June 14, 1938. P. J. TIMBERLAKE 2,120,583

AIR HEATER

Filed Oct. 16, 1936 2 Sheets-Sheet 1

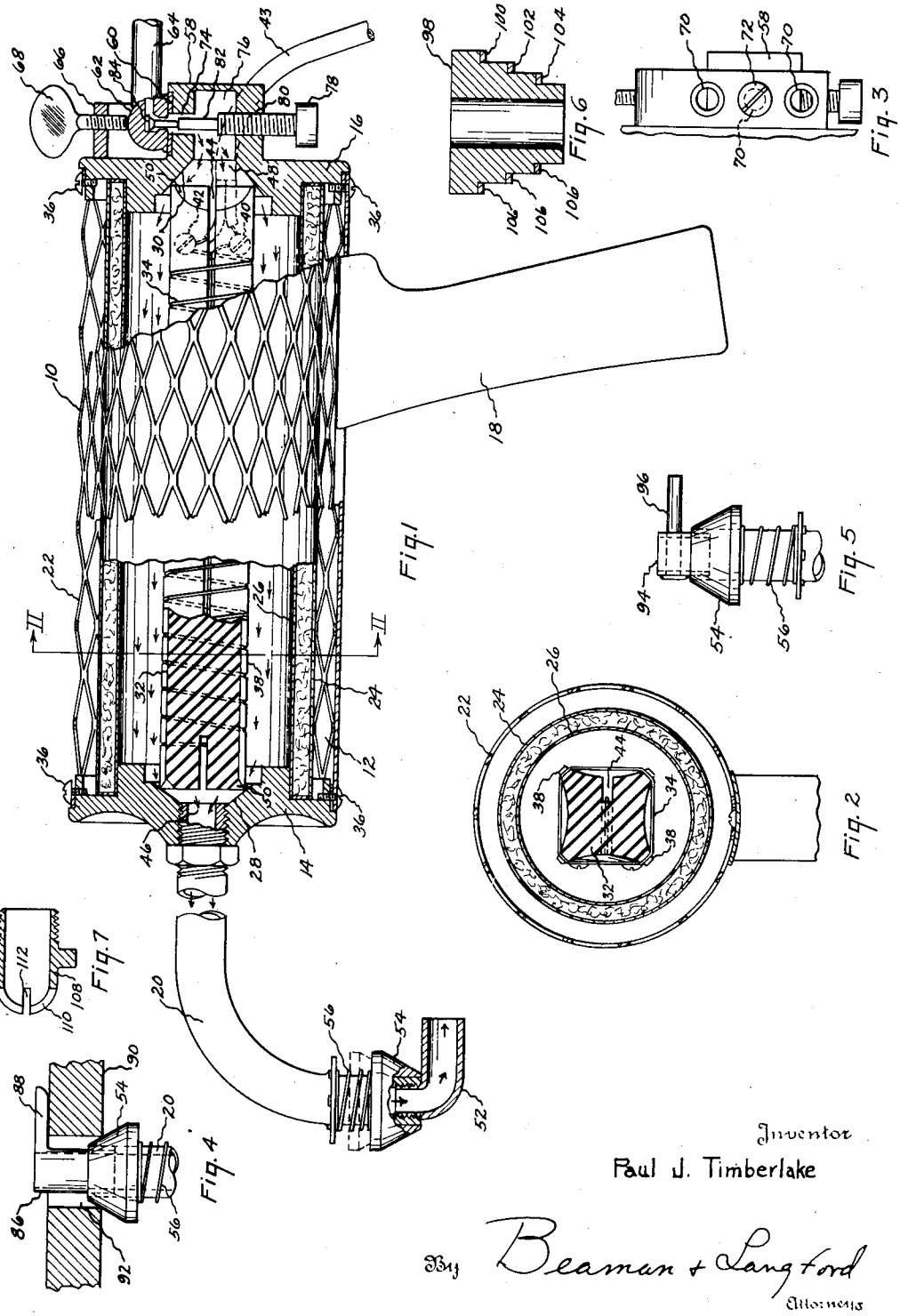


Fig. 1

Fig. 6

Fig. 3

Fig. 5

Fig. 2

Fig. 7

Fig. 4

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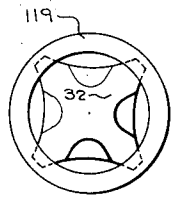


Fig. 8

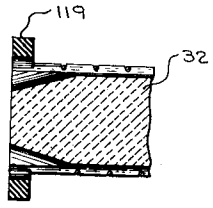


Fig. 9

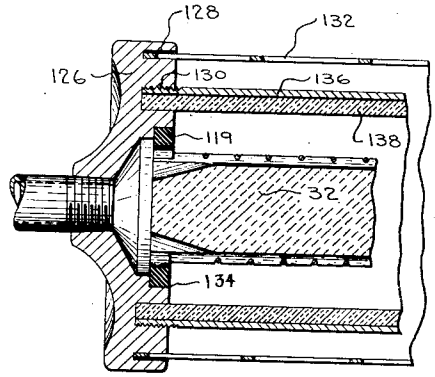


Fig. 10

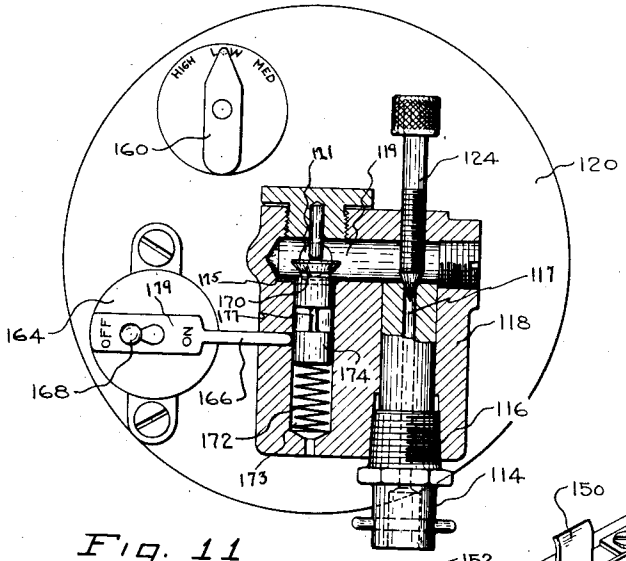
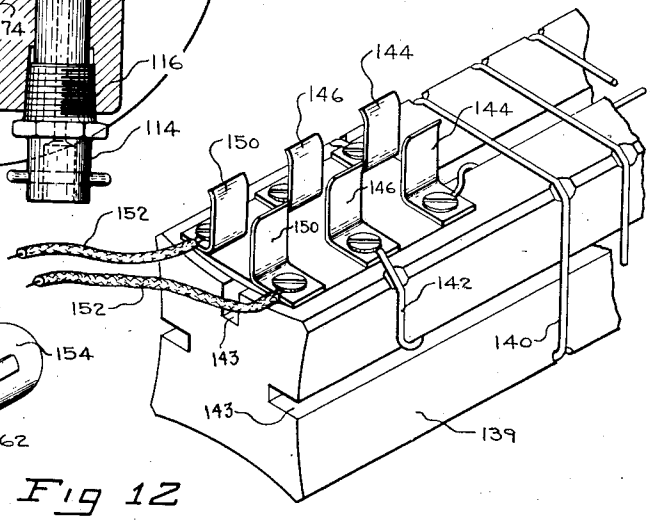


Fig. 11



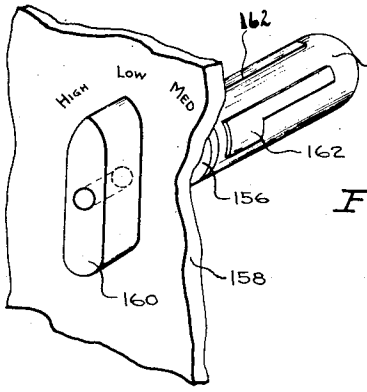


Fig 12

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2,120,583

AIR HEATER

Paul J. Timberlake, Jackson, Mich.

Application October 16, 1936, Serial No. 105,917

6 Claims. (Cl. 219—39)

The present invention relates to improvements in portable air heater construction and has particular reference to air heaters especially adapted for use in connection with the service of automobiles and the like. While concerned broadly with apparatus for heating and discharging a stream of air under pressure, the design of the present invention as herein illustrated is particularly suitable for the uses advocated in United States Patent No. 1,997,039 of the air heater disclosed therein.

Briefly my improved heater construction comprises a portable framework within which is supported a removable carrier supporting one or more resistance heat elements. At one end of the framework, structure is provided for connecting the interior of the heater with a source of air under pressure while at the opposite end a nozzle distributes the heated air as it leaves the chamber surrounding the carrier for the resistance element. One aspect of the invention consists of the novel arrangement of the parts going into the construction of the framework of my heater which expedites assembly and reduces cost of production. Another is present in the novel construction of the removable carrier supporting the resistance heating element which gives efficient and rapid heating of the air and prolongs the life of the heating element. Other features of the invention include the air coupling and air adjustment structures.

In the drawings:

Fig. 1 is a side elevational view partly shown in broken cross-section of one form of air heater embodying the present invention,

Fig. 2 is a cross-sectional view through the barrel of the air heater taken on the line II—II of Fig. 1,

Fig. 3 is a fragmentary side elevational view of the clamping yoke showing its adjustability for various sizes of air chucks,

Figs. 4 and 5 are side elevational views of modified types of attachment tips,

Fig. 6 is a cross-sectional view of a stepped conical shaped collar for use in connection with the attachment tip,

Fig. 7 is a cross-sectional view of another form of tip to be used with the air heater,

Fig. 8 is an end view of the carrier with an insulated spacing ring connected thereto,

Fig. 9 is a vertical cross-sectional view taken on the center line of Fig. 8,

Fig. 10 is a fragmentary cross-sectional view similar to Fig. 1 of another form of barrel and assembly construction with the carrier construction shown in Figs. 8 and 9 shown in assembled position,

Fig. 11 is an end view partly shown in cross-section of the barrel construction showing mechanism for controlling the heat and air supply to the heater, and

Fig. 12 is a broken perspective view showing a suitable arrangement for controlling the heating capacity.

In the form of the invention illustrated in Fig. 1 the heater **10** comprises a cylindrical barrel generally designated **12**, headers **14** and **16**, a handle **18** and a nozzle **20**. The barrel **12** is preferably fabricated from a tube **22** of expanded metal concentrically disposed in spaced relation from a sheet metal tube **24**. Likewise concentrically arranged within and spaced from the tube **24** is a tube **26**, the space between the tubes **24** and **26** is shown as filled with a suitable insulating material such as loose asbestos. Support is given the spaced tubes **22**, **24** and **26** through cylindrical shoulder portions upon the headers **14** and **16** which are preferably of cast metal. Opposed conical recesses **28** and **30** are provided in the headers **14** and **16** to support opposite ends of the carrier **32** upon which is wound the electrical resistance heating element **34**. The tubes **22**, **24** and **26** and the carrier **32** are maintained in their assembled relation by screws **36** or other suitable fastening instrumentalities securing the ends of the tube **22** to the headers **14** and **16**. By removing the screws **36** all the parts supported between the headers **14** and **16** may be removed. This arrangement enables the parts to be readily replaced and greatly simplifies the assembly and reduces the cost thereof. The specific construction of the carrier **32** and the manner in which the heating element is wound thereon is an important feature of the invention. As shown in Figs. 1 and 2 the carrier **32** has a fluted outer surface upon which the heating element **34** is spirally wound. Preferably the ridges **38** between adjacent flutes are notched along an interrupted spiral path to receive the element **34** thus preventing the same from shifting axially of the carrier **32** during use. With such a construction as will be clearly understood from Fig. 2, the major portion of the heating elements **34** will be spaced from the surface of the carrier **32** affording access of the air to be heated to all sides of the heating element **34** spaced between the ridges **38**. The terminals for the heating elements **38** are shown at **40** and **42**. To expedite the winding of the carrier **32** and to avoid imbedding any portions of the same, an axially

extending groove 44 is provided along which the heating element extends from the terminal 40 to the left end of the carrier 32 as viewed in Fig. 1 to the starting point of the spiral winding extending back to the terminal 42. The carrier 32 may be of any suitable insulating material and is preferably molded as an integral section. A suitable electrical connector 43 extends through a seal (not shown) in the header 16 and is connected to the terminals 40 and 42. The connector 43 in most cases will be provided with a suitable plug for connection to the electrical outlet. As the recesses 28 and 30 in which the carrier 32 is supported merge with the air outlet 46 and air inlet 48, respectively, it is desirable to bevel the ends of the carrier 32 as at 50 to provide adequate opening for the passage of air. In production the carrier 32 is loosely supported in the recesses 28 and 30 so as to provide for any axial expansion that may take place upon heating and thus avoiding any warping of the carrier 32 or distortion or loosening of the barrel 12.

The outlet 46 is threaded to receive various nozzles and conduit structure. As illustrated in Fig. 1 a nozzle 20 is provided which is particularly adapted for use in connection with the warming of grease to be removed from a differential housing of an automobile. A tip 52 is threaded into the end of the nozzle 20 for insertion into the usual opening in the differential housing. The conical shaped plug 54 functions to seal such opening under the stress of the spring 56 so as to assist in developing a pressure within the housing for forcing the warm grease from the differential through the drain opening. The tip 52 is preferably deflected at right angles to the axis of the connector plug 54 to enable the tip to be hooked behind the adjacent wall structure defining the opening in the differential housing.

As the heater shown in Fig. 1 is particularly designed to be used in garages and service stations for automobiles equipped with air pressure, the heater 16 has an integral projection 58 upon which there is provided a seat 60 for an air chuck 62 of well known construction imposed in the air line 64. For clamping the chuck 62 to the seat 60 a yoke 66 is provided in which a thumb screw 68 is carried for engaging with the chuck 62. To accommodate the various size air chucks that are found in use on the market the yoke 66, as shown in Fig. 3, has a plurality of vertically aligned openings 70 in which the attachment screws 72 may be selectively inserted to fasten the yoke 66 to the projection 58 in varied adjustment with respect to the position of the screw 68 with reference to the seat 60. The seat 60 embraces an opening 74 which communicates with the chamber 76 opening into the recess 48. Admission of air and regulation of the quantity of air to the heating chamber is controlled by an adjustment screw 78 threaded in the projection 58 at 80. The end of the screw 78 is shown reduced at 82 to engage and lift the poppet valve 84 from its seat to permit flow of air through the air line 64 into the interior of the heater. By regulating the screw 78 the amount of air admitted past the valve 84 may be controlled. The path of the air through the heater and nozzle 20 is indicated by the arrows.

In Fig. 4 a modified form of tip 86 is shown which is threaded into the nozzle 20 in a manner similar to that shown in Fig. 1 but in lieu of being angularly disposed to the axis of the conical plug 54 it is provided with an integral projection 88 which engages back of the wall 90 adjacent the wall structure defining the opening 92 which may be that found in the differential of an automobile. The tip arrangement 94 shown in Fig. 5, in lieu of the integral projection 88, a rivet 96 has been passed through the end of the tip 94 to provide a suitable hooking construction for engagement with the wall structure adjacent the opening through which the tip may be inserted. A modified construction 98 is shown in Fig. 6 which in lieu of having a smooth conical surface as the plug 54 a series of stepped circular shoulders 100, 102 and 104 are provided equipped with gaskets 106 to enable the plug to be used with various size openings and give a more effective air seal than may be found possible with the conical plug 54. In Fig. 7 a tip construction 108 is shown which may be threaded into the nozzle 20 in the manner of the tip 52 where it is desirable to spray the heated air against an object to be warmed up or thawed out. To get a good distribution of the air the tip 108 may have slots 110 and 112 at right angles to fan out the air as it passes through the nozzle.

In Figs. 8 and 9 an insulating ring 119 of non-absorbing material such as mica, porcelain and the like is shown fitted over an end of the carrier 32 for the purpose of further insulating the electrical heating element from the cast headers 14. This precaution may be advisable in cases where the carrier 32 is made up from a molded insulating material containing asbestos or similar material which may absorb sufficient moisture to become a conductor. As will be understood a ring 119 will be used at opposite ends of the carrier 32. In Fig. 10 the modified carrier construction in Figs. 8 and 9 is shown supported in position upon one of opposing headers 126 provided with circular slots 128 and internally threaded circular slots 130. In assembling the parts defining the barrel construction the expanded metal tube 132 is merely inserted in the slot 128 and with the insulating rings 119 at opposite ends of the carrier 32 loosely received in the opposed recesses 134 the tube 136 is threaded into the headers 126 which will tie the headers and barrel defining parts together in assembled relation. In lieu of having two sheet metal tubes for defining the space in which the insulating material is housed as shown in the construction of Fig. 1 a molded tube 138 of suitable insulating material is shown externally supported within the tube 136 but without any internal support other than its own bond. I have also found it practical to use the insulating tube 138 without the supporting and shielding tube 136 and holding the parts in assembled relation in the manner shown in Fig. 1. Such a construction may be very cheaply manufactured as the heater would consist primarily of an insulated carrier for the heating element and a tube of insulated material defining a chamber within which the carrier is supported by the perforated metal outer shield and spaced headers.

As it is desirable that air be circulated to the heating chamber at all times while the heating element is in a closed electrical circuit to avoid overheating, one suitable arrangement is shown in Fig. 11 for accomplishing this result and making it impossible for the operator to close the electrical circuit in which the heating element is located without first having air under pressure flowing through the heating chamber. As illustrated 118 and 120 correspond to the projection

58 and the header 16 of the construction shown in Fig. 1. The heater construction is shown adapted to a different form of air chuck from that shown in Fig. 1 in which the connection is made a bayonet lock. As shown the male member 114 carrying a coupling pin is threaded at 116 into the projection 118. With this type of air chuck at the time the air line is coupled to the member 114 air will be delivered through the conduit 117 which will be regulated by the shut off and adjustment needle valve 124. From the conduit 117 the air under pressure will pass through the conduit 119 and into the heating chamber through the conduit 121. Subject to the pressure in the conduit 119 is a piston having a conical head 170 and a body portion 174 supported for movement in a bore 173. The piston is loosely supported in the bore 173 and is lightly held in a raised position by a spring 172. When air under pressure is passing through the chamber 119 the piston will be lowered until the conical head 170 engages with a complementary seat 175 to seal the bore 173. This movement will position a reduced portion 177 of the piston in alignment with the pin 166 connected to a slide 179 reciprocated by movement of the button 168 of the toggle switch 164 of well known construction. With this construction it will become apparent that the button 168 can only be rocked to the "on" position when the air pressure is on and the restricted portion 177 is in alignment with the pin 166. It will be understood that the switch 164 is located in the electrical circuit in which the heating element is contained.

In Fig. 12 is shown an arrangement which may be used in connection with my improved heater if it is desired to have a regulation in heating capacity. This may be accomplished by winding the carrier 139 with two separate resistant heating coils 140 and 142 longitudinally spaced along the carrier 139 and terminating in spring terminals 144 and 146, respectively, these terminals being supported on the surface of the carrier 139. As in the case of the carrier 32, the carrier 139 is shown fluted and provided with longitudinally extending grooves 143 through which the electrical resistance elements are passed for insulating the terminal ends of the heating coils and for spacing the separate heating elements from each other. Suitable spring terminals 150 connect with the lead-in conductors 152 which may extend to the switch 164. For selectively connecting the elements 140 and 142 into the electrical circuit either in parallel, together or separately, or in series with each other to give high, low and intermediate heat, a contact drum 154 is provided which may be in the form of a bushing of insulating material pressed over a metal core 156 which extends through the wall of the header 158 and has connected at the outer end a button 160 which may be manually turned to selectively rotate the drum 154. For placing the elements 140 and 142 within the electrical circuit suitably arranged contactor plates 162 are secured to the surface of the drum 154 which upon rotation of the drum 154 through the turning of the button 160 are brought into engagement with the spring terminals 140, 146 and 150 in their proper sequence to give high, low and medium heats. Preferably the conductors 152 have a suitable snap switch such as 164, as shown in Fig. 11, interposed between the terminals 150 and the electrical outlet so as to avoid any arcing that might result from the type of switch construction shown in Fig. 12 if the same were employed to make and break the electrical circuit.

It is to be understood that the construction shown in Fig. 1 is extremely simple and effective in operation and may be manufactured and marketed at relatively low cost. The control of the heating capacity by the construction shown in Fig. 12 and the safety structure shown in Fig. 11 may be included if desired but are not essential for successful operation of the heater.

I claim:—

1. In an air heater of the class described, an elongated air chamber through which air to be heated is directed, walls at opposite ends of said chamber having recesses defined therein, air inlet and discharge passages defined in said walls and opening into said recesses, a carrier supported at opposite ends of said recesses and in said chamber having ridges defined on the surface thereof, said carrier and recess being so shaped as to direct the air flow along the outer side of said carrier and an electrical heating element imposed over and bridging said ridges so as to space the major portion of said element from the surface of said carrier and to dispose the same into the air stream through said chamber.

2. In the heater of the class described, a pair of end members having centrally disposed recesses therein, a carrier member having an electrical heating element supported thereon directly and axially supported from opposite ends in said recesses, an air inlet opening into one of said recesses and an air outlet opening out of the other of said recesses, means for directing air to and from said inlet and outlet, said carrier being removably supported, said carrier and recesses being shaped to provide openings directing the air flow substantially uniformly along the outer side of said carrier, and means supporting said end members in spaced relation and defining a chamber about said carrier.

3. In an air heater of the type described, an air inlet including a seat embracing the outer end of said inlet and adapted to receive an air chuck, means disposed over said seat, an adjustable clamp supported in said means and adapted to be brought into engagement with an air chuck to hold the same to said seat, an adjustment screw adapted to engage with the valve of an air chuck supported on said seat to open the same and regulate the amount of air admitted to the heater, and means supporting said adjustment screw for movement relative to said seat.

4. In an air heater of the type described, spaced end members, a central heating unit entirely and directly supported from said members, a non-metallic tube of insulating material embracing said unit in spaced relation throughout and defining therewith an uninterrupted tubular chamber, shoulder portions upon said members for supporting said tube independently of said unit, and an outer metal tube for spacing the said members and for holding said members and insulating tube in assembled relation, said insulating tube being relieved of all structural function by said metal tube and being shielded thereby, said insulating tube and unit being assembled and disassembled through relative spacing of said members.

5. In an air heater, the combination of a heating chamber, a conduit for conducting air under pressure into said chamber, means actuated by air pressure and moved from one position to another thereby, manually actuated switch mechanism, and means actuated by said switch and

coacting with said first means resisting movement of said switch with said first means in one position and being ineffective to resist movement of said switch in another position.

6. A heater of the type described comprising a pair of separate vertical end members, centrally located axially aligned recesses defined in the inner opposed faces of said members, shoulder portions concentric with said recesses defined outwardly therefrom in said faces, one of said members having an air inlet opening through its wall into one of said recesses, the other of said members having an air outlet extending through its wall out of said other recess, an elongated electrical insulating core of substantially uniform cross section having its opposite ends directly engaging and supported in said recesses, said core having telescoping engagement within the recesses of said members whereby assembly may be effected merely by axial displacement of said members, an electrical heating unit upon said core, an elongated heat insulating tube in which said core is concentrically located, said tube likewise having telescoping relation at opposite ends with said shoulder portions and assembled in the manner of said core, said tube forming with said core an elongated chamber of unobstructed uniform cross section into which said heat unit projects, said recesses and said core being shaped to provide air passages between the ends of said core and the defining walls of said recesses whereby the air flows uniformly along the outside of said core in entering and leaving said chamber.

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