March 16, 1937. E. R. ZADEMACH 2,073,669

DRIER

Original Filed Jan. 9, 1930 3 Sheets-Sheet 1

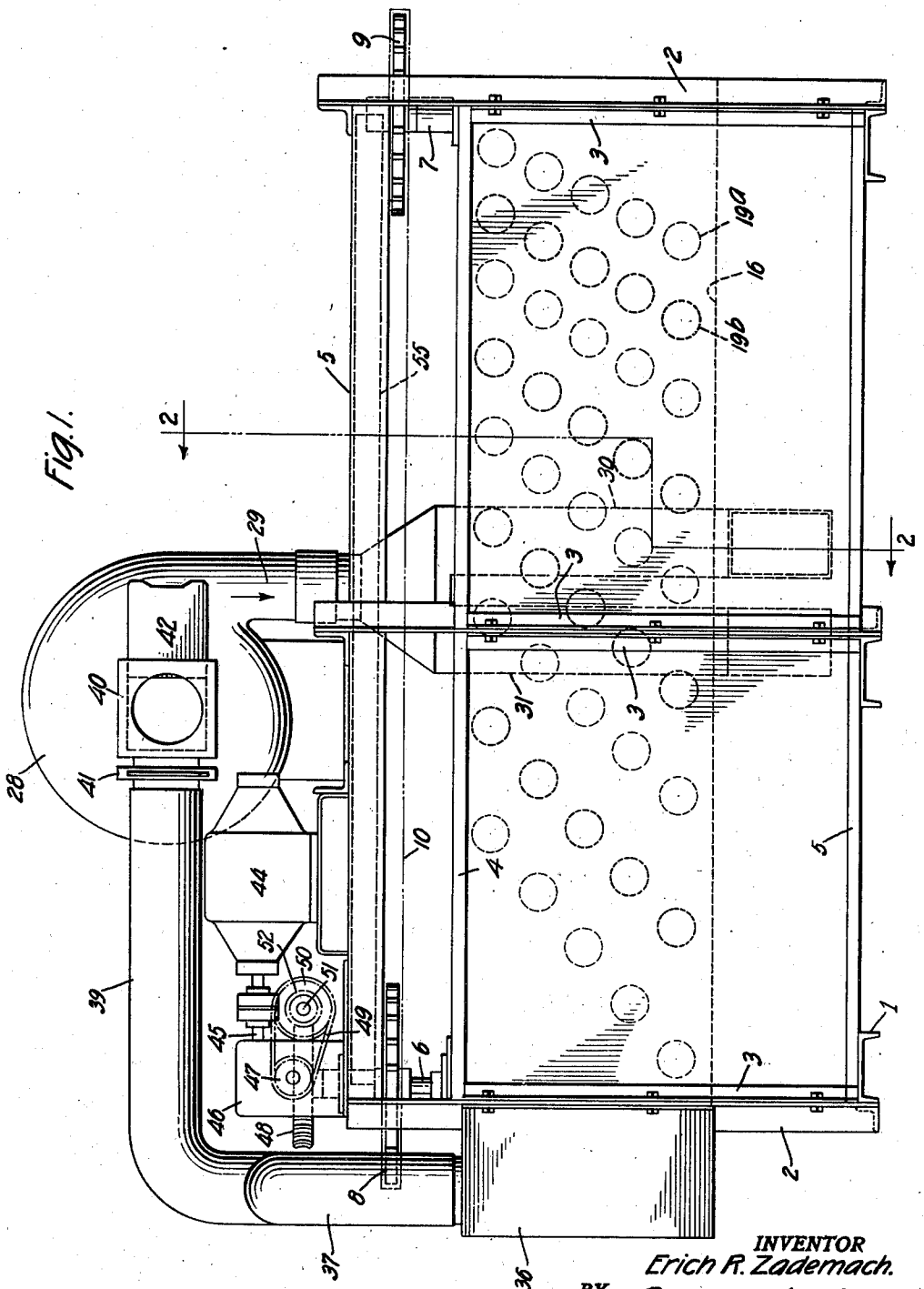

Fig. 1.

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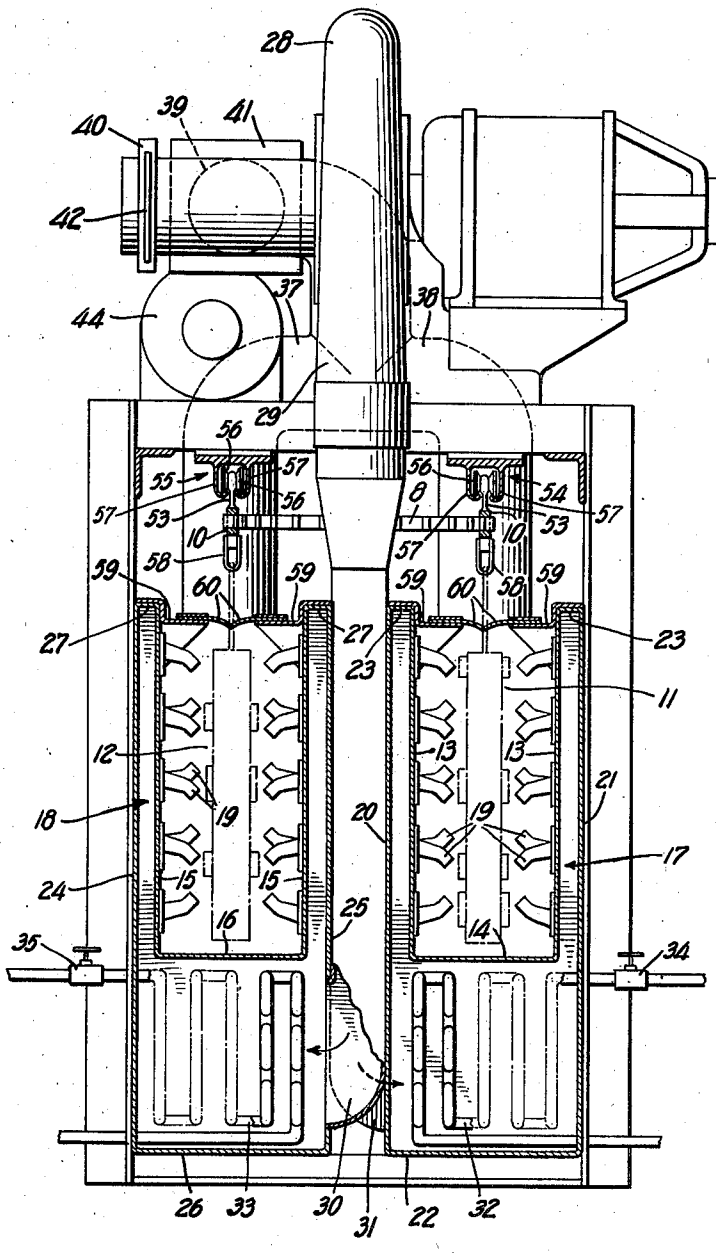
Fig. 2



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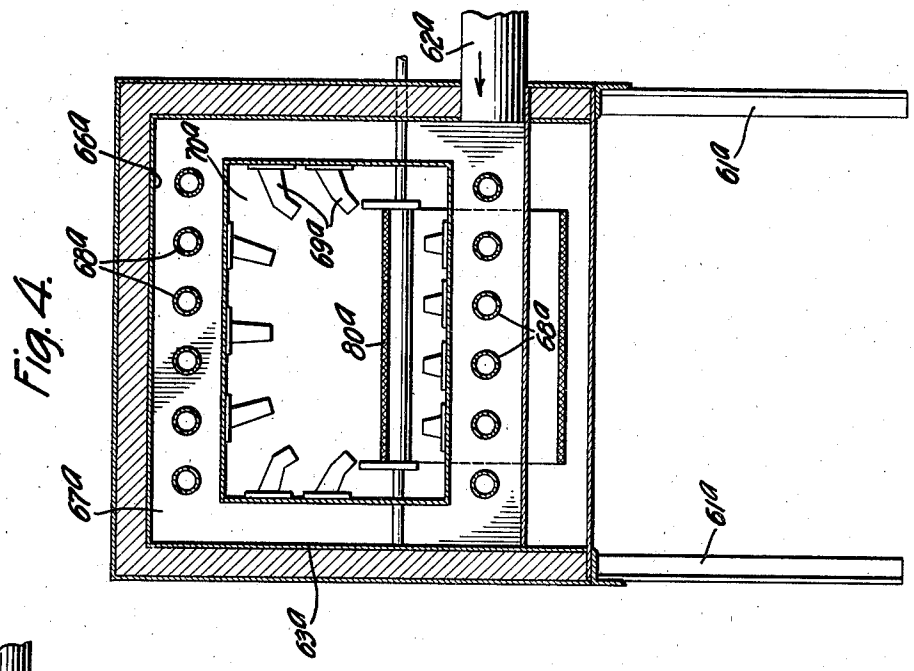

Fig. 4.

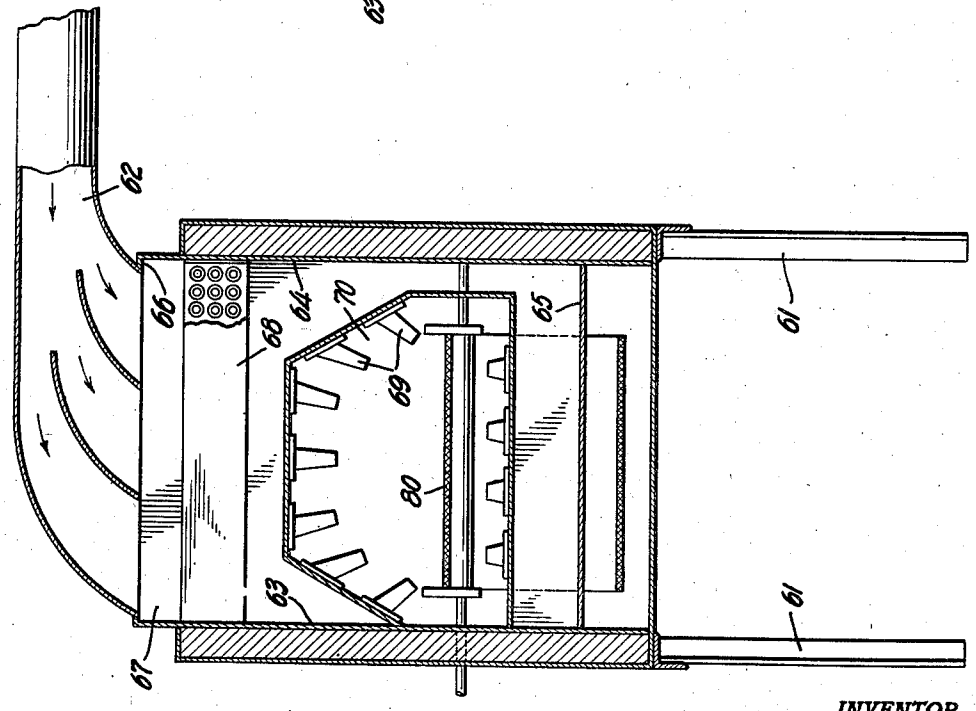

Fig. 3.

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UNITED STATES PATENT OFFICE

2,073,669

DRIER

Erich R. Zademach, Elizabeth, N. J., assignor to Metalwash Machinery Company, New York, N. Y., a copartnership consisting of Herman O. Boehme, Erich R. Zademach, and Albert C. Nolte

Application January 9, 1930, Serial No. 419,537
Renewed August 21, 1934

4 Claims. (Cl. 34—12)

This invention relates to drying apparatus adapted, for example, to be used in industrial plants for drying machine or instrument parts.

While the drying unit installed in a plant is ordinarily operated for long periods in one certain way, it is desirable from the standpoint of the manufacturer of such apparatus to contrive a standard unit adapted to be used in a variety of ways so that a few standard models may suffice for supplying the needs of a wide variety of users. Such adaptability also works out to the advantage of the user in case of re-arrangement of a factory, due to changing commercial conditions, since the installed units may be adapted to new manufactures and associated with other manufacturing processes without expensive replacement.

It is an important object of the present invention to provide a standard adaptable drying unit of the nature above indicated.

It is a further important object of the invention to provide an improved method of drying which will leave the dried articles free of deposit and which will, in most instances, obviate the necessity for rubbing or sawdusting the dried work pieces to remove spots after the drier has performed its work.

I have discovered that the above referred to result may be obtained by drying the work pieces first by subjecting them to a blast of cold air, and thereafter subjecting them to a blast of heated air. The cold air evaporates little of the water on the work pieces, its function being to blow off a considerable portion of the water without actual vaporization. By thus mechanically reducing the amount of water adhering to the articles, the major portion of the solid matter dissolved in the water, (which is all left as a deposit if vaporization alone is employed), is carried away and only a small and negligible portion remains at the time when the hot blast is applied to the work pieces. The precipitate remaining after the evaporation caused by the hot blast when this method is followed is substantially imperceptible and may be ignored.

As regards the apparatus of the present invention, it is an object to provide a drier unit adapted for the mode of operation outlined above, and also adapted for use in other ways.

To this end it is a feature of the particular construction of the invention herein illustrated that provision is made of drying chambers arranged side by side, of an endless conveyor for carrying articles through said chambers in opposite directions, of means for projecting air at high velocity upon the articles in both drying chambers, and of means for causing one or both of the air blasts to be hot, as desired. The conveyor is desirably accessible at both ends of the unit so that one or both ends may be used for loading and unloading. In such a unit the drying chambers may be used in tandem, the first cold and the second hot, or both cold or both hot, or they may be used independently of one another, each being hot or cold as desired.

Other objects and advantages will hereinafter appear.

In the drawings forming part of this specification:

Figure 1 is a side elevation of a drying unit embodying features of the invention;

Figure 2 is a transverse, sectional elevation on the line 2—2 of Figure 1 looking in the direction of the arrows;

Figure 3 is a transverse, vertical sectional view of a modified form of drier; and

Figure 4 is a similar view of a further modified form of drier.

In the illustrative embodiment of the invention the drying apparatus comprises a frame including cross beams 1, uprights 2 and 3 and longitudinal beams 4 and 5. Upright shafts 6 and 7 supported by the frame carry horizontally disposed sprockets 8 and 9 upon which an endless work carrying chain conveyor 10 is adapted to run. One stretch of this conveyor 10 travels above a drying chamber 11, while the other stretch of the conveyor travels in the opposite direction above a drying chamber 12. The drying chamber 11 comprises side walls 13 and a bottom wall 14, while the drying chamber 12 comprises side walls 15 and a bottom wall 16. The chambers 11 and 12 are surrounded by jackets 17 and 18, respectively, from each of which air under pressure may be projected at high velocity into the associated chamber through nozzles 19 trained upon the work. The nozzles are desirably so mounted, that they may be angularly adjusted and may therefore be installed to operate in the most effective manner. The nozzles may be mounted in the manner illustrated and described in my co-pending application Serial No. 208,799 filed July 27, 1927, for Nozzle construction, now Patent No. 1,756,965. The jacket 17 comprises side walls 20 and 21, a bottom wall 22, and top walls 23, while the jacket 18 comprises side walls 24 and 25, a bottom wall 26 and top walls 27.

The arrangement of the nozzles in the chamber 12 is indicated diagrammatically in Figure 1.

In this figure the circles formed by relatively long and light dash lines and designated 19*a* indicate the bases of the nozzles secured upon the left hand wall of the chamber 12 as viewed in Figure 2, while the circles drawn in relatively short heavy dash lines and designated 19*b* indicate the bases of the nozzles secured upon the right hand wall of the chamber 12 as viewed in Figure 2. The work enters the chamber 12 at the right hand end of the machine, as the same is illustrated in Figure 1. It will be noted that the nozzles designated 19*a* and 19*b* are arranged in inclined rows, and that the rows 19*a* are out of alignment with the rows 19*b*, so that the air jets projected by the nozzles from opposite directions do not directly conflict with one another. It will also be observed that because of the inclination of the line along which each aligned group of nozzles is situated the top of the work is subjected to the blast of the first nozzle, and that each succeeding nozzle directs its blast or jet upon a successively lower portion of the work. Water blown off of one portion of the work and alighting on another portion thereof will ordinarily progress toward the bottom of the work. The effect of the first nozzle will accordingly be to effect transference of some of the water near the top of the work onto the work at the next level below the first nozzle. This will facilitate the blowing off of water in drops or in a body, and will, in turn, result in the depositing of some water farther down on the work to thereby increase the effectiveness of the third nozzle, and so on. It will be noticed that toward the discharge end of the chambers the inclination of the nozzle rows is changed so that the nozzles are less numerous than at the introductory end. This arrangement is desirable when the chamber is being used for projecting hot air upon the work, for the reason that the air blast is somewhat less important when the work is nearly dried, it being necessary to effect the final step of drying principally by heat.

An air impeller 28 is provided on top of the frame for forcing air under pressure into the jackets 17 and 18. The air is conducted from the impeller 28 through a conduit 29 to branch conduits 30 and 31 which extend downward and communicate respectively with the jackets 18 and 17. The air passing through the impeller is not heated, but provision is made in the jackets 17 and 18 of heating coils 32 and 33. The heating coils 32 and 33 are adapted to be controlled respectively each independently of the other, provision being made of a valve 34 for controlling the coil 32, and of a valve 35 for controlling the coil 33. It will be seen that with this arrangement the air may be delivered to either drying chamber cold or to either drying chamber hot, and that the chambers may be used both hot or both cold, or with either hot and the other cold.

Since the preferred mode of operation is to subject the articles first to a cold blast and then to a hot blast, the articles will ordinarily be put upon the conveyor at one end of the unit and allowed to travel through substantially the complete circuit of the conveyor, the heating coil for the first chamber through which the articles pass being turned off and the heating coil for the second chamber turned on.

In some cases it is desirable to use both chambers hot.

Since the articles in this instance are hung on the conveyor and taken off of it at the same end of the machine, a detachable enclosure 36 may be provided for application to one end of the machine to avoid loss of heat to the atmosphere. The provision of this enclosure which is particularly valuable when both chambers are used hot has the further advantage of enabling the heated air to be drawn back into the blower and recirculated so that a further saving of heat is effected and the atmosphere of the room in which the dryer is situated is not rendered oppressively hot or humid. The detachable closure 36 has associated therewith branch conduits 37 and 38 which communicate with a conduit 39 adapted to be connected to an intake chest 40 of the blower. The chest 40 is provided with a damper or control valve 41 adapted to shut off communication of the chest 40 with the conduit 39 when desired, and with a damper or valve 42 adapted to shut off communication of the chest 40 with the outside atmosphere when desired. These valves may be adjusted as shown in Figure 1 to adapt the blower to take in air from the atmosphere. When it is desired to cause the blower to take in air from the conduit 39, the valve 42 is slid into position to cover the intake opening of the chest 40 and the valve 41 is slid to position to afford free communication between the conduit 39 and the chest 40.

Provision is made of a motor 44 mounted on the frame for driving the conveyor 10. The motor shaft 45 extends into a gear box 46 and through suitable gearing (not shown) drives a sprocket 47. The sprocket 47 drives a worm gear 48 through a train of mechanism comprising a chain 49, a sprocket 50, a sprocket shaft 51 and a worm 52 fast on the sprocket shaft. The worm wheel 48 drives the sprocket 8 through sprocket shaft 6, and the sprocket 8 is effective to drive the conveyor 10.

The links of the conveyor chain 10 are provided with trolleys 53 which run in guiding and supporting tracks 54 and 55. Each trolley comprises a pair of wheels 56, while each track comprises a pair of downwardly extending parallel arms 57, which arms have their lower ends turned inward and then upward to provide grooves or trackways in which the wheels 56 run. It will be seen that the trolleys are effective both to support the chain and to guide it against substantial lateral displacement.

Certain of the links of the chain 10 are provided with hangers 58 to which work pieces or work piece holders may be attached. The work pieces depend from the hangers 58 so as to travel within the chambers 11 and 12. Top wall members 59 extend part way across the top of the chambers 11 and 12 to partially close them, and flexible members 60 extend inward from the members 59 and meet one another beneath the stretches of the conveyor 10. These members 60 constitute closing flaps which yield locally when pressed aside by the work, but which substantially seal the tops of the chambers. The members 60 may be made of leather, fabric or other suitable material.

The mode of using the apparatus with the chambers in tandem, one cold and the other hot, has already been described. It is obvious that the apparatus may be used in the same manner, but with both chambers hot or both cold simply by appropriate adjustment of the valves 34 and 35.

The two drying chambers are also designed to be used for independent work. In this case the closure 36 and the conduit 39 are removed or omitted. Work pieces are attached to the conveyor at the left hand end of the machine, as seen

in Figure 1, and removed from the conveyor at the right hand end of the machine, after having passed through only one of the drier chambers. At the same time other work pieces are attached to the conveyor at the right hand end of the machine and removed at the left hand end after having passed through only the other of the drying chambers. When the machine is operated in this manner each of the chambers may be employed to project hot or cold air upon the articles treated, as desired.

In Figure 3 disclosure is made of a modified form of drier. In this embodiment the drying apparatus is supported upon suitable legs **61**. Air is blown through a conduit **62** into a jacket comprising side walls **63** and **64**, a bottom wall **65**, top wall **66**, and end walls **67**, only one of the end walls being shown. The air entering the jacket passes over a suitable heater **68**, and thence through nozzles **69** into a chamber **70** through which the work is carried. The nozzles **69** are mounted on the top, bottom, and side walls of the chambers **70** to direct air blasts in all directions upon the work. In this instance the work is carried through the chamber upon an endless belt conveyor **80**.

The embodiment of Figure 4 is similar to that of Figure 3. Corresponding reference numerals with the subscript *a* added have accordingly been applied to corresponding parts, and the parts will not, therefore, be described in detail. In this form it will be observed that the air enters the jacket surrounding the chamber **70***a* through the conduit **62***a* and is free to circulate on all sides of the chamber **70***a*. This arrangement is advantageous since it tends to equalize the pressure available at the various nozzles, there being no nozzles situated so that the air has to travel farther than along two sides of the chamber before reaching the nozzle through which it is to be delivered to the chamber **70***a*.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiment shown, but what I desire to cover by Letters Patent is set forth in the appended claims.

I claim:

1. In a drier, in combination, means forming a pair of open ended drier chambers arranged side by side, an endless conveyor for carrying articles in one direction into and out of one of the chambers and in the opposite direction into and out of the other, means for projecting air at high velocity upon the articles in the chambers, and individually controlled means for separately heating the air delivered to the two chambers, the conveyor being accessible for loading and unloading at both ends of the chambers.

2. In a drier, the combination with means forming a pair of chambers arranged side by side, of an endless loop conveyor having one stretch disposed to carry articles through one of the chambers in one direction and the return stretch disposed to carry articles through the other chamber in the opposite direction, means for delivering heated air to the chambers under pressure and projecting it upon the articles at high velocity, and means adapted to be detachably connected to the drier at one end thereof to form with the two chambers a continuous enclosure when attached, but to leave both ends of the conveyor exposed when removed.

3. In a machine for drying metallic articles, means constituting a plurality of chambers, a conveyor for conveying the articles to be dried through said chambers in succession, nozzles in said chambers for delivering blasts of air onto said articles from opposite sides, a source of relatively cold air, a source of relatively hot air, said nozzles being adjustable to point in different directions so that the directions of the blasts thereof may be varied to suit the configuration of the articles being passed through said chambers, and means for delivering relatively cool air from said cold source under pressure to the nozzles of the first chamber, and relatively hot air from said hot source under pressure to the nozzles of the second chamber.

4. In a machine for drying metallic articles, means defining a plurality of zones, a conveyor for conveying the articles to be dried through said zones in succession, nozzles in said zones for delivering blasts of air onto said articles, a source of relatively cold air, a source of relatively hot air, said nozzles being adjustable to point in various directions so that the directions of the blasts thereof may be varied to suit the dimensions of the articles being passed through said zones, and means for delivering relatively cool air under pressure from said cold source to the nozzles of the first zone, and relatively hot air from said hot source under pressure to the nozzles of the second zone.

ERICH R. ZADEMACH.