Oct. 18, 1960 F. J. BRUNO 2,956,301

WEB CLEANING APPARATUS

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Fig. 1.

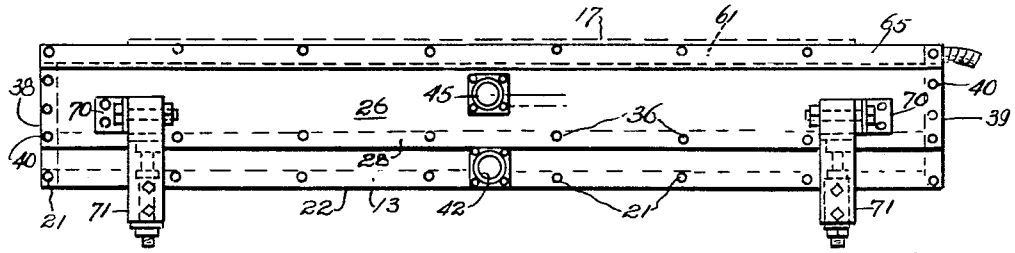


Fig. 2.

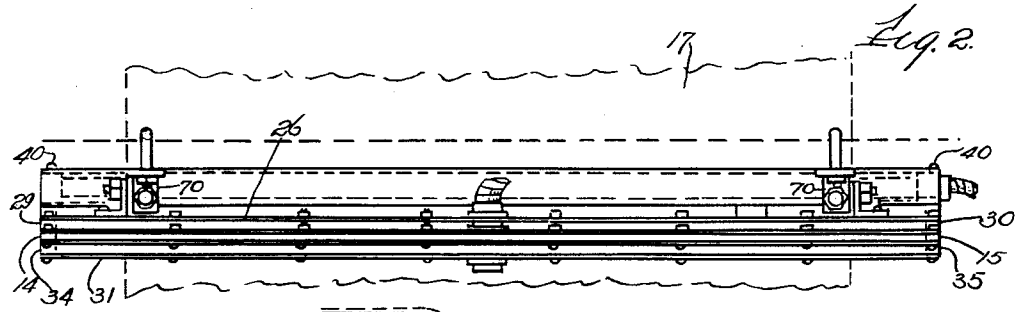
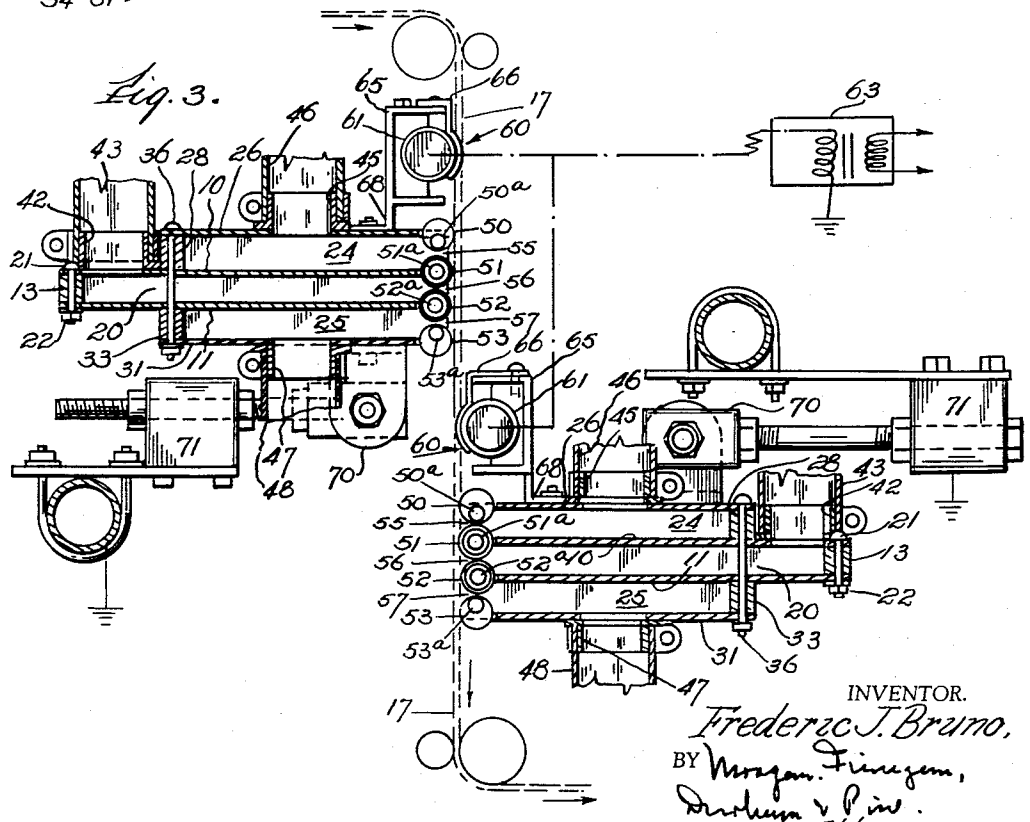


Fig. 3.



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Fig. 4.

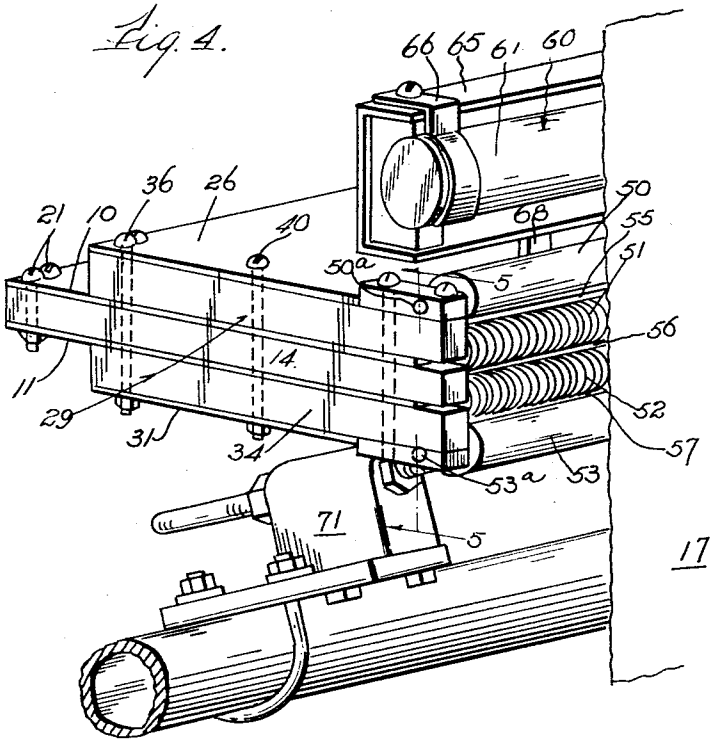
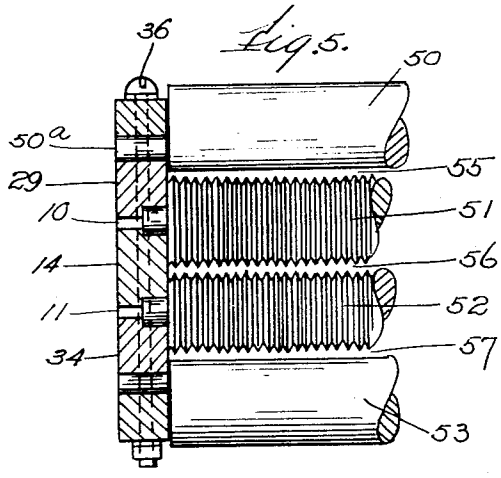


Fig. 5.



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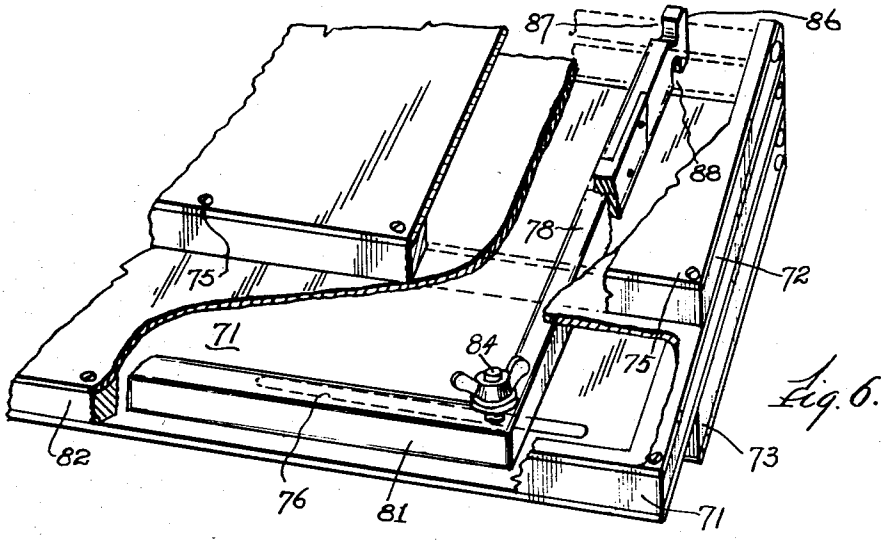


Fig. 6.

Fig. 7.

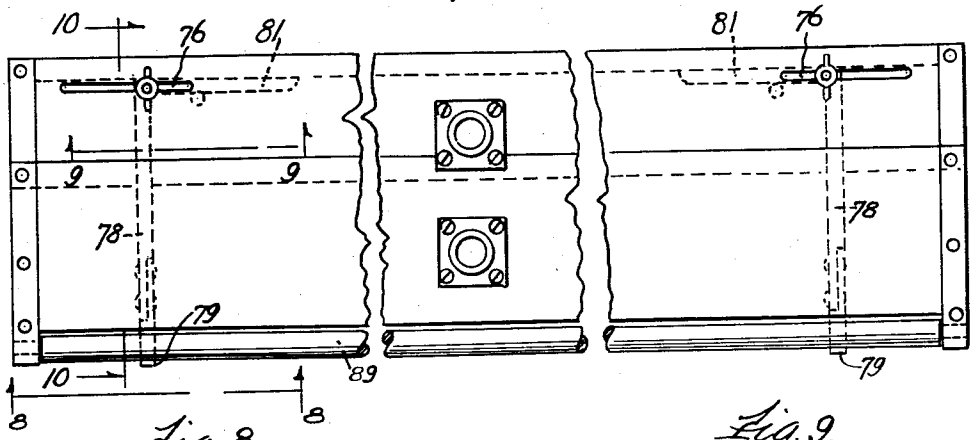


Fig. 8.

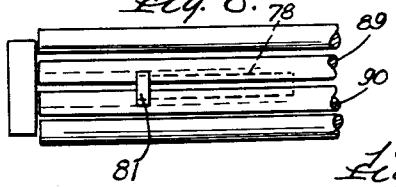


Fig. 9.

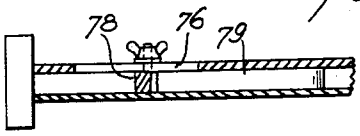
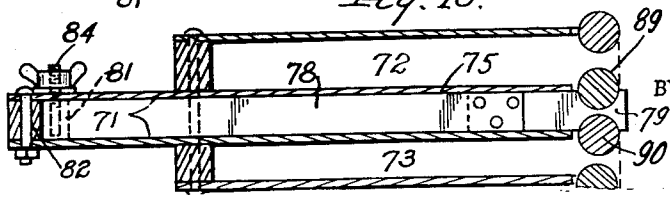


Fig. 10.



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2,956,301

WEB CLEANING APPARATUS

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Filed July 12, 1957, Ser. No. 671,475

4 Claims. (Cl. 15—306)

This invention relates to a cleaning system for paper and other web materials and more particularly concerns a new and improved means for removing dirt, fiber particles and foreign matter generally from paper, particularly newsprint, die-cut carton blanks, textile fabric and the like.

The invention to be hereinafter described constitutes an improvement upon the cleaning system disclosed and claimed in my prior application S.N. 630,977 filed December 27, 1956. The apparatus embodying the present invention is particularly adapted for cleaning the surface of newsprint although it may be used for cleaning all kinds of sheet material.

In general, of the various kinds of paper which are used in printing, newsprint stock has the most dirt and the cleaning thereof presents the most serious problem. This is particularly true if the paper web travels at high speeds present in modern press work. It has been found that other web cleaners do an inadequate cleaning job unless the speed of paper travel is reduced or a relatively large number of cleaning units are used.

This invention aims to provide relatively simple and economical means for handling newsprint at conventional paper speeds. As a rule newsprint may travel through a press at the rate from about 40 to 60 feet per second. It is therefore essential that the web cleaning means have high efficiency in order to operate satisfactorily.

An important feature of the present invention resides in the provision of a combined compressed air and suction head wherein the construction provides an uninterrupted path for dirt laden air from the paper surface to the suction generating means.

The apparatus embodying the present invention may be disposed to clean a web prior to the feeding of the web to any other desired means. Thus the web may be transferred from one roll to another or may be moved toward printing cylinders or the web may be travelling toward waxing means. In the latter case, the web is most likely to be of stock other than newsprint. Inasmuch as newsprint is considered to be one of the most difficult webs to clean, the invention will be disclosed in connection therewith. It is understood that the less rigorous demands of webs other than newsprint will be more than met by the apparatus embodying the present invention.

The invention in general contemplates web cleaning heads on opposite sides of the web. While the cleaning heads may be disposed directly opposite each other, it is preferred to stagger the cleaning heads along the length of the web travel. Such a staggered arrangement is advantageous in rendering the manual threading of paper easier when a new web is started. Each cleaning head in general has three chambers each extending across the full width of the web, said chambers having common walls separating them and provided with uninterrupted, laterally off-set, elongated slots disposed near the surface to be cleaned. One chamber is disposed between the remaining two chambers. The middle chamber acts as

one unit while the two outer chambers act as two other portions of a cooperating unit.

The one unit consisting of the middle chamber may have compressed air or suction applied thereto while the two remaining chambers as the other unit may have suction or compressed air applied thereto. The openings for the chambers are in the form of uninterrupted slots extending the full width of the web, said slots permitting air to travel out from the chamber or in thereto.

The chambers are so shaped that substantially direct paths for air are provided from the suction slot to the pipe connected to the chamber for applying suction. I have found that the provision of such direct paths greatly reduce the possibility of dirt piling up inside of a chamber with the result that operation at a high level of efficiency is possible for long periods of time.

In order that the invention may be fully understood, an embodiment will be described in connection with accompanying drawings forming part of this application. It is understood however that variations may be made without departing from the scope of the invention as defined by the appended claims.

Figure 1 shows a top plan view of one web cleaning head.

Figure 2 is a rear elevation of the cleaning head illustrated in Figure 1.

Figure 3 is a transverse section of a pair of cleaning heads for operating on two sides of a web.

Figure 4 is a perspective detail of one part of a cleaning head.

Figure 5 is a detail partly in section on an enlarged scale of a portion of the cleaning head illustrated in Figure 4.

Figure 6 is a perspective view of part of a modified cleaning head provided with slidable means for controlling the width of the active portion of the head, certain parts being broken away for clarity.

Figure 7 is a plan view of a cleaning head having the construction illustrated in Figure 6.

Figure 8 is a detail on line 8—8 of Figure 7.

Figure 9 is a sectional detail on line 9—9 of Figure 7.

Figure 10 is a sectional detail on line 10—10 of Figure 7.

A cleaning head such as illustrated in the drawings consists of a pair of flat rigid plates 10 and 11 maintained in spaced parallel relation by rear spacing block 13 and side spacing blocks 14 and 15 respectively. As is illustrated in Figures 1 and 2, plates 10 and 11 have a length extending transversely of web 17. The length of plates 10 and 11 is sufficiently great to accommodate the widest web to be handled.

Plates 10 and 11 are of smooth rigid material and may be of metal such as steel, aluminum or brass or of such rigid plastic material as fiber or Bakelite. It is preferred however to make plates 10 and 11 of metal. Spacers 13 to 15 inclusive may consist of rigid material, either metal or non-metal, the spacers being dimensioned to endow the structure with desired mechanical strength. Plates 10 and 11 and spacers 13 to 15 inclusive form the walls of chamber 20. The plates and spacers are maintained in assembled relation by bolts 21 and nuts disposed near rear edge 22 of chamber 20.

Plates 10 and 11 also form the dividing walls between middle chamber 20 and chambers 24 and 25 disposed laterally on opposite sides of chamber 20. Chamber 25 has end plate 26 parallel to plate 10. Plate 26 has a width which is somewhat less than the width of plates 10 and 11. The width is that dimension as seen in Figure 3 for example which extends from rear spacers 13 along plates 10 and 11. Plate 26 is maintained in spaced relation to plate 10 by rear spacer 28 and side spacers 29 and 30.

Chamber 25 is provided with outer plate 31 which is

similar in all respects to plate 26. Plate 31 is maintained in spaced relation to plate 11 by rear spacer 33 and side spacers 34 and 35. Rear spacers 28 and 33 for chambers 24 and 25 have bolts 36 passing through the spacers and through chamber 20. Suitable nuts on the bolts maintain the assembly intact. The spacers along side edges 38 and 39 of the complete head for chambers 24 and 25 as well as for chamber 20 are maintained by bolts 40 having suitable nuts.

It will be noted that plates 10, 11, 26 and 31 all have substantially the same length, this being the dimension across web 17. The spacing between plates 26 and 10, between plates 10 and 11 and between plates 11 and 31 may be of about the same order. It is preferred to have the spacing between the plates defining chambers 24 and 25 substantially equal.

Chamber 20 and the laterally offset chambers 24 and 25 will generally have about the same length (transversely across web 17) and will generally have about the same height (in the direction of movement of web 17) but will have different depths. Thus chambers 24 and 25 may have the same depth whereas chamber 20 will be somewhat deeper because of the portion projecting beyond rear spacers 28 and 33.

Means are provided for connecting air pipes to the three chambers. Chamber 20 has collar 42 rigidly attached to an accessible portion of plate 10. As illustrated in Figure 1, collar 42 is disposed substantially midway between edges 38 and 39 of the entire construction and adjacent rear edge 22. As is clearly shown in Figure 3, the material of plate 10 within collar 42 is removed. A hose or pipe 43 may be slipped over collar 42 and a suitable hose clamp may be provided for retaining the hose in position if necessary. If desired an air connection may be provided in opposed plate 11 so that pipes may communicate with chamber 20 from opposite sides.

Similar air connections are provided for chambers 24 and 25. For chamber 24, collar or flange 45 is provided at a suitable portion of plate 26. This flange may be disposed generally midway between edges 38 and 39 and about midway between the rear of chamber 24, this being where spacer 28 is and the wall of the flange to be described. Suitable hose 46 may be disposed over flange 45. Chamber 25 may be similarly provided with hose flange 47 for accommodating hose 48.

As has been indicated previously, chambers 24 and 25 may be connected to a suitable air pump for pulling a vacuum. In such case chamber 20 will be connected to a source of compressed air. The connections will be established through hoses 46 and 47 for chambers 24 and 25 and through hose 43 for chamber 20. It is also possible to reverse these connections so that the vacuum is applied to chamber 20 while compressed air is supplied to chambers 24 and 25.

Chambers 24, 20 and 25 have means at the front portions of the chambers, this being opposite to the rear spacer blocks, for defining long narrow slots extending transversely across the direction of web travel and adjacent a web in the normal operation of the cleaning head. Preferably, though not necessarily, each chamber has at the front thereof one long slot. While various means may be provided for defining the slots, a simple means consists of rods 50, 51, 52 and 53.

The rods are disposed in spaced, laterally offset, parallel relation to provide slots 55, 56 and 57 for chambers 24, 20 and 25 respectively. Rods 50 to 53 inclusive are preferably of smooth, polished metal and may have their surfaces chromium plated to reduce the possibility of dirt sticking to the rod surfaces. The rods may have any desired shape and may conveniently be long and round. Rods 50 and 53 are here illustrated as having smooth outer cylindrical surfaces. Rods 51 and 52 may also be smooth but are preferably provided with grooves or threading on the outside to break up the surface. The grooves may be formed by annular channels or may be helical and form part of a continuous thread, the length of the rod. It is also possible to have the outer surfaces of rods 50 and 53 similarly provided with annular grooves.

Rods 51 and 52 may be carried by pins 51*a* and 52*a* set in suitable apertures in the side spacer blocks. These pins are centered on the rods and the spacing between the opposed rod surfaces will provide slot 56 of suitable width.

Rods 50 and 53 are also carried by pins 50*a* and 53*a* respectively. These pins may be disposed eccentrically of the rods and are so designed as to permit rods 50 and 53 to be turned to adjust the width of slots 55 and 57.

Suitable means may be provided for mounting the four rods to control this lateral spacing between all of the rods and thus control the widths of the respective slots. It is understood that in all cases, slots 55, 56 and 57 will give access to chambers 24, 20 and 25 respectively. The round configuration of the rods is preferred for directing the air paths and dirt.

Each cleaning head has associated therewith a means for ionizing the air on the leading or advance side of the head. Referring for example to Figures 3 and 4, web 17 is pictured as travelling downwardly past the head. Ionizing means generally indicated by 60 is disposed above the cleaning part of the head to be near a web surface just prior to the time that the portion of the web reaches the cleaning part of the head.

Ionizing means 60 consists of elongated gas discharge tube 61 of glass or special material which is transparent to ultra-violet light. The tube material is insulating and extends for the width of the web.

Tube 61 has a filling of a rare gas such as argon or neon at a low pressure and also has some mercury therein. A gas tube of this character may have a discharge initiated therein by an electrode sealed within the glass and passing through the glass wall. The electrode is connected to a source of high potential such as transformer 63. Transformer 63 may be of the type used for neon signs.

It is well known that a gas tube of this character will first start with a discharge through the rare gas, unless the tube is warm, after which the mercury vapor within the tube will suffice to carry the electric discharge. The discharge through mercury vapor will provide a spectrum characteristic of mercury wherein red is absent. Such a mercury discharge is quite rich in ultra-violet.

The discharge circuit through the tube is completed by having grounded channel 65 supporting the tube. Transformer 63 has one terminal grounded. Channel 65 extends the length of the tube and has brackets 66 at the ends thereof for supporting the tube in proper relation to the channel. Channel 65 is supported on angle iron 68 on top plate 26 of the cleaning head. Channel 65 is preferably of aluminum having a bright reflecting surface. The ultra-violet light from tube 61 is concentrated on the surface of web 17.

Gas discharge tube 61 is supported in such a way that the outer surface thereof is almost tangent to the adjacent web surface. The entire assembly of cleaning head and ionizing means may be supported in any suitable fashion by brackets 70 and 71 and suitable bolts. This entire assembly is supported in proximity to web 17 by bolting to suitable bars.

As indicated in Figures 3 and 4, a complete cleaning head and ionizing assembly is provided on each side of web 17. It is preferred to stagger these assemblies along the path of travel of the web so that one assembly is not opposite the other. This makes it possible to thread a new web and also prevents vibration or flutter of the web due to one cleaning head effecting the position of the web with respect to the other cleaning head. In practice, a cleaning head and ionizing means will have a width great enough to accommodate the widest web to be handled. Any web narrower than maximum width

may be readily handled by masking the cleaning head with tape or a metal clamp.

For cleaning newsprint or web having a high dirt content, it is preferred to have compressed air at the central chamber and vacuum at the two side chambers. Where the load is not as great as for example, with other kind of paper or for fabric slitting, the air connections may be reversed. Irrespective of the manner of connections, the interior surfaces of the various chambers making up a cleaning head will provide for a free flow of air and dirt under suction.

It will be noted that the chambers enlarge the air space just back of the slots through which air and dirt pass. Thus for example referring to chambers **24**, and **25**, the height of the chamber, that is the dimension along the direction of travel of web **17**, is quite great in comparison to the dimension of the slot through which air and dirt due to suction pass from the web. This arrangement prevents an accumulation of dirt at the mouth of the chamber.

Once the dirt is inside the chamber, the relatively smooth surfaces of the chamber promote the flow of dirt and permit the dirt to be sucked up by the appropriate hose or pipe.

As has been previously pointed out, the cleaning heads are made to accommodate the maximum width of web. In order to accommodate narrower webs, it is necessary as a rule to block the unused part of the head off insofar as the suction slots are concerned. An adequate supply of compressed air and the maintenance of pressure as a rule presents no problem. Hence unused compressed air discharge portions of the head beyond the edges of a web are of no particular concern. However maintaining adequate suction pressure requires equipment having sufficient capacity. Any unused suction portion of the head beyond the web edges would represent a serious leak into the system and would greatly reduce the operating efficiency of the suction generating system. Accordingly it is desirable to block off those parts of the cleaning head having suction, which parts are not used because of the narrowness of a web. Figures 6 to 10 inclusive illustrate a simple construction for accomplishing the above.

Referring first to Figure 6, there is illustrated in perspective a three chamber cleaning head generally similar to the heads illustrated in Figures 1 to 5 inclusive. In this modification, the effective suction cutoffs are applied only to the central chamber which means therefore that this central chamber will have to be used for suction purposes. Thus referring to Figure 6, the cleaning head comprises suction chamber **71** having compressed air chambers **72** and **73** disposed laterally of chamber **71** in a manner previously described.

Middle chamber **71** has top wall **75** provided with slot **76** extending parallel to the rear edge of the wall plate. Disposed within middle chamber **71** adjacent an end thereof is movable end partition **78** extending forwardly from the rear of the chamber toward the front provided with a discharge slot **79**. Partition **78** consists of a block of metal or other suitable rigid material dimensioned to form a movable side wall between the top and bottom walls forming chamber **71**.

Partition member **78** is rigidly attached to or integral with elongated support member **81** which is dimensioned to fit snugly between the top and bottom walls of chamber **71** and bear against end spacer block **82** of chamber **71**. Partition member **78** and support member **81** thus form a right angle.

Elongated support member **81** carries pin **84** extending upwardly therefrom and through slot **76** of top wall member **75**. Pin **84** may have the outer portion thereof threaded and will accommodate wing nut **85** or a knob or any suitable means which may be handled. Wing nut **85** may be loosened to permit the right angle construction consisting of partition **78** and support member **81** to move along the length of chamber **71**. At any desired position, wing nut **85** may be turned down to tighten the same against top wall **75** to lock the partition and support member in position.

Partition member **78** extends forwardly of the chamber and has front portion **86** provided with suitable slots or clearance openings **87** and **88** for clearing rods **89** and **90** defining front suction slot **79**.

Support member **81** is snug against slot **76** of top wall **75**. Slot **76** will be covered by wider members **81** so that the portion of chamber **71** which is subject to suction will be substantially sealed. As illustrated in Figure 7, chamber **71** is provided at the two ends thereof with movable partition members so that the effective width of a web to be handled may be controlled. It is clear that there is no necessity for any symmetrical disposition of the two partition members.

Chambers **71**, **72** and **73** are provided with suitable connections for suction and compressed air respectively in a manner previously described in connection with Figures 1 to 5 inclusive. It is understood that the cleaning head described in Figures 6 to 10 inclusive may be used in conjunction with an ionizing lamp such as illustrated in Figures 1 to 5 inclusive.

In the modification illustrated in Figures 6 to 10 inclusive, the pin and wing nut for manual adjustment of the partition members extends through a top wall of the chamber. It is clear that pin **84** may extend through a bottom wall or may extend through spacing block **82**. The latter provisions will be necessary in case the central chamber is not greater than the top and bottom chambers insofar as depth is concerned.

While the adjustable partitions will provide only for the suction chamber as illustrated in Figure 6, it is also possible to provide the compressed air chamber with the same means. In such case it will be possible to reverse the suction and compressed air connections in a manner previously described in connection with Figures 1 to 5 inclusive.

Having thus described the invention, it is understood that various modifications and changes will be made without departing from the scope of the invention except as defined by the appended claims.

Having described the invention and illustrated the preferred embodiment, what is claimed is:

1. Apparatus for cleaning dirt from a travelling web, said apparatus comprising four smooth flat rigid plates long enough to extend transversely across the widest web to be handled, means including rectangular spacer blocks for maintaining said plates in spaced parallel relation to define three laterally offset chambers, each chamber having means defining a slot opposite the web when the apparatus is in normal use, each chamber being otherwise isolated from the other chambers and being defined by substantially flat smooth surfaces except at the region near the slots, means for establishing an air connection from each chamber to external air moving means, the outer two chambers being adapted to have one connection to air moving means and the inner chamber being adapted to have another connection to air moving means so that said connections are to compressed air and suction respectively, said slot defining means comprising round rods extending along the edges of the plates defining the chambers, said slots being defined between adjacent rod surfaces extending the full width of the web, each chamber having one slot and the slot being much narrower than the chamber dimension between adjacent plates, said slot keeping itself substantially free of dirt.

2. The construction according to claim 1 wherein means are provided for eccentrically mounting at least two of said rods so that the slots defined by said rods may be varied by turning said eccentric rods and controlling the space between rods.

3. Apparatus for cleaning dirt from the surface of a traveling web, said apparatus comprising a plurality of smooth flat rigid plates disposed in spaced, parallel but laterally offset relation, rectangular spacing members disposed between said plates adjacent the edges of said plates so that plates and members define chambers, each chamber having one side open, means for rigidly supporting said plates and spacing members in predetermined relation so that said open sides face a web, air connections for each chamber so that suction or compressed air conditions may be created in each chamber, slot defining means for closing the open chamber side, said slot defining means providing a continuous elongated slot for each chamber extending the full width of a web, said chambers having smooth flat walls except for the regions in back of the slot openings whereby dirt entering a slot because of suction will not accumulate within a chamber, means for effectively limiting the suction chamber so that the suction slot extends for the width of a web, said limiting means including a movable member adjacent end of the chamber and extending from the rear of the suction chamber to the slot of the suction chamber and manual means extending through one of the walls of said suction chamber for moving said movable member laterally to provide an adjustable end wall for each end of said suction chamber, said movable member having attached thereto at the rear of the suction chamber a supporting member which is adapted to slide against the adjacent chamber walls, one of the chamber walls having a pin slot therethrough, said movable member and supporting member having a pin extending through said pin slot, said pin having locking means on the outside of said chamber for locking said movable member in a fixed position, said supporting member functioning to seal the pin slot.

4. Apparatus for cleaning dirt from a travelling web, said apparatus comprising four smooth flat rigid plates long enough to extend transversely across the widest web to be handled, means including rectangular spacer blocks for maintaining said plates in spaced parallel relation to define three laterally offset chambers, each

chamber having means defining a slot opposite the web when the apparatus is in normal use, each chamber being otherwise isolated from the other chambers and being defined by substantially flat smooth surfaces except at the region near the slots, means for establishing an air connection from each chamber to external air moving means, the outer two chambers being adapted to have one connection to air moving means and the inner chamber being adapted to have another connection to air moving means so that said connections are to compressed air and suction respectively, said slot defining means comprising four round rods extending along the edges of the plates defining the chambers, said rods defining slots between adjacent rod surfaces, there being four rods in laterally aligned relation, means including eccentric pins for securing the end rods, said rods being rotatable on said pins to adjust the slot opening for the outer two chambers, the remaining two inner rods having their outer surfaces provided with grooves around said rods.

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