodiment shown) it is advisable to provide guard or shield means for closing any large-sized openings into which the tubes forming the nozzles may be inserted for a thawing operation, such as the filler hole of the differential casing, for example. The guard, as shown in Figs. 1, 9 and 10, comprises a disc 80 having a central opening to receive the tube, see Fig. 1—and means for frictionally engaging the tube to hold the guard in position thereon. As shown (Figs. 8 and 9) the guard is made of two sheet metal parts 80', welded together, the parts having central annular oppositely cupped portions 81 embracing between them a coil spring 82 formed into a substantially continuous annulus. The inner peripheral portions of the individual spring coils at 82a normally extend inwardly beyond the margins of the central openings in the discs, so as to bear tightly on the tube wall to hold the guard to place in the desired position.

Referring again to Fig. 3, reference is directed to the bore 85 in the lower arm of the hollow handle, which bore leads the conductor wires 86 from the switch mechanism of the handle to within the casing part 2. Preferably the various necessary conductors are secured to the heating element and motor (conventionally) and the free ends of the heads 87 may be spliced to the feed wires 86 as at 88 just before the casing sections 1 and 2 are secured together.

The operation of the heat gun will be apparent from the above description; likewise, the manner in which the construction and arrangement accomplishes the various objects earlier set forth.

I claim:

1. In an electrically operated heat gun, a generally cylindrical casing having air inlet and air outlet openings in its opposite ends, a multiple stage centrifugal fan unit, including a plurality of rotary and stationary blade couples mounted in the casing centrally thereof, a motor in the casing drivingly coupled with the rotary elements of the fan, and a resistance heating element in

the casing between the fan and the outlet opening.

2. In a portable heat gun, a hollow, elongated casing having air inlet and air outlet openings in its opposite ends, a multiple stage centrifugal fan unit disposed within and coaxially of the casing adjacent the air inlet opening, and discharging air admitted thereby towards the outlet, a motor within the casing operatively associated with the fan coaxially thereof, and a resistance heating element disposed between the fan and the outlet opening for heating air discharged by the fan as aforesaid.

3. In a portable heat gun, an elongated casing having air inlet and outlet openings at its opposite ends, a centrifugal fan unit disposed within the casing adjacent the inlet opening with its working axis parallel to the axis of the casing, an electric motor within the casing having a rotor shaft drivingly connected with the fan, the motor being disposed between the fan and outlet opening, a resistance heating element disposed in the casing between the rotor shaft and the outlet opening, and a transverse member supported by the casing wall and supporting one end of the rotor shaft, said member also supporting said element centrally of the casing and having circumferentially spaced air passages there-through for distributing air delivered by the fan uniformly about the heating element.

4. A heat gun comprising a hollow casing having an air inlet, a motor and fan mounted in the casing, a heating chamber comprising a conical wall in sealed relation to the casing, said fan forcing air from said inlet toward the chamber, the small end of the chamber having a central axial hot-air discharge opening, a generally conical electric heating element disposed in the chamber coaxially thereof, and means to support the same in substantially uniformly spaced relation to the conical wall circumferentially thereof.

5. A portable heat gun comprising an elongated hollow casing, a transversely extending handle at one end of the casing aligned therewith and disposed in a vertical plane longitudinally bisecting the casing, a centrifugal blower having its operating axis disposed centrally of the casing, a motor drivingly connected with the blower, inlet means in the end of casing adjacent the handle for supplying air to the blower, a heating element disposed in the casing beyond the blower and motor in the direction of air passing through the casing, and discharge means for the heated air.

6. A heat gun of the class described, comprising an elongated hollow casing, a centrifugal fan, an electric motor for driving the fan and an electric heating element, the fan, motor and element being disposed concentrically with each other in the casing, air inlet means centrally of the casing at one end for supplying outside air to the fan, and an air discharge nozzle communicating with the interior of the casing at the opposite end thereof and having a bayonet lock connection therewith for directing the heated air to extraneous spaces or parts to be heated.

7. In a heat gun of the class described, a generally cylindrical casing, power blower means in the casing, a wall extending transversely of the casing at one end thereof and having a plurality of air passages therethrough, circumferentially arranged with respect to the casing, a conical insulating support on said wall radially inwardly

from said passages, an electric heating coil hellically arranged on said conical support, the apex of the cone lying beyond the wall in a direction away from the blower, and a conical wall forming with the transverse wall, a heating chamber surrounding the heating coil, said conical wall having an air discharge opening at the small end thereof.

8. In a portable heat gun, having heat generating means and an outlet opening for the heated air, the combination of a flanged adapter in said outlet opening, notches in the flange and an applicator nozzle having a spring device yieldingly and frictionally engageable with said notches, and disengageable therefrom consequent upon relative axial movement and relative turning movement of the applicator and adapter.

9. In a heat gun of the class described, an elongated tubular applicator, a splash guard or seal comprising a pair of mutually rigid disc members having aligned apertures adapted to receive such applicator, said disc members having an annular space between them adjacent said apertures, and an annular spring element located in said space and normally extending inwardly toward the axis of said disc members beyond the marginal limits of the apertures, for yielding engagement with such applicator.

10. A portable heat gun comprising an elongated casing, a multiple-stage centrifugal fan unit arranged to operate in a manner to force air outwardly from the axis of the casing, thence inwardly, and again outwardly, a motor for driving the fan disposed in said casing axially parallel therewith, means for supplying air to the fan centrally thereof, means forming a heating chamber at the end of the casing opposite from the motor and fan, said chamber having a restricted air discharge orifice and being arranged to receive air from the fan, and a heating element in said chamber.

11. In a heat gun of the class described, having a tubular discharge device for hot air, the combination of a heat applicator adapted to be supported by said device in substantially sealed relation thereto, and having a fan-shaped discharge portion with a gradually widening axial passage therethrough terminating in a long, narrow, discharge slot, whereby the heated air may be confined in one direction and widely spread in a direction normal thereto.

12. In a heat gun of the class described, having a tubular discharge device for hot air, the combination of a heat applicator adapted to be supported by said device in substantially sealed relation thereto, said applicator comprising an elongated tube of substantially uniform cross-section having its discharge end steeply beveled so that the extremity will act as a stop against a congealed substance to be softened by heat, to reduce the likelihood of accidental plugging of said end by said substance.

13. In a heat gun of the class described, having a tubular hot air discharge device, of a bayonet type lock adapter element on said device a set of applicator attachments each having a complementary bayonet type lock element for detachably engaging the aforesaid element, and a flexible tubular extension for said device having a bayonet type lock element operatively identical with that of the said attachments at one end, and an element operatively identical with that of the device at the other end.

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