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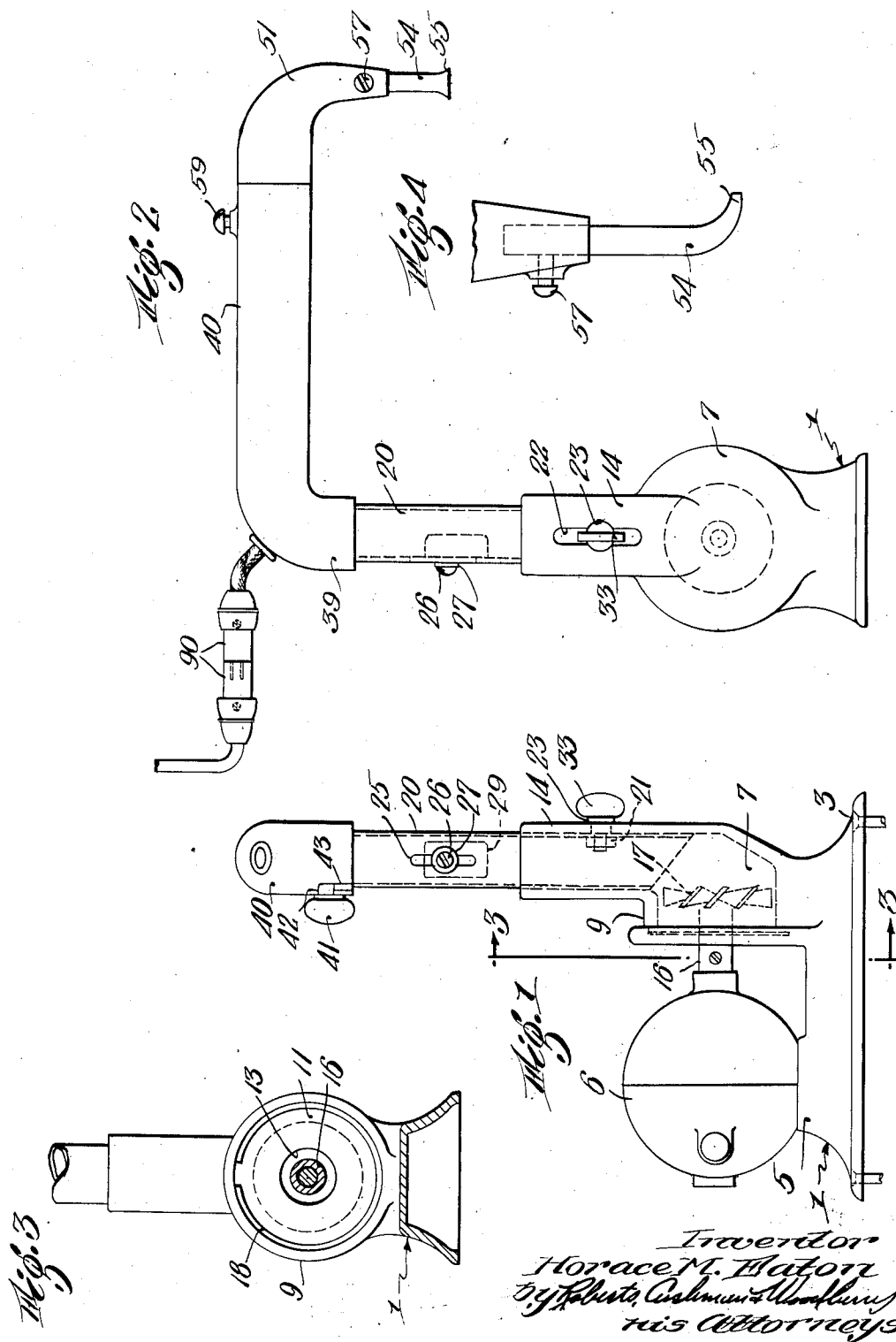
H. M. EATON

1,991,734

AIR JET APPARATUS

Filed Dec. 2, 1930

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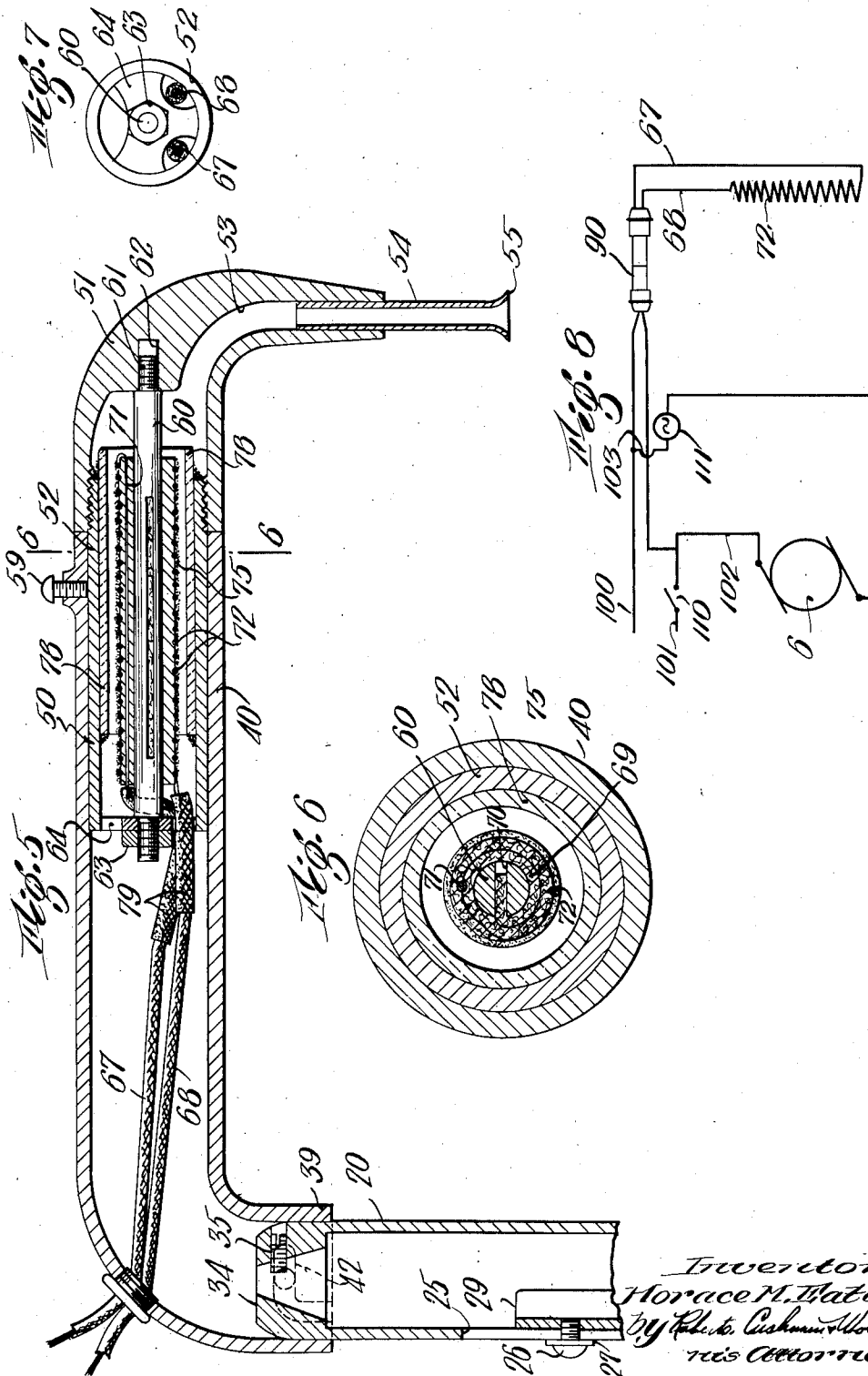
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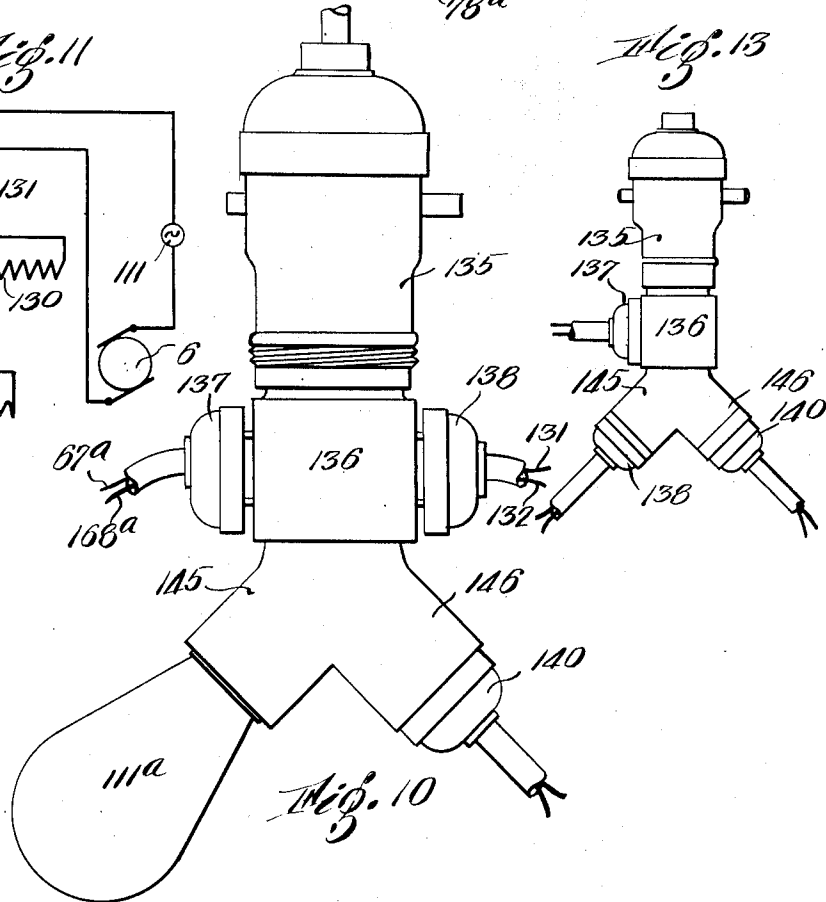
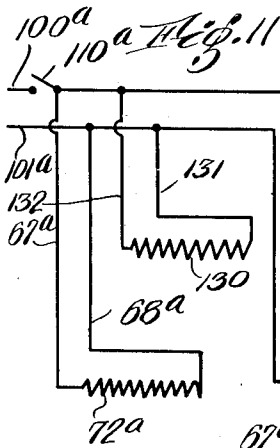
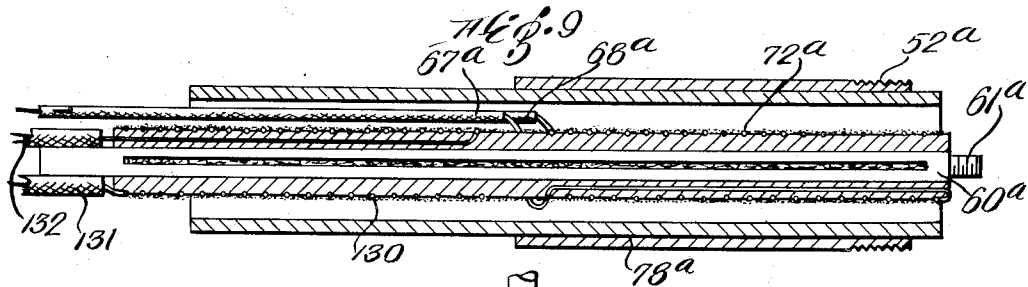


Fig. 13

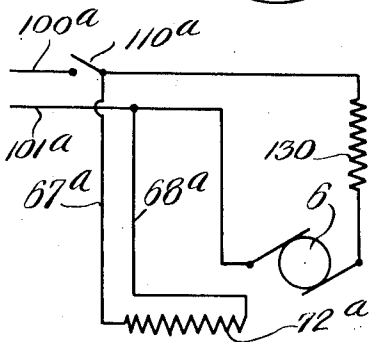
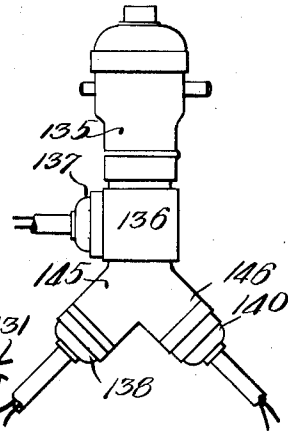


Fig. 12

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UNITED STATES PATENT OFFICE

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AIR JET APPARATUS

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Application December 2, 1930, Serial No. 499,466

12 Claims. (Cl. 219—39)

This invention relates to an improved type of hot air jet apparatus which may be used for softening heat plastic adhesive preparatory to the joining together of two articles by said adhesive.

5 This apparatus is particularly applicable to the softening of thermoplastic cement on French cord binding which is applied to shoe uppers, and the apparatus may be conveniently employed as an accessory for the folding machines which are
10 used for this purpose in shoe factories.

While hot air jet devices have been previously employed for this purpose, they have been expensive to install and have generally not afforded satisfactory control for either the air pressure
15 or the heat of the air jet. Many of these devices have been supplied with compressed air from a central pressure tank, thus necessitating the installation of a large amount of piping extending to the various folding machines. This arrangement causes varying air pressure at the different
20 machines which has to be regulated by individual control valves at each machine. Under some conditions moisture condenses in the piping and thus moisture or steam may be deposited on the
25 melted adhesive and destroy its tackiness. Each machine of this type has its own heating unit and is provided with a rheostat for regulating the heat. These rheostats are expensive and the manual control afforded thereby is often im-
30 properly used by the operator, resulting in the employment of excessive heat and sometimes causing liquefaction of the adhesive coating and staining of the binding ribbon.

It is an object of the present invention to reduce the cost of this accessory for any heat plastic pressing device, and to decrease the trouble and cost of installation as well as affording economical operation, while affording a satisfactory control of air pressure and the proper amount
40 of heat without necessitating the employment of a rheostat which is likely to be misused by the operator.

To permit these desirable results, a separate device is supplied for each operator and includes
45 a motor, an air impeller, and a heating unit, the motor and heating unit being in the same electric circuit and arranged to be controllable by a common switch; thus each of these devices may be energized by providing a single connection to the ordinary factory lighting circuit. A device
50 of this character may be secured to the bench adjoining the folding machine or the like by ordinary fastening elements, such as screws, and merely requires connection to the lighting circuit, so that the device may be installed at a very

low cost and without necessitating skilled labor, individual fitting of parts, etc. Preferably the device is provided with a plurality of adjustments to locate the hot air nozzle in substantially any desired position, so that the nozzle outlet may be
5 juxtaposed to the coated ribbon as it passes to the point of application as, for example, to the folding machine. Furthermore, this device preferably is provided with means properly to regulate the air supply and yet to permit efficient
10 employment of the amount of air which is supplied by the impeller to the heating unit by avoiding objectionable back pressure.

One important aspect of my invention relates to the provision of a heating unit which may be
15 designed or calibrated to conform to the particular voltage available in the local lighting circuit to give the appropriate amount of heat. This unit is readily interchangeable with other similar units of different resistance capacity, so
20 that by merely employing the proper one of a graduated series of these units, the proper amount of heat may be supplied to meet the requirements of any local conditions. A further
25 aspect of the invention relates to the arrangement of this heating unit and the adjoining air passage or passages, so that high thermal efficiency is realized as the air passes the unit on its way to the nozzle.

A further aspect of my invention relates to
30 the provision of a heating unit which may comprise two electrical resistance elements, one of which may be disposed adjoining the nozzle and provide a main heating element, while a secondary heating element may be disposed adjoining
35 the main element, but further from the nozzle, and may be arranged in series with the motor if desired. This arrangement permits proper control of the motor speed, and yet economy in the current consumed, since the heat which would
40 normally be wasted by a motor rheostat is employed in heating the air. Furthermore, detachable connections may be associated with the leads so that when more intense heat is desired
45 the secondary resistance element may be connected in parallel across the main circuit rather than being disposed in series with the motor; under these conditions another resistance element, such as a light, may be disposed in the
50 series with the motor.

In the accompanying drawings:

Fig. 1 is a rear elevational view of my improved air blast device;

Fig. 2 is an end elevation of the same;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is an elevational detail of the nozzle;

Fig. 5 is an enlarged section indicated by line 5—5 of Fig. 1;

Fig. 6 is an enlarged section on line 6—6 of Fig. 5;

Fig. 7 is an end view of a portion of the heating unit;

Fig. 8 is a wiring diagram;

Fig. 9 is a transverse section of a portion of the device, showing an optional form of heating unit;

Fig. 10 is an elevational view of the socket connection, which may be employed in conjunction with the heating unit of Fig. 9;

Figs. 11 and 12 are wiring diagrams showing optional connections for the heating unit illustrated in Fig. 9; and

Fig. 13 illustrates an optional arrangement of the connection shown in Fig. 10.

Referring to the accompanying drawings, which illustrate the invention, the numeral 1 designates a metal base which may conveniently be in the form of an aluminum casting, and which is adapted to be secured to the bench upon which a folding machine is located by screws 3, extending through openings at the corners of the base. The base 1 preferably provides a support 5 for a small motor 6, which may conveniently be a universal motor. This motor is operable upon either direct or alternating current; it may have a rated capacity of the order of 1/100 of a horsepower, and ordinarily is supplied without any speed controlling means incorporated therein. A hollow extension 7 of the base provides an impeller housing 9 which has an open end adjoining the motor; a cover plate 11 normally is disposed in this opening and provides a central air inlet opening 13 about the drive shaft 16. A spring wire ring 18 normally engages an annular flange upon the housing 7 to hold the cover 11 in place, while permitting its ready removal when desired.

Disposed within the housing 7, I preferably provide an impeller 17 of the propeller type which may be inexpensively stamped out of a single disk of sheet metal. This type of impeller is not only very economical to manufacture, but it gives excellent aerodynamic efficiency with a motor of the type indicated. The extension 7 of the base also provides an integral upright outlet tube 14 adjoining the fan or impeller and communicating with the casing 9 so that air from the impeller passes upwardly into the tube 14. A slidable riser duct 20 is mounted in telescopic engagement with the tube 14. The latter is provided with a vertical slot 22 through which the shank of a thumb screw 33 extends, this thumb screw being in threaded engagement with the tube 20 and with a nut 21 welded onto the same, and being provided with a clamping washer 23. Thus an adjustment is provided to permit ready alteration of the vertical positioning of the duct 20 in relation to the tube 14 while permitting the proper clamping of the former in the desired adjusted position.

Disposed in one side of the riser duct 20 is a vertical slot 25 which receives the shank of a screw 26 provided with a clamping washer 27 engaging the wall of the duct at the sides of the slot. The inner end of the screw 26 is in threaded engagement with a curved closure plate 29 which normally is held against the inner face of the duct 20 (Fig. 5). Loosening of the screw 26 permits vertical adjustment of the plate 29 in

relation to the vent slot 25 so that the effective opening provided by the slot may be varied.

In the upper end of the duct 20, I provide an annular member 34 having a central upwardly converging air passage. A valve screw 35 is threaded into an opening in the upper part of the duct 20 and into the annulus 34 so that the movement of this screw into and out of the central opening in the annulus may vary the effective cross section of the air passage afforded thereby, thus permitting a variation in the resistance to air flow and in the amount of air which passes out of the upper end of duct 20.

A crossarm or casting 40 has a down-turned end portion 39 disposed in interfitting engagement with the upper end of the tube 20. The inner end of a thumb screw 41 is in threaded engagement with the upper end of tube 20 and its shank extends through a substantially horizontal slot 42 in the depending portion of the tube 40, this slot being connected to a vertically disposed slot 43 which extends downwardly to the lower edge of this portion of the casting. This arrangement permits the ready removal of the casting 40 from the riser duct 20 when desired, thus, for example, allowing adjustment of valve screw 35, and permits angular adjustment of the casting in relation to the vertical axis of the riser duct. In normal operation the clamping screw 41 is effective in holding the casting in the proper angular position.

Disposed within the casting 40 is a heating unit, designated generally by numeral 50, through which the air passes to an elbow 51 which is threaded onto the sleeve 52 within casting 40. This elbow provides an air passage 53, in which the upper end of the nozzle tube 54 is received. The latter may conveniently be in the form of a copper tube with a suitably shaped end portion 55 to afford an air outlet of suitable proportions to conform to the width of the thermo-plastic coating which is to be softened. A screw 57 in the lower end of elbow 51 serves to hold the nozzle in proper place, while permitting additional adjustment if desired.

The heating unit 50 is disposed within the metal sleeve 53 which has a sliding engagement with the casting 40 and which is normally clamped in position by the screw 59. Within the sleeve 52 is a central metal rod 60 which has a threaded end portion 61 engageable in a threaded recess 62 in the elbow 51. A clamping nut 63 is in threaded engagement with the opposite end of the rod and normally clamps a metal spider 64 against a shoulder upon the end of the rod. This spider preferably fits within the end of sleeve 52 and provides three openings, one of which adjoins the upper part of the sleeve 52. Electrical leads 67 and 68 may extend into the casting 40 and through the two lower openings provided by the spider into the sleeve 52. These leads are connected to the heating element which may conveniently comprise a spiral winding of high resistance wire insulated from the central rod 60. For this purpose, I may employ material such as asbestos paper 69 which as shown in Fig. 5 has one end engaged in a diametric slot 70 in the rod 60, and which is wound thereabout to afford an insulating covering. A portion 71 of the resistance wire 72 is then disposed longitudinally of the rod upon the first paper winding and a successive paper winding is then supplied to entirely enclose the wire portion 71 within the asbestos paper. The wire is then coiled about the outer layer of asbestos paper so that the end

of the coil may be juxtaposed to the spider 64. The wire coil is then coated with a suitable electrical insulating cement 75. This heating element is located within a porcelain tube 78 that is disposed within tube 52 and cemented thereto. The leads 68 and 67 joined to the ends of resistance wire 72 are provided with protective sleeves or stockings 79 where they pass through the openings provided by spider 64. The outer ends of leads 67 and 68 are connected to one portion of a conventional plug connection 90, (Fig. 2) which permits the convenient connection and disconnection of the leads when desired.

It is thus evident that the heating unit may be removed and another unit substituted therefore by loosening the clamping screw 59 and disconnecting the leads 67 and 68 from the connection 90 by loosening the conventional connecting screws. The elbow 53 and metal tube 52 may then be disengaged from the casting 40 and the rod 60 may be screwed out of engagement with elbow 53, thus permitting the heating unit to be removed and replaced by another interchangeable unit with different electrical resistance.

Referring to the wiring diagram of Fig. 6, the leads 100 and 101 may be connected to a suitable socket plug that is inserted in any suitable outlet from the conventional lighting circuit. I have found that the voltages of such circuits vary widely and that it is desirable to employ different heating units in conjunction with different voltages. The leads 100 and 101 may be provided with branches 102 and 103 respectively which are included in the motor circuit. A universal motor without speed control may run at as high a speed as 15,000 R. P. M. when directly connected to the lighting circuit. Such a high speed is not desirable and would necessarily cause rapid wear of the motor bearings. Furthermore, the motor under these conditions will consume about 20 watts. I therefore find it advantageous to dispose an incandescent light 111, which may be of 25 or 40 watts rating, in series with the motor, this light being shown in the lead 103. Under these conditions, the motor and light together may consume only about 9 watts of current, and the light is dimly energized to afford a visual indication that the current is on. Leads 100 and 101 are connected to the leads 67 and 68 by the detachable connection 90, thus supplying current to the heating element 72. It is thus evident that but a single control switch 110, which may be provided in the lead 101 and which may be associated with the socket connection, is necessary in order to control the operation of the motor and heating unit. Thus under normal operating conditions after the machine has been properly adjusted and the proper size of heating unit has been determined and installed, it will only be necessary for the operator to close the switch 110 in order to cause the heating of the air. The motor having the light in series therewith runs at a normal speed which may be of the order of 2500 R. P. M. and the air is drawn into the impeller housing through the opening 13, being blown upwardly through tube 14 into the riser duct 20. Due to the resistance to air flow provided by the heating unit, a certain back pressure tends to develop, which is relieved by the vent 25, proper adjustment of the size of the opening provided by this vent, preventing undesirable back pressure and properly regulating the amount of air vented to permit the proper flow of air out of the nozzle 54. The valve screw

35 is also effective in permitting more accurate control of the air flow. The air passing into the casting 40 flows through the openings provided by the spider, and particularly through the opening adjoining the upper part of sleeve 52. Thus the major portion of the air passes into the porcelain tube 78 above the heating element where the major portion of the heat is received. From the heating unit the air flows through the passage 53 in the elbow 51 into the nozzle 54 being forced out of the latter in a concentrated high temperature jet. This nozzle may be juxtaposed to the coated tape as it passes to the folding device, for example when its coated portion is disposed in a substantially vertical plane. Thus sufficient heat is supplied to soften the thermo-plastic cement and any possibility of excessive heat is avoided since the heating effect provided by the heating element is fixed and may not be made excessive due to adjustment of a control rheostat.

An optional form of heating unit is illustrated in Fig. 9. This heating unit comprises a rod 60^a of the same general type as the rod 60, and provided with a threaded end portion 61^a corresponding to the portion 61 of the rod 60, and adapted similarly to engage the threaded recess 62 in elbow 51. This heating unit is similarly provided with a metal sleeve 52^a which receives a porcelain tube 78^a. A main heating coil 72^a is arranged adjoining the threaded end portion 61^a of the rod 60^a, and may be similar to the heating element 72 described with reference to Fig. 5. Another heating coil 130 is also disposed upon the rod 60^a and in insulated relation thereto. Leads 67^a and 68^a connect the coil 72^a with the source of current supply, while leads 131 and 132 are similarly arranged to energize the coil 130. If desired the leads 67^a and 68^a may be disposed in the insulating material and within coil 130, thus affording a larger air passage. An arrangement of this character may be employed in conjunction with a standard four-way electrical connection 136 (Fig. 10) that is engageable in a standard lighting socket 135. The leads 67^a and 68^a to the main heating coil 72^a are connected to one side of the four-way connection by a plug element 137, while the leads 131 and 132 may be connected by a similar plug connection 138 to the other side of the connection 136. The sockets 145 and 146 of the connection 136 are preferably wired in series, and one of these sockets may receive a light 111^a, while the other may receive a plug 140 connected to the motor 6. The wiring diagram for this arrangement is shown in Fig. 11, the leads 101^a and 100^a being connected to the main lighting circuit, and the single switch 110^a, which may be associated with the socket 135, being effective to control the flow of current to all of the electrically energized elements. As shown, the main heating coil 72^a may be disposed across the line, being supplied with the full voltage of the lighting current by the leads 67^a and 68^a. Similarly, the secondary heating unit 130 may be disposed across the line to receive the full voltage of the lighting circuit, the light 111^a and the motor 6 being arranged in series. Thus the light is energized to give an indication that the switch 110^a is closed, and that the device is in its operating condition, while excessive speed of the motor 6 is prevented. With this arrangement the coils 130 and 72^a are effective in providing a relatively high heat when desired.

The arrangement also may be readily changed

to permit the coil 130 to be in series with the motor. The arrangement of the connections for this purpose is shown in Fig. 13, and the wiring diagram of Fig. 12. Under these conditions the leads 67^a and 68^a to the main coil 72^a remain connected across the line. The plug 138 is disconnected from the side of the connection 136 and is connected to the socket 145 in place of the light 111^a so that the resistance 130 is in series with the motor, it being understood that the heating element 130 will be chosen to have a resistance substantially corresponding to that of light 111^a. Fig. 12 shows the wiring diagram for this arrangement which permits economy in the use of current, since the resistance which is desirable to reduce the speed of the motor is effective in aiding the heating of the air passing to the nozzle.

It is evident that heating units such as shown in Fig. 9 may be provided with different calibrated resistances or heating elements 72^a corresponding to the different voltages which are in different lighting circuits, and that these heating units may be readily interchangeable so that when the proper heating unit is chosen, no further adjustment is necessary. The leads 132 and 131 may be connected to the main circuit through a detachable plug connection similar to the connection 90 of Fig. 2, while the leads 67^a and 68^a may be similarly connected. Thus these leads may be readily disconnected to permit interchanging of heating units when desired.

The heating unit shown in Fig. 9 may be employed in a manner similar to the heating unit 50, and these heating units may be interchanged as desired. The heating unit shown in Fig. 9 is particularly effective where a high degree of heat is desired, affording maximum economy when the heating element 130 is in series with the motor, or permitting greater heat when the element 130 is connected directly across the main circuit. If desired, when this heating unit is cold and being initially energized, the unit 130 may receive the full line voltage, the plug 138 being connected to the side of connection 136, and there being no resistance or light connected to the socket 145. After the unit has thus been initially heated the plug 138 may be connected to the socket 145 and the motor thus started, or, if desired the resistance 130 may remain connected across the line and the light 111^a be inserted in the socket.

It is evident that a device of this character is inexpensive to manufacture and provides suitable control for the air supply, and permits the employment of a heating element or elements, the capacity of which is properly calibrated in accordance with the characteristics of the current supplied thereto. For example, the resistance elements 72 or 72^a may be provided in a graduated series of sizes which differ from each other by small amounts, for example, they may differ by substantially 5 watts of current consumption at the voltages ordinarily encountered in lighting circuits; thus choice of the proper unit to suit the local voltage permits the air jet to have the proper temperature with requiring a rheostat. Thus the element may receive the full line voltage, unnecessary waste of current is avoided, and the cost of a rheostat is eliminated as well as the possibility of its misuse and consequent excessive and harmful heating of the cement. Furthermore, after the proper adjustments of the vent opening 25 and the valve screw 36 have been made, and after the nozzle

54 has been properly positioned in relation to the path of the ribbon, no further attention is necessary upon the part of the operator, except to open and close the switch 110 and even the necessity of doing this may be indicated by the condition of the signal light 111. In other words, the operator can continue to feed material to the folding machine or the like while the heating of the thermo-plastic coating is automatically effected without requiring any attention upon the part of the operator.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Apparatus of the class described comprising a motor, an impeller driven by the motor, an impeller housing having an inlet, an outlet duct connected to the housing, a nozzle of restricted diameter at the end of said duct, an electrical heating unit in said duct adjoining the nozzle, said unit permitting the flow of air to the nozzle, but cooperating with the nozzle in affording resistance to air flow, and a vent of controllable size in said duct between the housing and unit.

2. Apparatus of the class described, comprising an air impeller, driving means therefor, a casing surrounding the impeller, an outlet duct communicating with the casing, a nozzle at the end of the duct, a heating unit in the duct arranged to permit the passage of air, said duct comprising a duct portion extending upwardly from the casing, a substantially horizontal portion containing the heating unit, and a downturned extension of the horizontal portion in interfitting engagement with the upper end of said duct portion, and swingable about the latter in a substantially horizontal plane, and means for clamping the horizontal portion in adjusted position in relation to said upwardly extending portion.

3. Apparatus of the class described comprising an air impeller, a casing surrounding the impeller, an individual motor driving the impeller, an upwardly extending duct connected to the casing, a horizontal duct forming a continuation thereof, a nozzle connected to the end of the horizontal duct, an electrical heating element disposed within said horizontal duct and arranged to permit the flow of air to said nozzle, said upwardly extending duct having a vent in the side thereof, and an adjustably mounted closure to vary the effective size of said vent.

4. Apparatus of the class described comprising an air impeller, a casing surrounding the impeller, an individual motor driving the impeller, an upwardly extending duct connected to the casing, a horizontal duct forming a continuation thereof, a nozzle connected to the end of the horizontal duct, an electrical heating element disposed within said horizontal duct and arranged to permit the flow of air to said nozzle, said upwardly extending duct having a vent in the side thereof, an adjustably mounted closure to vary the effective size of said vent, and an adjustably mounted valve member carried by one of said ducts and movable into the same to permit variation of the air flow to the nozzle.

5. Apparatus of the class described comprising an air impeller, a casing surrounding the impeller, an individual motor driving the impeller, an upwardly extending duct connected to the casing, a horizontal duct forming a continuation thereof, a nozzle connected to the end of the

horizontal duct, an electrical heating element disposed within said horizontal duct, and arranged to permit the flow of air to said nozzle, said upwardly extending duct having a vent slot in the side thereof, and an adjustably mounted closure to vary the effective size of said vent, the closure being a curved plate, and a screw threaded element extending through the slot and into said plate to hold the latter in position, and yet permit its movement to vary the effective size of the vent slot.

6. Apparatus of the class described comprising an air impeller, a casing surrounding the impeller, an individual motor driving the impeller, an upwardly extending duct connected to the casing, a horizontal duct forming a continuation thereof, a nozzle connected to the end of the horizontal duct, an electrical heating element disposed within said horizontal duct and arranged to permit the flow of air to said nozzle, said element being readily removable for replacement with interchangeable elements of different resistance, said upwardly extending duct having a vent in the side thereof, and an adjustable mounted closure to vary the effective size of said vent.

7. Apparatus of the class described, comprising a base, an impeller, an electric motor on the base driving the impeller, a casing surrounding the impeller, an upwardly extending outlet duct connected to the casing, a substantially horizontal duct connected to said outlet duct, a metal sleeve fitting within the end of said substantially horizontal duct, means clamping the sleeve within the duct, an elbow connection threaded onto the outer end of the sleeve, a nozzle carried by said elbow, and an electric heating element in said sleeve.

8. Apparatus of the class described, comprising a base, an impeller, an electric motor on the base driving the impeller, a casing surrounding the impeller, an upwardly extending outlet duct connected to the casing, a substantially horizontal duct connected to said outlet duct, a metal sleeve fitting within the end of said substantially horizontal duct, means clamping the sleeve within the duct, an elbow connection threaded onto the outer end of the sleeve, a nozzle carried by said elbow, and an electric heating element in said sleeve, said heating element comprising a rod threaded into engagement with the elbow, insulating material on the rod, and a coil of resistance wire-mounted on said material.

9. Apparatus of the class described comprising an air impeller, a motor driving the impeller, a casing surrounding the impeller, an outlet duct extending from the casing, a nozzle at the end of

said duct, an electric heating unit in said duct adjoining the nozzle, said unit comprising a main heating element and a secondary heating element, and leads connecting the main element, secondary element and motor with a source of electrical current, said leads being arranged so that the secondary element and motor are in series with each other and in parallel with the main heating element.

10. Apparatus of the class described, comprising an air impeller, a casing surrounding the impeller, an outlet duct for the casing, a nozzle section at the end of said duct detachable therefrom, and an electrical heating unit secured to said section, the unit including a central rod in screw-threaded engagement with said section, insulating material on the rod, and a wire coil disposed about said material, whereby the nozzle section may be removed to permit replacement of the heating unit by another unit of different electrical resistance.

11. Apparatus of the class described comprising an air impeller, a motor driving the impeller, a casing surrounding the impeller, an outlet duct extending from the casing, a nozzle at the end of said duct, an electric heating unit in said duct adjoining the nozzle, said unit comprising a main heating element and a secondary heating element, and leads connecting the main element, secondary element and motor with a source of electrical current, said leads being arranged so that the secondary element and motor are in series with each other and in parallel with the main heating element, and quick-detachable connections, whereby the main and secondary heating elements may be arranged in parallel, and whereby a resistance may be inserted in series with the motor.

12. Apparatus of the class described comprising an air impeller, a motor driving the impeller, a casing surrounding the impeller, an outlet duct extending from the casing, a nozzle at the end of said duct, an electric heating unit in said duct adjoining the nozzle, said unit comprising a main heating element and a secondary heating element, said unit including a central, removable rod, insulating material on the rod, the heating elements comprising coils wound about the rod, and leads connecting the main element, secondary element and motor with a source of electrical current, said leads being arranged so that the secondary element and motor may be in series with each other and in parallel with the main heating element.

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