Feb. 24, 1970 H. H. HERING, JR 3,496,648

WEB DAMPING NOZZLE SYSTEM

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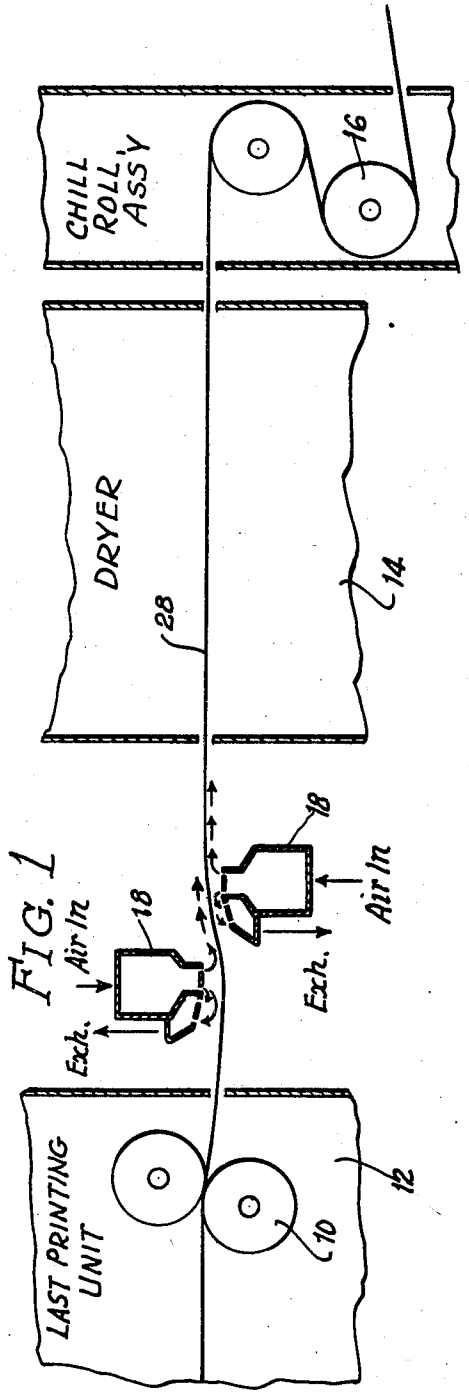

FIG. 1

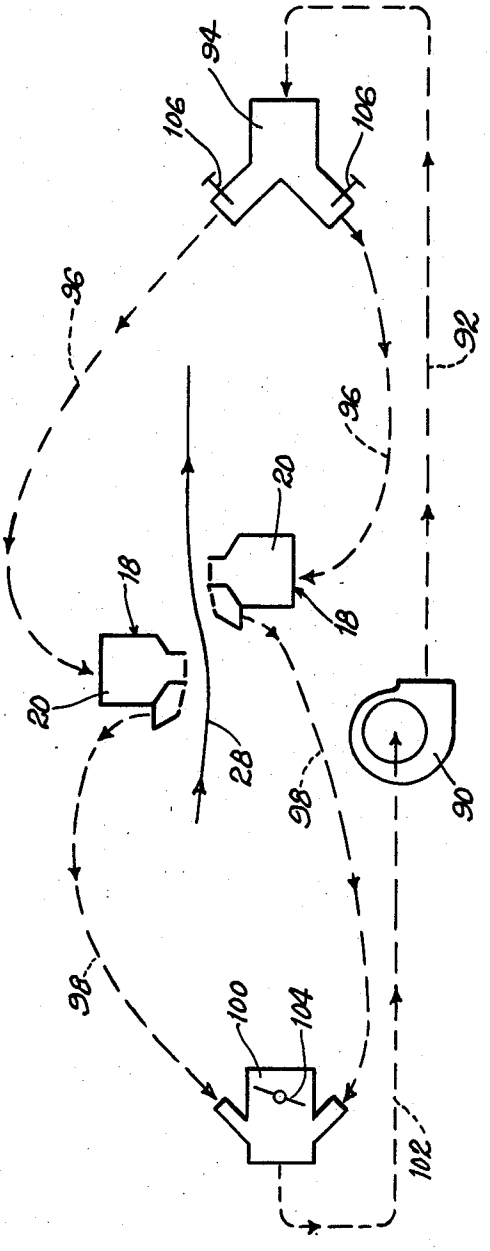

FIG. 2

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FIG. 3

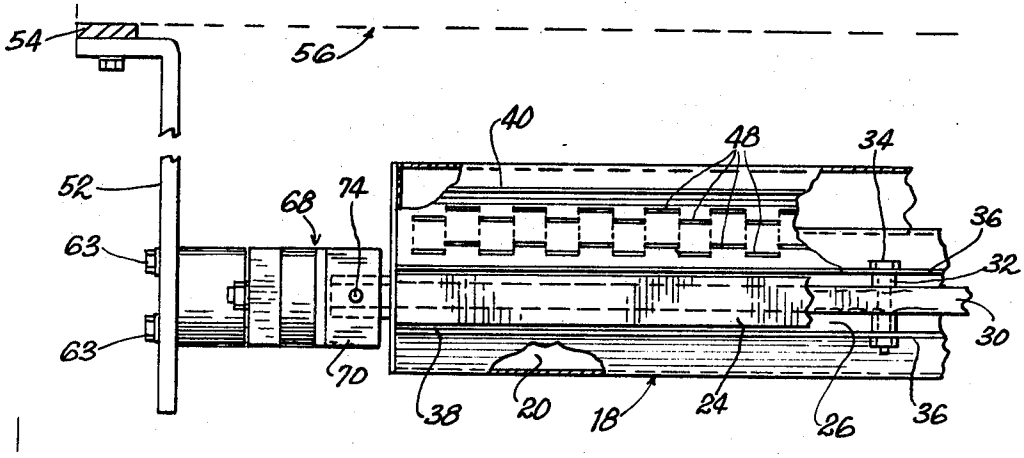

FIG. 5

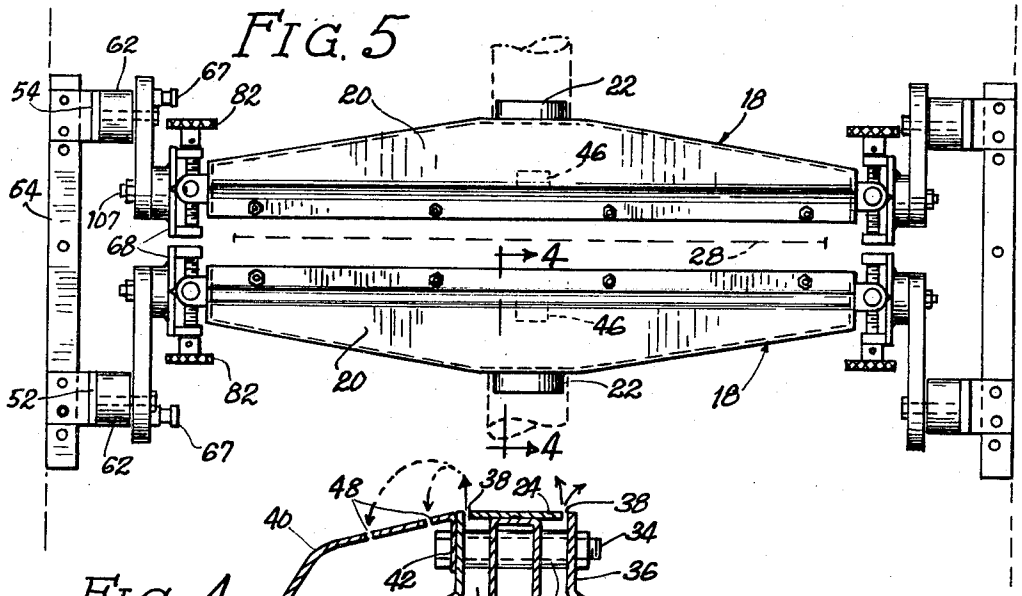

FIG. 4

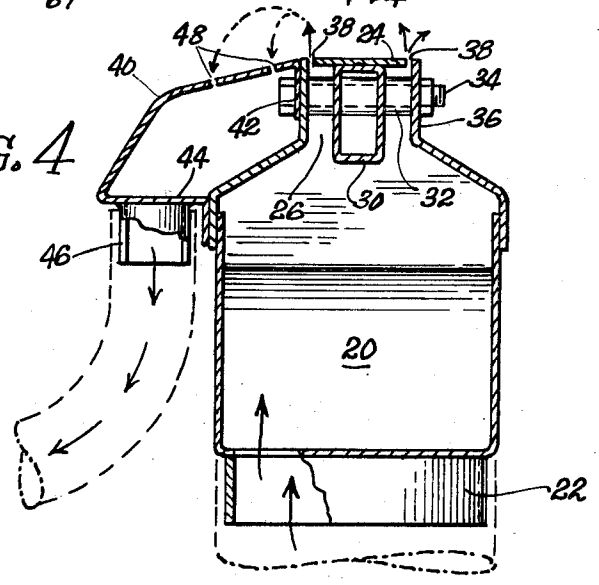

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FIG. 6

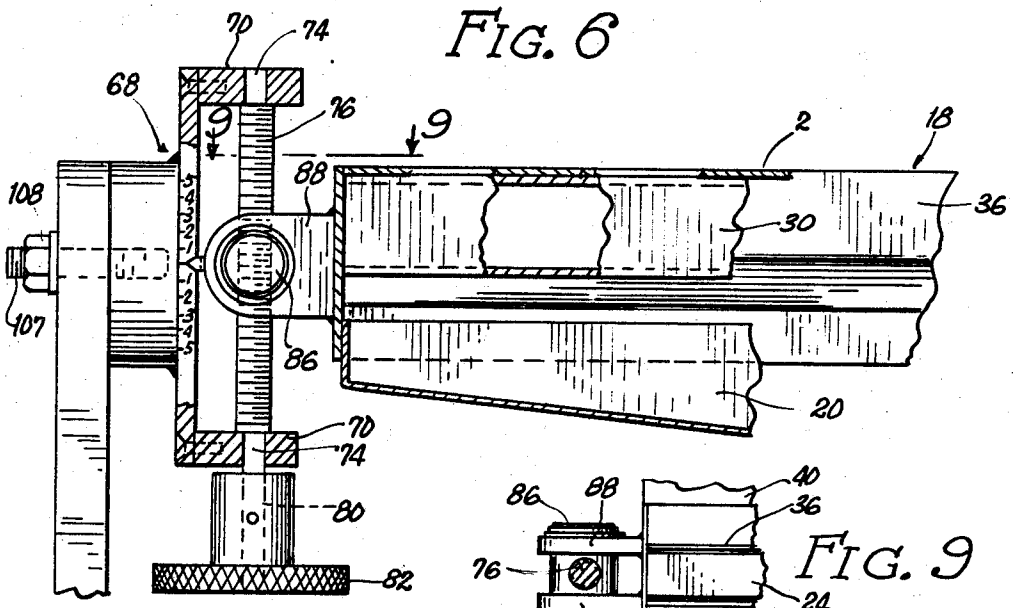


FIG. 9

FIG. 7

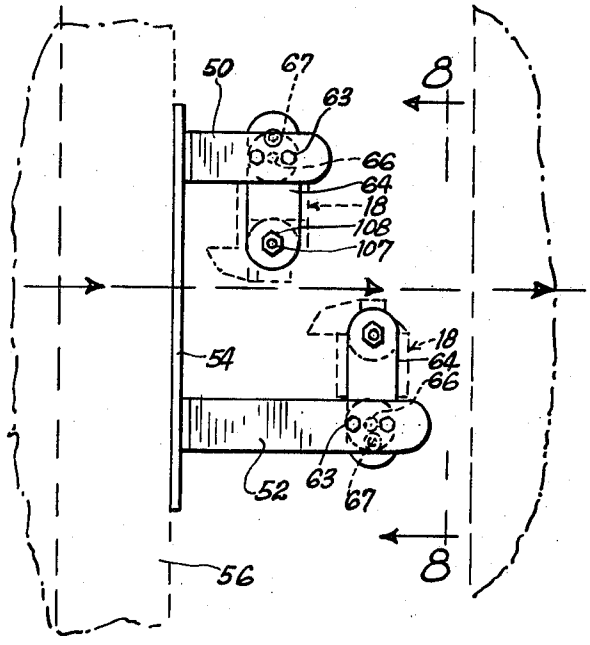
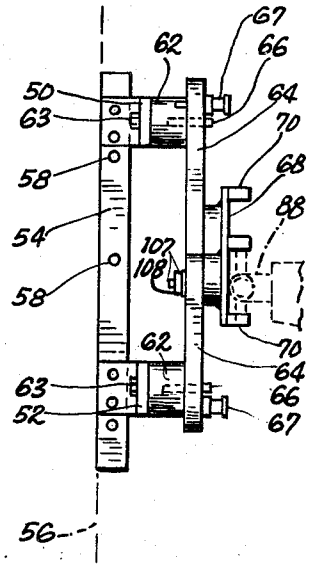


FIG. 8



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WEB DAMPING NOZZLE SYSTEM

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Int. Cl. F26b 13/12
U.S. Cl. 34—156 11 Claims

ABSTRACT OF THE DISCLOSURE

A construction for reducing vibrations in elongated webs which are moved between widely spaced-apart points while being suspended between these points. The vibration suppressing means comprise a pair of air nozzles for directing streams of air against the web from opposite sides of the web. The nozzles are positioned at spaced locations along the length of the web whereby the air streams impart an S-shaped configuration to the web. Furthermore, the air streams which are directed against the web are divided into a downstream and an upstream portion with the upstream portion being passed to return ducts associated with the nozzles.

This invention is directed to constructions employed for the handling of webs, particularly constructions capable of handling webs moving at relatively high speeds.

There are many applications which require the handling of webs of material wherein the material is suspended between spaced-apart points while being out of contact with solid surfaces during movement between these points. For example, dryers employed for the drying of webs of material such as paper and cloth fabrics are designed so that any printing on the webs will not be damaged during the drying operation. In web offset printing constructions, a web of material must be moved from the last printing roll and then through a long dryer without any contact with supporting rolls.

In order to accomplish printing and drying on an efficient basis, it is necessary to move the webs at extremely high speeds. When such operations are attempted, vibrations can be set up in the webs, and these vibrations may be of sufficient amplitude to move the web into contact with solid surfaces whereby the printing on the web would be damaged. The instant invention will be described with reference to the handling of webs in offset printing machines. It will be appreciated, however, that the concepts described are also applicable to other web handling systems wherein it is desirable to reduce or eliminate vibrations in materials handled in the system.

It is the general object o fthe instant invention to provide an improved means for the handling of webs whereby the webs can be safely transported for substantial distances while being suspended between spaced-apart points and while being otherwise maintained out of contact with solid surfaces.

It is a more particular object of this invention to provide a construction which accomplishes the foregoing objects, and which specifically eliminates or reduces vibrations in webs whereby the webs can be maintained in a substantially constant path of travel while being suspended between two widely spaced-apart locations and while being moved at high speed.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawings in which:

FIGURE 1 is a schematic illustration of a web handling construction characterized by the features of this invention;

FIGURE 2 is a schematic illustration of air circulating means employed for the construction;

FIGURE 3 is a fragmentary plan view illustrating an air discharge nozzle and return duct assembly of the type employed in a construction characterized by the features of the invention;

FIGURE 4 is a vertical sectional view of the assembly taken about the line **4—4** of FIGURE 5;

FIGURE 5 is a front elevation of the assembly;

FIGURE 6 is a fragmentary view of the assembly illustrating a portion of the bracket means used in setting up the assembly;

FIGURE 7 is a fragmentary view illustrating the manner of attachment of the bracket means to a press frame;

FIGURE 8 is a view of the bracket means taken about the line **8—8** of FIGURE 7; and

FIGURE 9 is a fragmentary sectional view taken about the line **9—9** of FIGURE 6.

The web handling construction of this invention is generally concerned with the movement of material between two spaced-apart points. The particular improvement of this invention concerns a vibration suppressing means which acts on the web as it moves between such points. The suppressing means is particularly advantageous where the points are a substantial distance apart, therefore, requiring suspension of the web for a long distance without contact with solid surfaces, and the suppressing means is also of most value where the web is moving at high speeds.

FIGURE 1 illustrates the application of the invention to a standard web offset printing construction. In such a construction, a web of paper or the like is passed between printing rolls with the last set **10** of such rolls being illustrated. These rolls are included in a printing unit **12**, and there may be several such sets of rolls, depending upon the printing operation. As the web moves beyond the last set of rolls, the printing ink is still wet and the web must still be moved through a dryer **14**. After the web has passed out of the dryer, it is moved into contact with chill rolls **16**.

In many web drying constructions, for example, as referred to in Hering Patent No. 3,319,354, the web is maintained completely out of contact with solid surfaces between the last set of printing rolls and the chill rolls. This is particularly necessary where the web is printed on both sides since any contact with solid surfaces would tend to mar the printing.

In order to maintain the web in position as it passes through a dryer, and in order to assist in drying, air nozzles are provided for directing streams of air onto the web surfaces. As illustrated in the aforementioned patent, such nozzles may direct streams of air toward the opposite surfaces of the web with the web being maintained in position between the nozzles.

Where the web is moved at high speeds, there is a tendency for the web to vibrate and, in such case, contact with the air nozzle surfaces, or with other surfaces, becomes possible. The air nozzles **18** shown in FIGURE 1 are designed to reduce or overcome this tendency to vibrate whereby the web can be safely passed through a dryer even though the web may be moving at high speed, and even though there is a substantial distance between the last set of printing rolls and the chill rolls.

As best shown in FIGURES 3, 4 and 5, the nozzles **18** consist of a plenum chamber **20** having an inlet **22**. Air passing through the inlet **22** is distributed throughout the plenum chamber and is forced toward a plate **24** which is mounted in position across outlet **26**. This outlet **26** and the plate **24** extend completely across the nozzle. The nozzle extends beyond the side edges of the web **28**

whereby air streams issuing from the nozzles will contact the web across its entire surface.

A tubular support **30** extends along the length of the nozzle for supporting the plate **24**. Sleeves **32** are associated with the support at intervals along its length, and bolts **34** fit within these sleeves for securing the support to side walls **36** of the nozzle.

The plate **24** has a width slightly less than the width of the outlet **26** whereby elongated slits **38** are defined along both side edges of the plate. The slits **38** provide openings for the passage of air streams out of the nozzle.

Each of the nozzles includes a return duct having a top sheet portion **40**. A flange **42** is defined by the sheet **40**, and the sheet is secured to the nozzle by means of the bolts **34** which extend through openings defined by the flanges.

The sheet **40** tapers outwardly away from the path of travel of the web from its point of connection with the outlet **26** of the nozzle. At the outer end of the sheet **40**, there is provided an inturned portion **44** which defines an opening comprising outlet **46**. A hose can be attached to this outlet for withdrawing air from the return duct.

The duct sheet **40** defines a plurality of openings **48** for the entry of air. As will be more fully explained, air streams passing through upstream slits **38** will move into contact with the web, and then the air streams are drawn into the openings **48** for passage through the return ducts.

FIGURES 6, 7 and 8 illustrate the manner in which the nozzles and return ducts are secured in position in a typical operation. The securing means include arms **50** and **52** which extend outwardly from a bar **54** secured to the press frame **56** by means of bolts **58**. Spacers **62** are secured to the arms **50** and **52** by means of bolts **63**. Arms **64** are hung on pivot pins **66** which extend out from the spacers **62**. Spring mounted pins **67** extend into openings in spacers **62** to fix the angular relationship of the arms **64** with associated arm **50** and **52**. When the pins **67** are withdrawn, the arms **64** can be swung to an inoperative position. At this point, additional openings are provided in the spacers **62** whereby the pins **67** can lock the arms **64** in the inoperative position.

In FIGURE 5, the nozzles are shown spaced apart for clarification purposes. A typical operational relationship of the nozzle arms **64** is shown in FIGURE 7. Each of the arms **64** carries a bracket member **68**. The bracket member, as best shown in FIGURE 6, defines opposed extensions **70** which define bores for receiving the ends **74** of threaded rod **76**. An extension **80** of one end **74** carries an adjusting knob **82**.

The threaded rod **76** is received within a threaded bore defined by a cylinder **86** which is received in circular bores defined by opposed elements **88**. The elements **88** are attached to the end wall of the plenum chamber **20** of the nozzle **18**. It will be appreciated when considering the structure described that the nozzles can be vertically adjusted by rotation of the knobs **82**. The adjusting means are provided at either end of each of the nozzles.

FIGURE 2 illustrates schematically a proposed arrangement for the handling of air streams in a system of the type described. A blower **90** forces air through pipe **92** to a supply connection **94**, and the supply connection divides the air between hoses **96**. The respective hoses are attached to the inlet **22** of the plenum chambers **20** for the nozzles **18**. The return ducts are each connected to hoses **98** which pass air to exhaust connection **100**, and a pipe **102** directs the air back to the blower **90** to provide for complete circulation.

As previously indicated, two separate air streams issue from the nozzles **18**, and since the elongated slits **38** are of the same dimension, the respective air streams are substantially equal in volume and intensity. As best illustrated in FIGURE 1, the air streams tend to remain divided with one of the air streams following the direction of the web, and with the other air stream moving upstream against the movement of the web. This latter stream is drawn into the return duct due to the suction effect created by the blower.

In the operation of the construction described, it is preferable to first locate the face of the nozzle nearest the dryer in position adjacent the web line. The other nozzle is then put into position, and the damper **104** for exhaust connection **100** is placed in the wide open position as are the blast gates **106** for the supply connection **94**. With the blower turned on, the nozzle nearest the printing unit is lowered until a definite S-shaped deflection occurs in the web.

If web vibration still continues, the same nozzle should be lowered until maximum damping it attained. With the adjustability features described, and through the use of the dampers and blast gates, ideal operating conditions can be easily accomplished. It will be appreciated in this connection that the supporting means for the nozzles may permit horizontal adjustment of the nozzle positions (e.g. by providing elingated slots for the bolts **63**) as well as angular adjustment (e.g. by providing rotational adjusting means through stud **107** and lock nut **108** in FIGURE 7) whereby the best operating conditions can be achieved. When the nozzles are not in use, the connection achieved by the pins **66** and **67** permits rotation of the nozzles out of position whereby the nozzles need not be removed but will also not interfere with the other operations of the system.

Although it is difficult to specifically analyze the reasons for the reduction in vibrations achieved by the instant invention, it is believed that the S-shape acts as a barrier to the wave motion generated by impulses transmitted to the web. Furthermore, the S-shape takes up additional web length which is caused by plastic flow.

When the S-shaped system is used without the return ducts, problems arise, particularly with respect to the press operation. The return ducts eliminate these difficulties by picking up substantially all air which is directed toward the printing unit so that there is no danger of drying the ink during the printing operation.

It will be understood that various changes and modifications may be made in the above described construction which provide the characteristics of this invention without departing from the spirit thereof particularly as defined in the following claims.

That which is claimed is:

1. In a web handling construction wherein a length of material forming the web is suspended between spaced-apart points and is moved between these points, the improvement comprising means located between said points for suppressing vibrations in said web as the web moves between said points, said suppressing means comprising a first air nozzle located on one side of said web and a second air nozzle located on the other side of said web, one of said air nozzles being located upstream of the other nozzle with each of said nozzles including air outlet openings which direct streams of air toward said web whereby an S-shaped configuration is imparted to the web in the vicinity of said nozzles and including return ducts associated with each of said nozzles and located upstream of the respective nozzles, and including means for directing at least some of said air passing out of said outlet openings upstream in opposition to the direction of web movement and over the respective surfaces of the web before passage into said return ducts.

2. A construction in accordance with claim **1** including an offset printing press and an associated drying apparatus, said spaced apart points comprising the last printing rolls of said press and the outlet of the drying apparatus, said web being carried through said drying apparatus subsequent to printing with the web being out of contact with supporting rolls, and wherein said suppressing means is located immediately upstream of the drying apparatus.

3. A construction in accordance with claim **1** wherein said nozzles discharge separate streams of air with a

portion of said air passing upstream into said return ducts and the balance of the air passing downstream in contact with the web surfaces.

4. A construction in accordance with claim 3 wherein said nozzles define elongated discharge ends extending the width of said web, a plate located within the openings defined by each discharge end, said plate having a width slightly less than the width of said opening whereby elongated slits extending the width of said web are defined along the opposite side edges of said plate, said slits comprising said air outlet opening.

5. A construction in accordance with claim 1 wherein the return ducts each comprise a top sheet member attached to said nozzles and extending along the length of said nozzles, a chamber defined between said top sheet, and a hose connection to said chamber for withdrawing air from the chamber, said top sheet defining inlet openings and being attached to an associated nozzle along a line in substantially the same plane as the outlet openings of the nozzle, each of said top sheets tapering outwardly away from the web from this line of connection with the nozzles.

6. A construction in accordance with claim 1 including means for adjusting the relative vertical positions of said suppressing means.

7. A construction in accordance with claim 6 wherein said suppressing means are attached to a bracket, said adjusting means comprising manually operable means for moving said suppressing means relative to said bracket.

8. A construction in accordance with claim 1 including means for adjusting the relative horizontal positions of said suppressing means.

9. A construction in accordance with claim 1 including means for adjusting the angular relationship of the suppressing means relative to the web.

10. A construction in accordance with claim 1 including air circulating means for drawing air into said return ducts whereby at least a portion of the air issuing from said outlet is positively drawn in a direction opposite the direction of movement of the web and into said return ducts.

11. A construction in accordance with claim 2 wherein said air circulating means comprises an air blower having its intake end communicating with said return ducts.

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