Oct. 6, 1959 A. MAESCHER 2,907,118

SILK SCREEN PRINT DRYER

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Fig. 1.

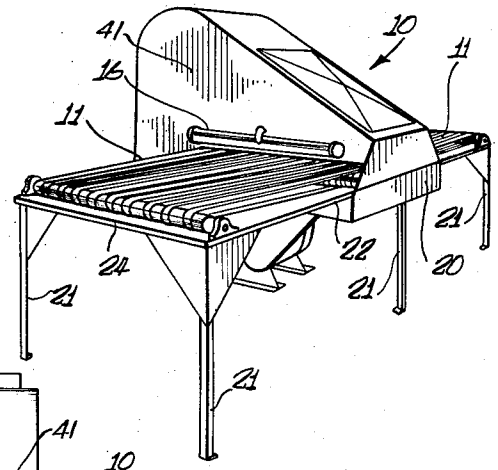


Fig. 2.

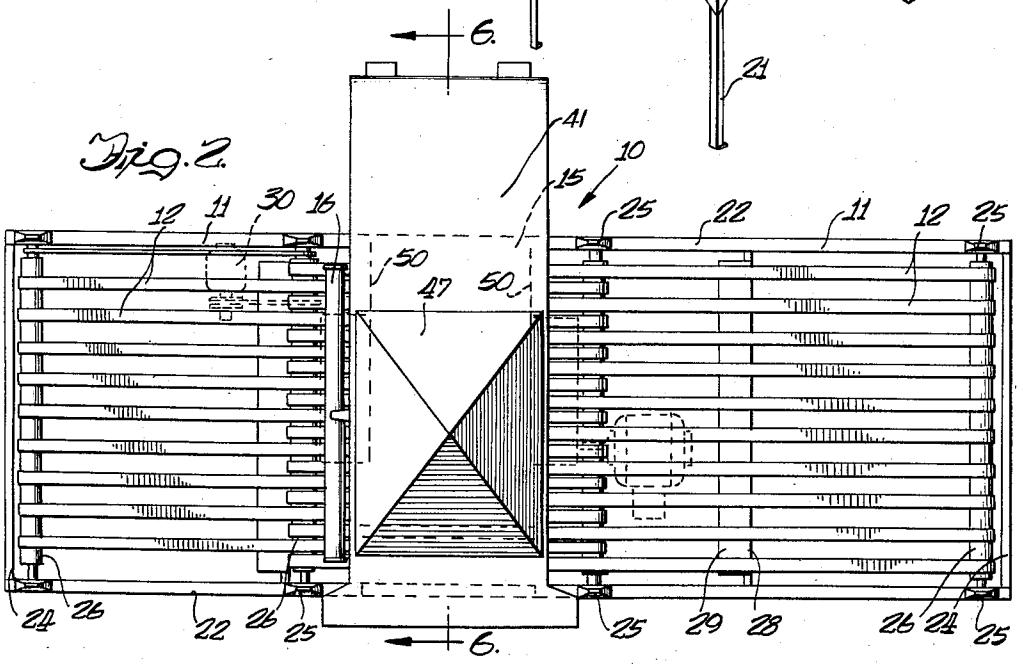
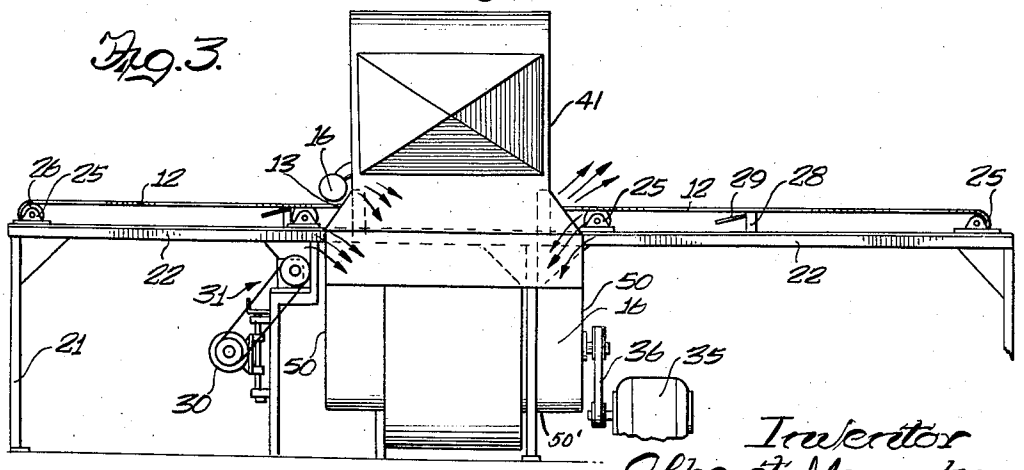


Fig. 3.



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Fig. 4.

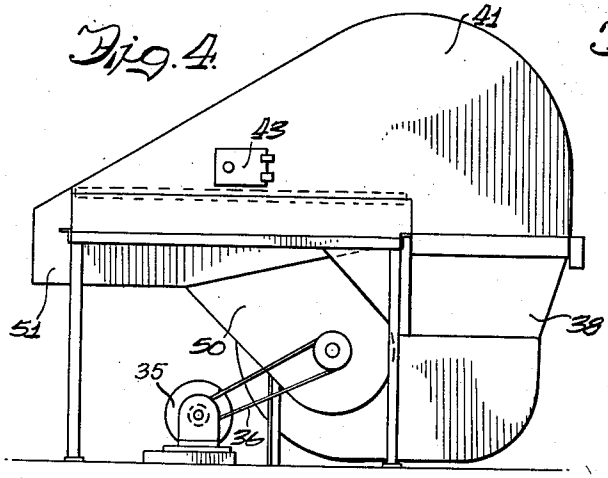


Fig. 5.

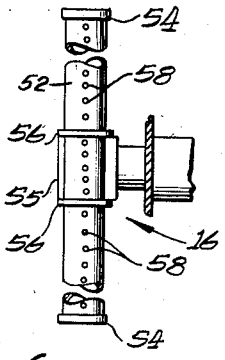


Fig. 6.

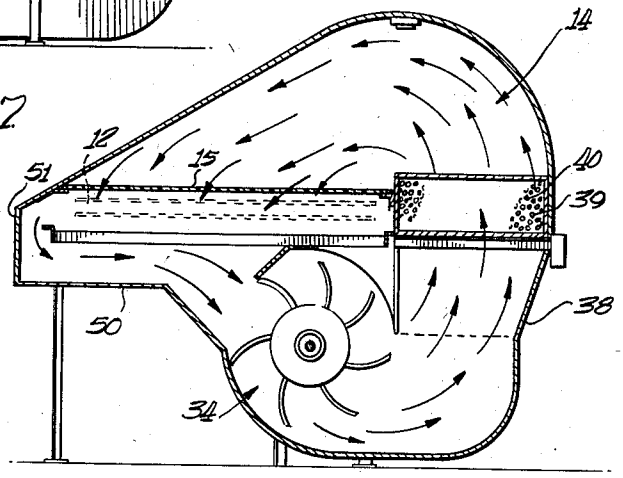


Fig. 7.

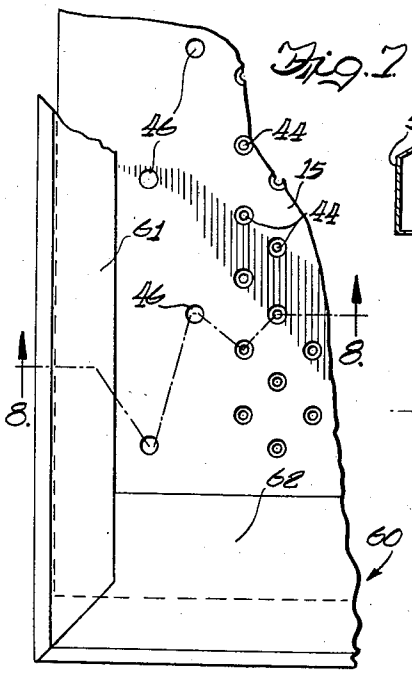


Fig. 8.

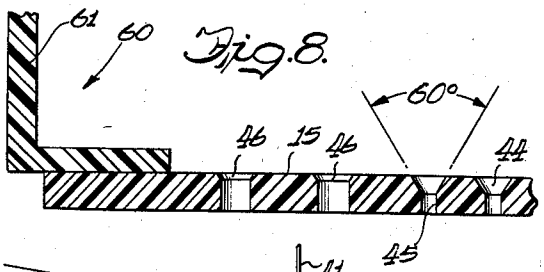
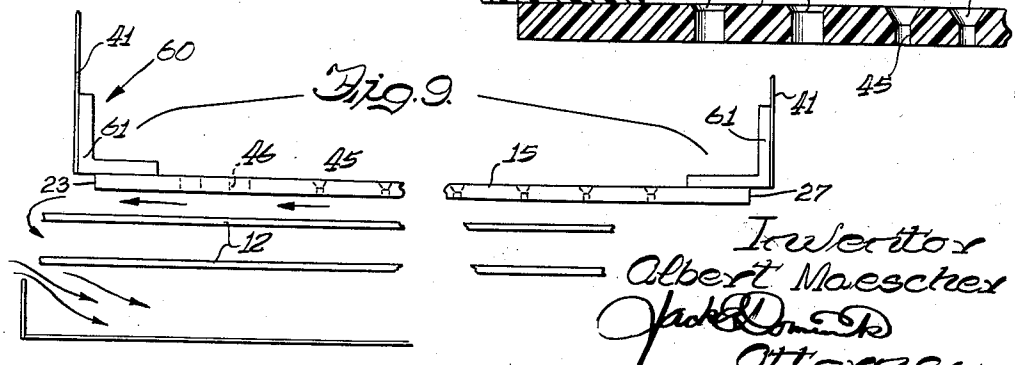


Fig. 9.



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SILK SCREEN PRINT DRYER

Albert Maescher, St. Louis, Mo., assignor, by mesne assignments, to Cardel Electric Co. Inc., Cincinnati, Ohio, a corporation of Indiana

Application April 6, 1956, Serial No. 576,611

8 Claims. (Cl. 34—155)

The present invention relates to the silk screen printing field and specifically contemplates a dryer for materials printed by the silk screen processes.

In connection with the preparation of large posters and advertising display, particularly where multicolor media is desired, the silk screen process is employed for reproducing prints on a wide variety of materials. In the process a fine grade of silk is stretched across a frame, and treated with a gelatinous substance so that only the untreated area will pass the printing ink into material to be printed. After the sheets have been printed, it is necessary that they be dried before additional colors can be applied and also before they can be stacked for storage and eventual shipment.

Many expedients have been resorted to for drying. One well known device is the wicket dryer in which the printed material is stacked in plurality of wire wickets which travel along a longitudinal axis holding the sheets until they air dry. In other instances, the sheets may be merely stacked in horizontal slots in a fixed jig.

In the shop where there are short runs of a wide variety of material, varying in size, as well as the pattern being printed, there has been a long-felt need for a high speed dryer which is also inexpensive to build and operate. A dryer which works with an air blower would be more desirable, particularly where the air has been heated and passes over the printed material as it travels through the dryer on an endless belt. Such a dryer was disclosed in the Silk Screen Process magazine, October 1954 issue at page 36, et seq. As indicated in the article, however, the dryer is quite noisy in operation. In addition, a distinct problem is introduced when air jets are employed improperly holding the printed material on the belt as it passes through the dryer so that it does not blow around and mar the printed surface.

With the foregoing in mind it is the general object of the present invention to provide a silk screen processed material dryer which efficiently and rapidly dries silk screen printed material with a hot air blast.

Another object of the present invention is to furnish a hot air silk screen print dryer which is quiet in operation and yet is effective to dry the printed material in a single pass through the dryer.

Still another object of the invention is to furnish a silk screen dryer which incorporates pneumatic work pieces engaging features thereby ensuring proper register of the material as it passes through the dryer.

A further object of the invention is to provide a silk screen dryer with a variably adjustable pneumatic working engaging element permitting the accommodation of a wide variety of printed material under operator-adjusted conditions.

Further objects and advantages of the invention will become apparent as the following description of an illustrative embodiment of the invention proceeds taken in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a typical screen dryer incorporating the features of the present invention.

Fig. 2 is a top view of the dryer shown in Fig. 1.

Fig. 3 is a front elevation of the dryer shown in Fig. 2 in the same scale as shown in Fig. 2.

Fig. 4 is an end view of the dryer shown in Figs. 2 and 3 on the same scale as shown in Figs. 2 and 3.

Fig. 5 is a bottom broken view of the adjustable work engaging jet mechanism.

Fig. 6 is a transverse cross-sectional view of the blower mechanism taken along section line 6—6 of Fig. 2.

Fig. 7 is a top view in an enlarged scale showing a corner of the jet plate inside dryer unit.

Fig. 8 is a sectional view taken along section 8—8 of Fig. 7 showing the arrangement of the holes in the jet plate illustrated in Fig. 7.

Fig. 9 is a broken end view of the jet plate shown in Fig. 7 illustrating its assembled relationship for use in the dryer.

In broad outline, the dryer **10** to be described serves to illustrate an exemplary embodiment of the invention. The dryer contemplates a long flat moving endless belt assembly **11** (as best illustrated in Figs. 1 and 2) which is actually made up of a plurality of belts **12**. A closed path hot air circulating system **14** surrounds the mid-portion of the moving belt assembly **11**. Within the closed path hot air system the unique perforated plate **15** is placed to cause the air to impinge upon the work piece as a plurality of small jets. The exhaust system co-acts with the various jets to firmly engage and hold the work on the belt by a dynamic air movement thereby ensuring the proper positioning and travel of the work pieces through the dryer. An auxiliary adjustable jet system assembly **16** may be employed to further implement work engagement and proper feed through the dryer.

In more specific detail, it will be seen that the dryer has a frame assembly **20** which includes a plurality of legs **21** which are joined to the frame side members **22** and members **24**. The frame side members **22** serve as supports for the pillow block bearing assemblies **25** which in turn journal the belt rollers **26**. Intermediate belt supports **28** may be employed where the belt span would induce an objectionable amount of slack in the belts **12**. The belt support assembly **28** is in the form of a transverse member with a supporting flange **29**. In the present instance the belt supporting assembly **28** has been employed at the discharge portion of the unit where the endless belt table portion is longer than at the entrance to the unit.

As will be seen, the belts are separated at the terminal rollers at a distance in excess of the width of a belt. Between the two middle rollers this provides a more continuous support area as the work piece passes through the hot air circulating system **14**. The belting system is driven by an electric motor **30** through a belt and gear train assembly **31** to drive the roller **26** which is immediately adjacent the entrance to the closed hot air drying system **14**.

As will be seen particularly by reference to Fig. 6, the path of air in the hot air circulating system **14** moves in a modified circular path. The air is driven by a centrifugal blower assembly **34**, the power to which is supplied by an electric motor **35** by a belt drive **36**. The blower assembly **34** is located beneath the moving belt but within a closed portion of the path of circulating air. The air is driven upwardly from the blower assembly **34** through the heating duct **38** and into the heater assembly **39**. The heater assembly **39** contemplates a plurality of heat exchange elements **40** which may be in the form of staggered chrome-nichrome electrically heated elements. Although such a device has been found most satisfactory in a commercial embodiment of the invention, other units which would raise the temperature of the air and yet

permit its ready passage through the heater duct **38** would be satisfactory.

After the air has been heated it is then directed by the hood **41** over toward the work. The hood **41** is completely traversed in its inner portion by the jet plate **15**. It is in the specific construction of the jet plate **15** that many of the unique features of the invention are found, and particularly in the cooperative relationship between the jet plate and the exhaust ducting. The jet plate **15**, may be readily prepared from a one-fourth inch material, the pressed wood material sold under the trade name of "Masonite" having been found highly satisfactory for this use.

A plurality of counter-sunk jet holes **44** are drilled in the jet plate. As will be seen from Fig. 8 the jet holes themselves are approximately half the diameter of the thickness of jet plate **15**, thus when a one-fourth inch "Masonite" jet plate **15** is employed the jet hole **45** is one-eighth inch in diameter. The jet holes are countersunk with an included angle of 60 degrees to a depth approximately half the thickness of the jet plate **15**.

At the leading edge of the jet plate **15**, two rows of staggered air curtain ports **46** have been provided. The ports **46** have a diameter equal to the thickness of the jet plate **15**. The detailed function and arrangement of the jets **44** and air curtain ports **46** will be described hereinafter, but will be better understood when the combined operation of the exhaust system and jets is first explained. Referring again to Figs. 2 and 3, it will be seen that a pair of flanking exhaust ducts **50** are provided to feed the blower assembly **34** with air after the warm air has passed over the work piece. The exhaust ducts **50** are connected at their lower ends by a floor **50'** to prevent escape of air from beneath the conveyor and with an extension shroud **51** effectively suck the air off of the work piece and belt assembly after the material has been first contacted by the air.

Because the exhaust ducts **50** operate adjacent the entrance and exit of the material through the hot air circulating system **14**, they serve to cooperate with the jet plate in forcing the stream of air to pass over the entire area of the work piece. This action assists in rapidly and thoroughly drying the inked face of the work piece.

Because the air moves in diverse directions upon contacting the work piece, particularly near the entrance to the hot air circulating system **14**, a turbulence is set up at the entrance **13**. The ports **46** have been provided at the leading edge of the jet plate **15** for the purpose of setting up a curtain of air to confine the turbulence at the entrance **13** to the oven area. This minimizes the tendency of the printed sheets to drift upon approaching the entrance **13**. The curtain of air also acts to firmly hold the work piece on the belts **12** as well.

To augment the action of the air curtain provided by the ports **46** an external auxiliary jet system assembly **16** may be provided at the inlet portion of the hot air circulating system **14**. The external jet assembly **16**, as will be seen in Fig. 5, contemplates an elongated tubular member **52** capped at its ends with caps **54** and secured and fed by support **55**. The support **55** is flanked by guide rings **56** secured to the tube **52** which serve to prevent lateral displacement of the tube **52**. A convenient port (not shown) is provided in the tube **52** so that the tube may be fed through the support **55** which is in turn coupled to the inside of the hood **41** of the hot air circulating system **14**. A plurality of jet holes **58** are provided along a longitudinal axis on the base of the tube **52**. In operation, it has been found that the jet holes **58** in the tube **52** operate most satisfactorily when their diameter is 5/16 inch and the holes are placed on three-inch centers.

Because the tube **52** may be readily rotated, the auxiliary curtain of air which is provided by the air jets from the air holes **58** may be selectively directed to engage the work in accordance with the dictates of the particular shop. By rotating the tube **52** until the connecting port to the support **55** is shut off, the auxiliary work engaging assembly **16** may be disengaged. In operation, therefor, two curtains of air are available for cooperation with the flanking exhaust duct **50** to firmly engage the work piece before it enters the turbulent area beneath the jets **44** of the jet plate **15**.

Jet orientation

Both the shape and proportion of the jets on the jet plate **15** play a role in the quiet and efficient operation of the dryer. The jet plate **15** is secured to a jet plate frame **60**. The frame **60** is made of angle iron end members **61** and side members **62** which are secured to the hood **41**.

As stated above, the jet holes **44** are countersunk to half their depth with a 60° included angle. In practice this countersinking serves the twofold purpose of increasing the effective jet of air. The jet holes are arranged on center lines which intersect at a 45° angle with the side and end members **61**, **62** of the jet plate frame **60**. Although the jet spacing may be varied, it has been found that when the one eighth inch countersunk holes **45** are used a spacing along one inch centers along the axis parallel to the belt travel is satisfactory.

The jet holes **45** permeate the jet plate **15** and are brought close to the edges of the frame **60**. In practice it has been found that the jet holes **45** may be brought within one half inch of the end frame **61** at the trailing edge **27** and three quarters of an inch from the side frames **62**.

A two inch spacing is provided, however, at the leading edge **23** of the jet plate **15** to accommodate the air curtain ports **46**. These ports are on three quarter inch longitudinally staggered centers and two inch lateral centers and located within one half inch of the leading cross member **61** of the jet plate frame **60**. It has also been found desirable to chamfer the ports **46** to a depth of one fourth of the jet plate **15** thickness at an included angle of 60°. The jet plate **15** is located about one inch above the belts **12**.

Operation

In operation the air is heated to about 200° F. and the belt speed regulated to pass a thirty inch workpiece into the unit in five to twenty seconds. The air circulates with a static pressure of three and one quarter inches. An electric heater, a blower motor, and a belt motor are the main sources of energy. With such capacities normal silk screen processed sheets can be dried with a single pass through the dryer.

For cleaning and servicing a side inspection door **43** and removable hood panel **47** have been provided. Thermostatic controls for the heater **39** are provided (not shown) to maintain a preselected operating temperature. Similarly motor speed controls (not shown) are provided to control the static pressure induced by the blower and the speed of belt travel.

Although a particular embodiment of the invention has been shown and described in full here, there is no intention to thereby limit the invention to the details of such embodiment. On the contrary, the intention is to cover all modifications, alternative embodiments, usages and equivalents of the dryer and running gear as fall within the spirit and scope of the invention, specification and appended claims.

I claim as my invention:

1. A dryer for printed sheets comprising, in combination, a moving conveyor, a housing surrounding the conveyor at a transverse portion thereof, a blower within the housing, the housing defining an endless air path for air delivered to and discharged from the blower, a heater within the housing to warm the circulating air to a predetermined temperature, a jet plate within the housing and traversing the entirety of the air path defined by said housing, the plate being characterized by leading and

trailing edges and a plurality of countersunk jet holes therebetween, the plate being oriented above the conveyor, and a pair of exhaust ducts beneath the jet plate leading and trailing edges.

2. A dryer for printed sheets comprising, in combination, a moving conveyor, a housing surrounding the conveyor at a transverse portion thereof, a blower within the housing, the housing defining an endless air path for air delivered to and discharged from the blower, a heater within the housing to warm the air to a predetermined temperature, a jet plate within the housing and traversing the entirety of the air path defined by said housing, the plate being characterized by leading and trailing edges and a plurality of jet holes therebetween, the plate being oriented above the conveyor, the jet holes being countersunk at their upstream portion, and a pair of exhaust ducts beneath the jet plate leading and trailing edges to augment the flow of air at those stations thereby assisting in preventing stray air currents from blowing out of the housing to disturb the insertion of the work piece.

3. A dryer for printed sheets comprising, in combination, a moving conveyor, a housing surrounding the conveyor at a transverse portion thereof, a blower within the housing, the housing defining an endless air path for air delivered to and discharged from the blower, a heater within the housing to warm the circulating air to a predetermined temperature, a jet plate within the housing and traversing the entirety of the air path defined by said housing; the plate being characterized by leading and trailing edges, a plurality of countersunk jet holes, a plurality of ports staggered along the leading edge of the plate, the plate being oriented above the conveyor; and a pair of exhaust ducts beneath the jet plate leading and trailing edges to augment the flow of air at those stations thereby assisting in inserting the paper into the dryer.

4. A dryer for printed sheets comprising, in combination, a longitudinal belt, a housing defining an air path having an air blower and heater, said belt passing through said housing a jet plate positioned within the housing and across the air path defined by said housing, exhaust ducts positioned beneath the leading and trailing edges of the jet plate, a plurality of holes in the jet plate on uniformly spaced centers, and a transverse line of holes along the leading edge of the jet plate to provide a curtain of air to initially hold the work, said work holding holes being at least twice the diameter of the jet holes.

5. A dryer for printed sheets comprising, in combination, a longitudinal belt, a housing defining an endless air path and containing an air blower and heater, a jet plate positioned within the housing and across the air path defined by said housing, said belt passing through said housing, an exhaust duct positioned beneath the jet plate, a plurality of countersunk jet holes in the jet plate on uniformly spaced centers, the countersunk portion of the jet holes being oriented at the upstream portion of the jet plate, and a transverse line of ports along the leading edge of the jet plate, to provide a curtain of air for initially engaging the work.

6. A dryer for printed sheets comprising, in combination, a longitudinal belt, a housing defining an endless air path containing an air blower and heater, said belt passing through said housing, a jet plate positioned within the air path and across the air path defined by said housing, an exhaust duct positioned beneath the jet plate, a plurality of countersunk jet holes in the jet plate on uniformly spaced centers, the jet holes being of a diameter equal to one half the thickness of the jet plate and countersunk to half their depth on the upstream side, and a transverse line of holes for initially engaging the work along the leading edge of the jet plate, the said holes being at least twice the diameter of the jet holes.

7. In a dryer for printed sheets having a longitudinal moving belt and a housing defining an endless path surrounding the mid-portion of the moving belt said belt moving through said housing, said housing having an air heater and blower, the improvement comprising, a jet plate positioned within the housing in parallel relation to the moving belt, the jet plate being characterized by a plurality of jet holes equal in diameter to half the thickness of the plate, the holes being countersunk to half their depth on the upstream side of the air path defined by said housing, and a plurality of transversely spaced holes disposed along the leading edge of the jet plate, the holes along the leading edge of the jet plate being of at least a diameter equal to the thickness of the jet plate to provide a downwardly flowing curtain of air to initially engage the printed sheets fed into the dryer by the moving belt and hold the sheet in axial alinement on the belt until the sheet is well within the dryer.

8. In a dryer for printed sheets having a longitudinal moving belt and housing defining an endless path of circulating air surrounding the mid-portion of the moving belt said belt moving through said housing, the said housing having an air heater and blower, the improvement comprising, a jet plate positioned within the air path in parallel relation to the moving belt, the jet plate being characterized by a plurality of jet holes, the holes being countersunk on the upstream side of the air path defined by said housing, and a pneumatic work engaging element comprising a tube oriented transversely over the belt where the belt enters the housing and having a plurality of exhaust holes, the tube being connected to the closed circuit to deliver air to the exhaust holes which engages the work piece and holds it on the belt.

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