Nov. 3, 1959 E. D. BEACHLER 2,911,041

STOCK DISTRIBUTOR ASSEMBLY

Filed Dec. 27, 1956 3 Sheets-Sheet 1

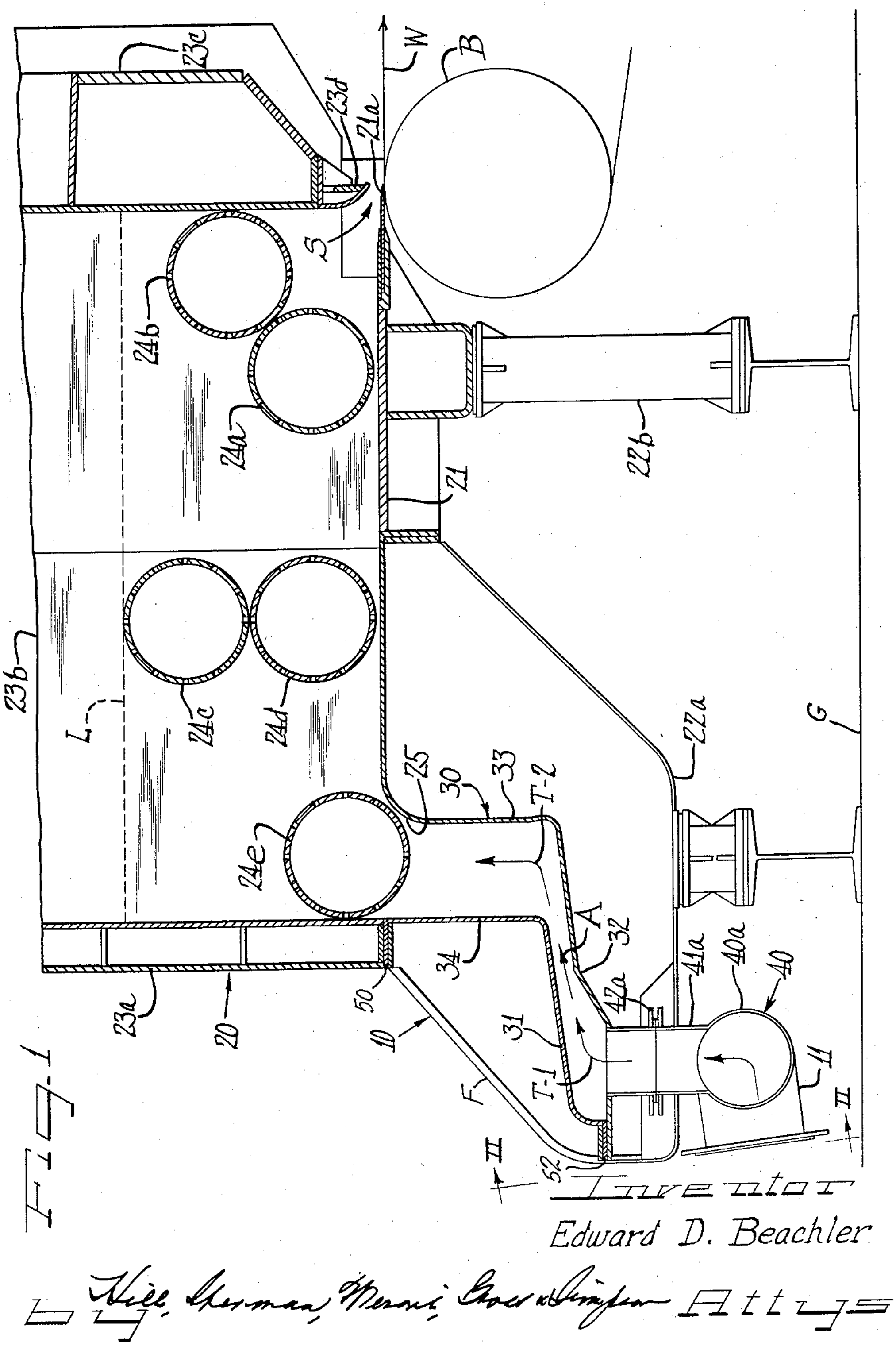

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Fig-2

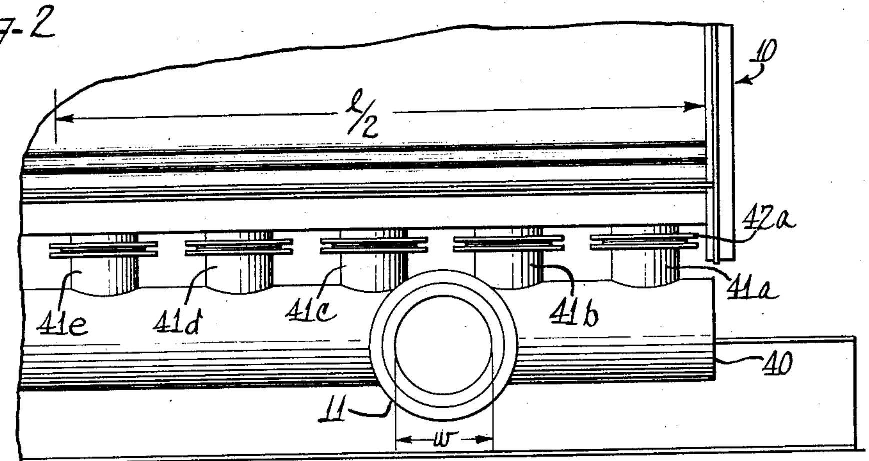

Fig-3

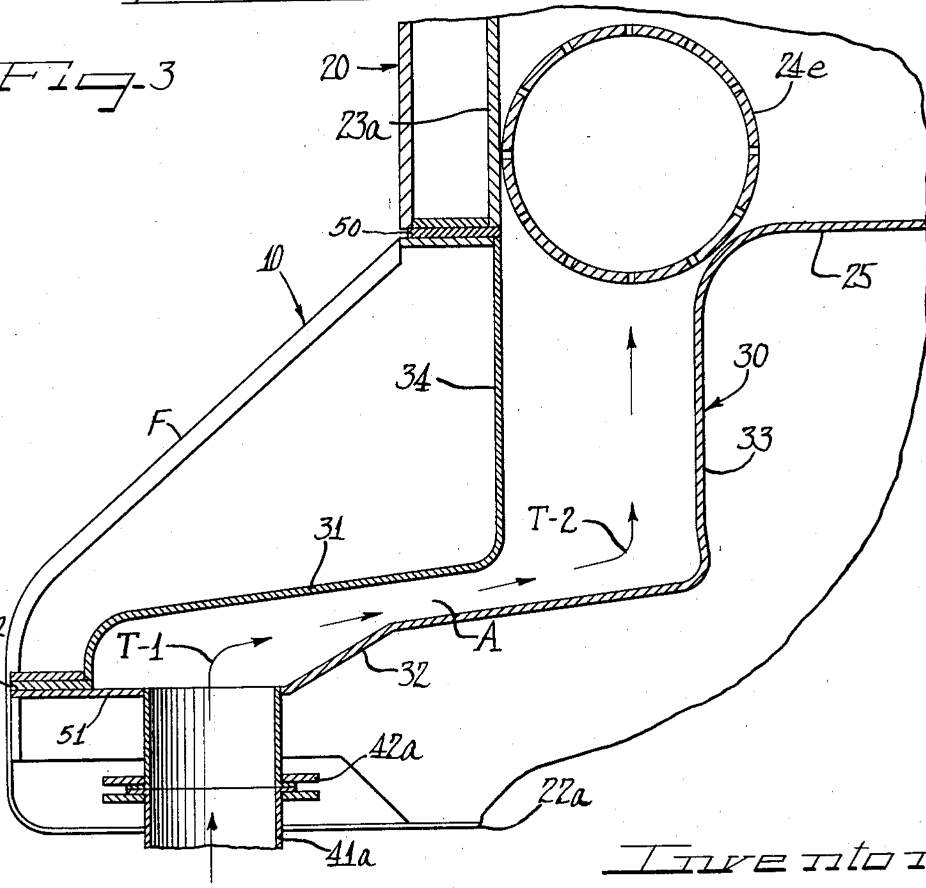

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Fig. 4

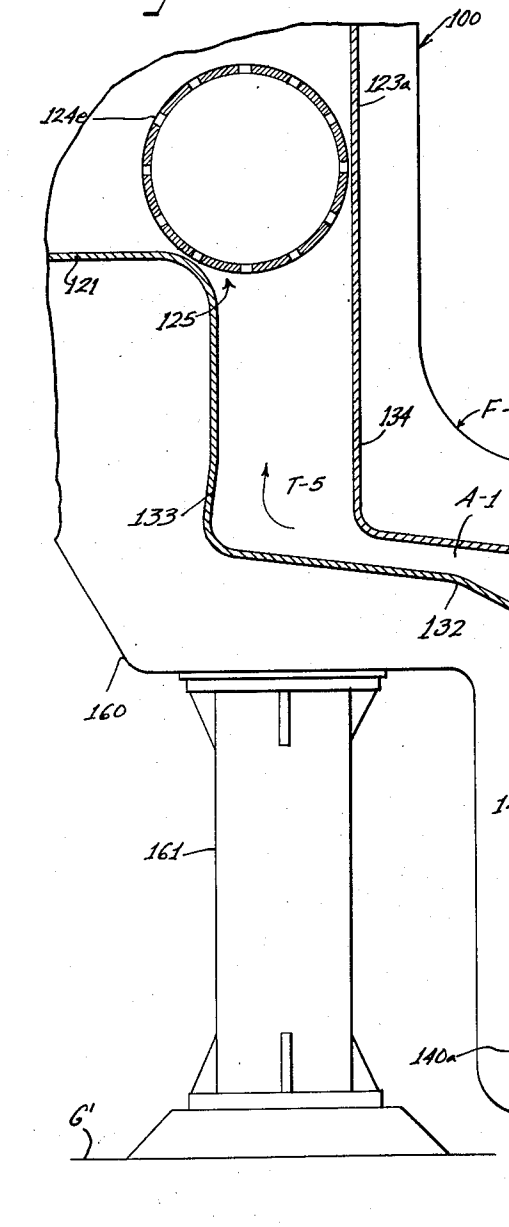
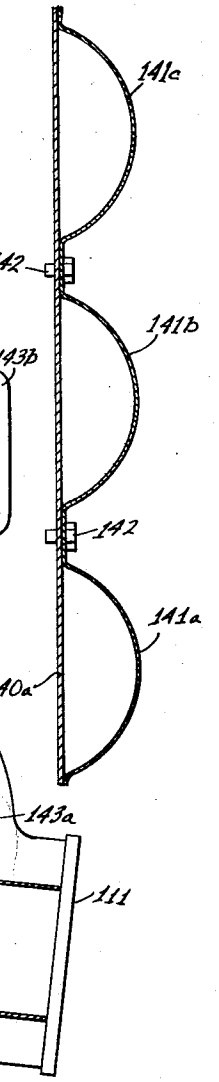


Fig. 5



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STOCK DISTRIBUTOR ASSEMBLY

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Application December 27, 1956, Serial No. 630,898

5 Claims. (Cl. 162—336)

The present invention relates to a stock distributor for use with paper making machines, and more particularly, to a stock distributor for converting relatively high speed flow of stock in a conduit of small cross-section into a uniform relatively slower flow of stock in the inlet box for insuring an even deposition of paper stock across the entire forming surface of the machine.

In the art of paper making, the even distribution of stock fibers across the entire width of the forming surface of a paper making machine has long presented a problem. Also, there is constantly a desire to flow stock more rapidly onto the forming surface, and by the use of a minimum amount of uncomplicated stock distribution structure. Relatively complicated countercurrent flow devices have been used; but the instant invention relates to a greatly simplified flow distributor which converts a fast flowing stock stream of relatively small cross-section to a slower flowing stock stream of large cross-section and substantially the width of the inlet box wherein the stock flow is uniform by virtue of the stock having been forced through right angle turns and/or a restricted passageway, both of which serve to direct the stock laterally so that the flow will be uniform by the time it enters the inlet box.

It is, therefore, an important object of the instant invention to provide an improved stock distributor and/or method of stock distribution.

It is a further object of the instant invention to provide an improved stock distributor wherein stock is taken from a conduit of small cross-section into a distributor of substantially the width of the inlet box and is then forced through a stock flow path through a right angle turn and through a reduced cross-sectional area and then into the inlet box.

Other and further objects or advantages of the instant invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

On the drawings:

Figure 1 is a sectional elevational view of a stock distributor and inlet box embodying the instant invention;

Figure 2 is a fragmentary end elevational view taken substantially along the line II—II of Figure 1;

Figure 3 is an enlarged fragmentary sectional elevational view of the stock distributor shown in Figure 1;

Figure 4 is a view comparable to Figure 3 showing a different embodiment; and

Figure 5 is taken along the line V—V of Figure 4.

As shown on the drawings:

A stock distribution system embodying the instant invention, herein designated generally by the reference numeral **10** comprises a first conduit **11** of small cross-sectional area and width directing a high velocity stream of stock, a stock inlet box **20** of relatively larger cross-sectional area and width accommodating a relatively slower flow of stock, a second conduit **30** flowing stock into the inlet box **20**, said second conduit **30** extending

the width of the inlet box **20** and defining a stock flow path through a first right angle turn T–1, a reduced cross-sectional area A and then through a second right angle turn T–2, and a distribution header **40** extending the full width of the stock inlet **20** receiving stock from the first conduit **11** and feeding into the second conduit **30** through a plurality of laterally spaced openings or pipes **41***a*, **41***b*, etc.

Referring first to the general structure of the inlet box **20**, as best shown in Figure 1, it will be seen that the inlet box **20** is defined by a generally horizontal floor **21** suitably mounted on a rear supporting frame **22***a* and a front supporting frame **22***b*, both of which are supported by the operating floor G in the usual manner. The inlet box **20** is further defined by an upright rear wall **23***a*, side walls **23***b* on the backside and a front side wall (not shown), and a forward wall structure **23***c* carrying a slice-defining element **23***d* cooperating with an apron **21***a* carried by the floor **21** to define the outlet slice gates, from which stock flows onto a travelling forming wire W turning over a breast roll B in the usual manner. The inlet box **20** is also equipped with a plurality of rectifier rolls **24** having the customary rectifier roll design and function. Rolls **24***a* and **24***b* are positioned in close running relationship with the floor **21** and the forward upright wall **23***c* and with each other so as to bridge the stock flow passing into the slice S. The rectifier rolls **24***c* and **24***d* are stacked in the middle of the inlet box **20** to approximately the level L at which the stock will flow in the inlet box **20** so that all of the stock flowing therethrough will pass through the rectifier rolls **24***c* and **24***d*.

The inlet box **20** is also provided with a bottom opening **25** extending the full width of the inlet box **20** and opening downwardly therefrom along the rear wall **23***a*. A rectifier roll **24***e* is mounted in close running relation to the wall portions defining the bottom opening **25**.

In the operation of the instant device **10**, stock is forced from a fan pump or other suitable pumping device (not shown) into the first conduit **11** which has a relatively small cross-sectional area and width. As here shown the first conduit **11** has a width *w* of approximately one foot with stock flowing therein at rates of 12 to 15 feet per second. The inlet box **20**, by contrast, has a lateral dimension 1 of about 14; but as indicated in Figure 2, the conduit **11** feeds approximately one-half of the width or lateral dimension of the inlet box **20** and the opposite side (not shown) of the device **10** in Figure 2 is equipped with another conduit comparable to the conduit **11** and an extension of the header **40** with another five pipes **41***f* through **41***j* (not shown). To complete the picture with respect to the differences in cross-section between the inlet box **20** and the first conduit **11**, the stock level L ranges from about 2 to 3 feet. It will thus be seen that the stock flows much more slowly in the inlet box and that a stock flow rate that is relatively high and relatively difficult to handle is required in the first conduit **11**.

The header **40** is positioned just above the first conduit **11** (so that there will be upward flow of stock from the conduit into the header) and extends the full width of the inlet box **20** receiving stock from the first conduit **11**. The stock flows from the first conduit **11** into the header **40** whereat it is abruptly turned through a 90° angle. The effect of this is to impinge the stock stream against the front side **40***a* of the header **40** so that the stock will be forced laterally as it enters the header **40**. Next the stock is forced into a pattern of generally parallel streams flowing through the laterally spaced outlet pipes **41***a*, **41***b*, etc. from the header **40**. The outlet pipes **41***a*, **41***b*, are closely spaced and in generally parallel alignment so as to provide guide means for guiding the

stock flow perpendicular to the header **40** and to generally reduce excessive lateral flow of the stock. Generally perpendicularly aligned baffles in laterally spaced relationship could be mounted in a conduit replacing the pipes **41***a*, **41***b*, but the pipes **41***a*, **41***b* afford a preferred arrangement. Although a flange connection **42***a* is here shown so as to separate the pipe **41***a* into upper and lower sections, it will be appreciated that the two sections (in the case of each of such pipes) carry out the function of a single pipe. The stock thus flows from the pipes **41***a* upwardly and is then impinged against a baffle **31** above and generally normal to the pipes **41***a*, **41***b*, etc. for turning the stock flowing from the pipes through a right angle turn T–1. It will be noted that the baffle **31** slants upwardly slightly in the direction of stock travel (as indicated by the arrows), and the baffle **31** extends the full width of the inlet box **20** so as to provide a chamber in the region of the right angle turn T–1 that is opened the full width of the inlet box **20** to receive all of the stock flow from the pipes **41***a*, **41***b*, etc. The baffle **31** defines the roof of the chamber. The second conduit **30** is also defined in part by a floor portion **32** which cooperates with the baffle portion **31** to define a conduit portion having an increasingly restricted mouth the full width of the inlet box **20** receiving stock turned by the baffle **31**. At the point of maximum restriction A in the conduit **30**, the height of the conduit is approximately one-half the height of the conduit in the region of the first turn T–1 where the stock is first received by the baffle **31**. The stock flows in the upwardly extending pipes **41***a*, **41***b*, etc. at a rate of about 6–8 feet per second and this flow rate is reduced to approximately one-half that figure in the region of the first turn T–1 and is again increased to 6 to 8 feet per second at the point of maximum restriction, at A in the conduit **30**. As will be appreciated, impinging stock against the baffle **31** imparts a lateral component to the stock flow so as to further distribute the stock at the point of the turn T–1. In addition, it will be appreciated that restricting the stock flow area at A serves to unify the flow throughout the width of the inlet box **20** in this region A. It will thus be appreciated that the restricted portion A serves to compensate for inequalities in stock flow throughout the entire width of this restricted portion A. Next, the stock flows along the conduit floor **32** and against a second baffle **33** generally normal to the stock flow from the restricted area A so as to turn the stock again at a right angle in the stock flow path at the turn T–2.

The second baffle **33** cooperates with an upwardly extending conduit portion **34**, spaced a substantial distance therefrom to define an upwardly directed portion of the conduit **30** wherein the cross-sectional area is sufficiently great to obtain a relatively slow stock flow rate of 1 to 2 feet per second. This is just a little more than twice the flow rate that is ordinarily employed in the inlet box **20** and the uniformity of stock flow is further accomplished by flowing the stock at this relatively slow rate through the rectifier roll **24***e* mounted in close running relation to the walls in the bottom inlet **25** for the box **20**. The conduit portions **33** and **34** are spaced apart approximately the same distance as the width *w* for the first conduit **11**.

The conduit portions **32**, **33** define in cross-sectional elevation an L; and the conduit portions **31**, **34** also define in cross-section an L. The cross-section of the conduit **30** is that of nested L's.

It will further be noted that all of the horizontal reaches of the instant stock flow device **10** have roof portions inclined upwardly along the direction of stock flow therethrough for preventing the lumping of stock flowing through such passages and into the inlet box **20**. In other words, the conduit **11** has its roof portion inclined upwardly along the direction of stock flow into the header **40**. Also, the baffle portion **31** is inclined upwardly along the direction of stock flow. Actually, it is important to have the upwardly inclined roof portions in such passageways upwardly inclined if the stock flowing therein is not flowing at at least 9 feet per second. For this reason, the relatively short roof spaces in the header **40** between the pipes **41***a* and **41***b*, for example, need not be upwardly inclined. The stock flowing in the header **40** is flowing at only slightly less than the flow rate in the main conduit **11**. Any roof portion of a passageway wherein the stock is not flowing at at least 9 feet per second should be upwardly inclined at a rate of at least 1 inch per foot in the direction of flow, and preferably 1½ inches per foot in the direction of flow (in the manner in which the baffle portion **31** is upwardly inclined). The rectifier roll **24***e*, which is a rotary perforate shell or sleeve, does not function as a roof portion and the stock flows freely therethrough, so that there can be no accumulation of air in this region. With respect to the baffle **31** the stock flow expressed in process terms involves impinging the stock against a baffle portion following which the stock stream flowing laterally (toward A) is being raised at its top at a rate of at least 1 inch (and preferably 1½ inches) per foot of travel above the horizontal in the direction of travel.

It will further be noted that a frame element F carrying the baffle portion **31** and the upwardly extending conduit portion **34** as an integral part thereof is spaced from the inlet box rear wall **23***a* by a shim or spacer **50** and is spaced from a bottom framework **51** carrying the upward extremity of the pipes **41** by a shim or spacer **52**. As will be appreciated, the frame F is secured by bolts or similar removable securing elements (not shown) to the rear wall **23***a* and the bottom frame **51**. The shims or spacers **50** and **52** are, however, employed for the purpose of permitting limited adjustment of the position of the frame F. Thus, if it is desired to lower the frame F the shim **52** can be withdrawn and mounted with the shim **50** to increase the spacing from the rear wall **23***a* and thus lower the baffle portion **31** and further restrict the mouth or minimum restriction A. In this way control of stock flow, or the rate of stock flow, into the inlet box **10** is effected.

Referring now to Figures 4 and 5, it will be seen that a somewhat different structure for an inlet indicated generally by the reference numeral **100** is shown. Comparable elements in these views are indicated by reference numerals corresponding to those shown in Figures 1 through 3 in the 100 series. The top portion of the inlet box **100** is omitted from this view, but it will be noted that the box **100** is provided with a generally horizontal floor **121** wherein there is provided a bottom opening **125** extending the full width of the box **100** and opening downwardly therefrom along the rear wall **123***a* of the box **100**. A rectifier roll **124***e* is mounted in close running relation to the wall portions defining the bottom opening **125**. As will be seen the floor or bottom wall **121** is suitably mounted on a framework **160** supported by a pedestal **161** mounted on the floor or ground level G'.

In the operation of the device **100**, stock is forced from a fan pump or other suitable pumping device (not shown) into a first conduit **111** which has substantially the shape of the conduit **11** hereinbefore described. The stock flows from the first conduit **111** into a laterally extending header **140** wherein the stock is impinged against a back wall **140***a* and forced through a right angle turn T–3 and also forced laterally. The stock flows upwardly from the conduit **140** through a plurality of vertically extending pipes **141***a*, **141***b*, **141***c*, etc. The stock is thus forced into a pattern of generally parallel streams flowing upwardly through the pipes **141** from the header **140**. As shown in Figure 5, the pipes **141** are relatively closely spaced and these pipes are formed by the use of only two separate sheets of metal bolted together, as by the bolts **142**, **142**. One of such sheets is the conduit back wall **140***a* which extends upwardly a substantial distance as shown in Figure 4. The other

of the sheets, indicated generally by the reference numeral **143** in Figure 5 is formed by bending the same so that it will provide in conjunction with the back wall **140***a* the plurality of pipes or conduits **141** hereinbefore described. It will be noted that this structure simplifies the assembly and disassembly of the device **100**. The sheet **143** has a bottom skirt portion **143***a* (Figure 4) which is actually a separate sheet welded to the pipe defining upper portion of the sheet **143**, which defines the front wall of the header **140**. Also, the sheet member **143** has a top frame portion **143***b* which defines a vertical wall above the pipe elements **141** at **143***c*. It will thus be seen that the metal sheet element **143** is actually integrated with a bottom skirt portion **143***a* and a top portion **143***b* so as to provide a single element that can be removed as one piece or put in position as one piece during disassembly or assembly of the device **100**.

The stock flows upwardly through the pipes **141** and is then impinged against a baffle element **131** above and generally normal to the pipes **141** for turning the stock flowing from the pipes **141** through a right angle turn T–4. The baffle **131**, of course, slants upwardly in the direction of stock travel and converges with a floor portion **132** which is actually a continuation of the lower rear wall **140***a*. The walls **131** and **132** converge to a point of maximum restriction at A–1 in the manner hereinbefore described and the stock flows therethrough and impinges against a second baffle **133** which is mounted generally normal to the stock flow from the restricted area A–1 so as to turn the stock again at a right angle at a turn T–5, from which the stock flows directly through the rectifier roll **124***e*. The baffle element **131** is integral with an upwardly extending conduit portion **134**, both of which are mounted on a frame element F–2 which also mounts the back wall **123***a* of the inlet box **100**. The frame element F–2 is mounted for limited vertical adjustment so as to control the size of the minimum restriction A–1 and thus the stock flowing therethrough. This is accomplished by the use of vertically extending slots **143***d* mounted on the face **143***c* and receiving bolts or similar replaceable securing means **162** which are carried by a flange portion **131***a* of the baffle **131**. It will thus be seen that controlled stock flow in the device **100** is accomplished by mounting the frame F–2 in the position desired and locking the same in position with the bolts **162**.

A key to the invention resides in forcing the entering stock to impinge upon a conduit surface, which include a baffle in the conduit. The essential idea is to convert the longitudinal velocity energy to obtain transverse mixing velocity. This can be accomplished with a baffle, a 90° turn or even a 180° turn. In any event, the turn is at least about 90°.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. In a paper machine, a first conduit of small cross-sectional area and width directing a high velocity stream of stock, a stock inlet box of relatively larger cross-sectional area and width accommodating a relatively slower flow of stock, a header below the box and extending the full width thereof receiving stock from the first conduit, a plurality of laterally spaced ducts extending generally vertically from said header to flow stock therefrom, and a flow distributing conduit having a generally flat, generally horizontal baffle beyond and generally normal to said ducts turning stock flowing from the ducts at a right angle, means defining an increasingly restricted mouth the full width of the inlet box receiving stock turned by the horizontal baffle, and a generally flat generally vertical baffle generally normal to stock flowing from said means turning stock again at a right angle and into the bottom of said inlet box.

2. The device claimed in claim 1 wherein said generally horizontal baffle is upwardly inclined in the direction of stock flow.

3. In a paper machine, a first conduit of small cross-sectional area and width directing a high velocity stream of stock, a stock inlet box of relatively larger cross-sectional area and width accommodating a relatively slower flow of stock, a header below the box and extending the full width thereof receiving stock from the first conduit, a plurality of laterally spaced ducts extending generally vertically from said header to flow stock therefrom, and a flow distributing conduit having a generally flat, generally horizontal baffle beyond and generally normal to said ducts turning stock flowing from the ducts at a right angle, means defining an increasingly restricted mouth the full width of the inlet box receiving stock turned by the horizontal baffle, and a generally flat generally vertical baffle generally normal to stock flowing from said means turning stock again at a right angle and into the bottom of said inlet box, and a rectifier roll mounted in a bottom opening in said inlet box receiving stock flowing off said vertical baffle.

4. In a paper machine, a first conduit of small cross-sectional area and width directing a high velocity stream of stock, a stock inlet box of relatively larger cross-sectional area and width accommodating a relatively slower flow of stock, a header below the box and extending the full width thereof receiving stock from the first conduit, a plurality of laterally spaced ducts extending generally vertically from said header to flow stock therefrom, and a flow distributing conduit having a generally flat, generally horizontal baffle beyond and generally normal to said ducts turning stock flowing from the ducts at a right angle, means defining an increasingly restricted mouth the full width of the inlet box receiving stock turned by the horizontal baffle, and a generally flat generally vertical baffle generally normal to stock flowing from said means turning stock again at a right angle and into the bottom of said inlet box, and mounting means adjustably carrying said generally horizontal baffle for movement thereof relative to said ducts to control flow of stock therethrough.

5. The apparatus of claim 4 in which the baffle means are integral with the inlet box rear wall.

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