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O. R. WITWORTH ET AL

2,728,271

PAPER MACHINERY

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Fig-1

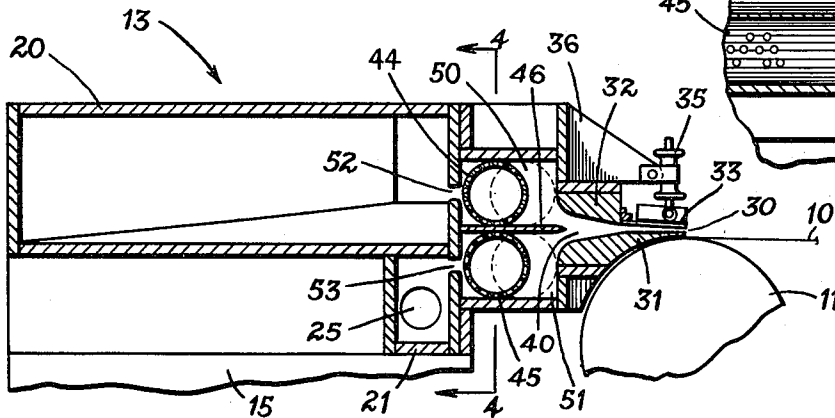


Fig-4

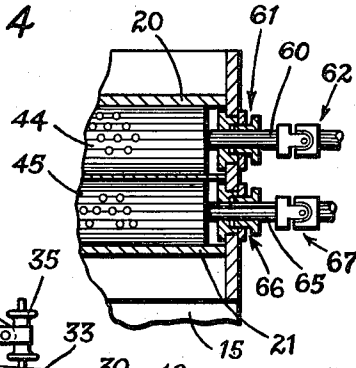


Fig-2

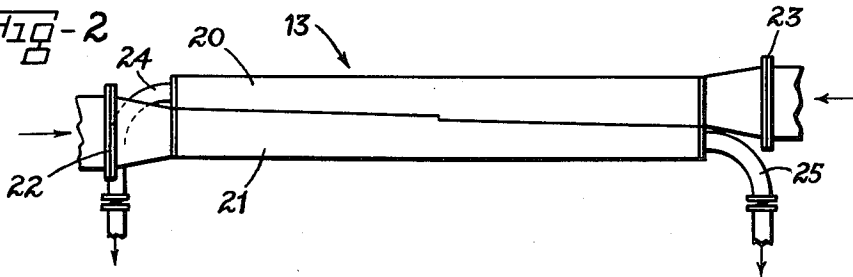


Fig-3

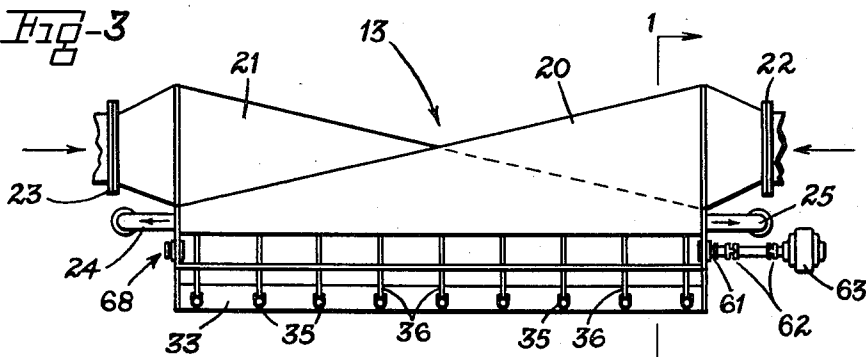
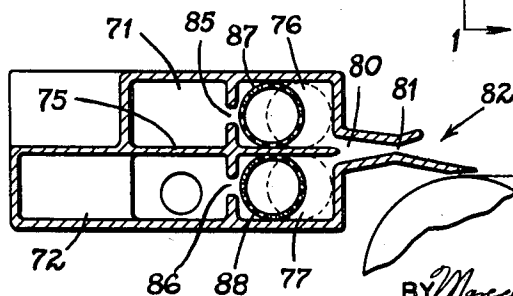


Fig-5



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2,728,271

PAPER MACHINERY

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6 Claims. (Cl. 92—44)

This invention relates to paper making and more particularly to a stock inlet for supplying paper making stock to the traveling forming member of a paper making machine.

The invention has special relation to counterflow stock inlets for paper machines of the type disclosed in Staeger Patent 2,347,717 issued May 2, 1944, to the assignee of this application. This type of counterflow inlet includes a pair of oppositely tapered conduits which extend transversely across the machine and are provided with a common slot orifice through which both conduits discharge stock in a merged flow for delivery to the forming member of the machine. This slot orifice is of materially restricted cross-sectional area with respect to that of the tapered conduits so that the velocity of flow through the orifice is thus correspondingly higher than that in the conduits so that the velocity flow component transversely of the machine in the merged flow is kept to a minimum.

The present invention is directed to further improvements in counterflow inlets of this general type and is concerned primarily with establishing substantially complete suppression of the transverse flow component in the merged stock flow to the forming member of the paper machine. More particularly the invention is directed to the construction of such a counterflow inlet in which positive provision is made in each tapered conduit for effectively straightening the velocity components in the stock which are in directions other than the machine direction before the stock reaches the slot orifice where it merges with the stock from the other tapered conduit.

In accordance with the invention, there is provided a counterflow inlet of the above type in which each of the tapered conduits is equipped with means in the path of flow therefrom to the slot orifice for suppressing cross-machine velocity components and generally straightening the direction of flow of such components in the machine direction, and these straightening means are mounted upstream from and closely adjacent to the orifice in the path of flow thereto from each tapered conduit in such manner that the straightening of the cross-machine velocities is effected before merging of the flow from the two conduits at the slot orifice.

For example, if as in the above Staeger patent the tapered conduits are separated by a common baffle terminating at the slot orifice, straightening of the flow in accordance with the present invention may be effected by positioning a perforate roll on each side of the baffle in such location that substantially all the stock delivered from each tapered conduit to the slot orifice is forced to flow first through one of these perforated rolls. This arrangement also has the further advantage that the two rolls can be rotated in opposite directions and thus will effectively neutralize rotational currents set up by each other so as to avoid rotational currents in the merged stock flow such as may result from impingement thereof on a single perforate rotating roll or other flow straightening or rotating baffle member.

It is accordingly among the specific objects of the pres-

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ent invention to provide a counterflow inlet having a pair of tapered cross-flow conduits discharging through a common slot orifice in which the stock flow from each conduit is caused to pass through a rotating perforate roll before merging with the flow from the other conduit at the slot orifice, and it is also an object to provide such an inlet in which the two perforate rolls may be rotated in opposite directions in order to neutralize rotational currents in the merging stock flow.

It is also an object of the invention to provide a counterflow inlet in which each cross-flow conduit includes a supplemental slot orifice spaced upstream from the common slot orifice for both conduits and in which a perforate roll is mounted in the space between each supplemental orifice and the common slot orifice to suppress and straighten cross-machine velocities in the stock before the flow from the two conduits is merged at their common slot orifice.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing—

Fig. 1 is a view generally in section on the line 1—1 of Fig. 3 showing a stock inlet constructed in accordance with the invention for a Fourdrinier paper machine;

Fig. 2 is an elevational view of the inlet looking towards the dry end in the machine direction;

Fig. 3 is a plan view of the inlet;

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 1; and

Fig. 5 is a somewhat diagrammatic section generally similar to Fig. 1 and showing a modified construction of inlet in accordance with the invention.

Referring to the drawing, which illustrates preferred embodiments of the invention, Fig. 1 shows fragmentarily the forming wire 10 and the breast roll 11 of a Fourdrinier paper machine. The inlet indicated generally at 13 for delivering the paper making stock to the wire 10 is shown as of the totally enclosed pressure type, and it may be mounted by any suitable base structure as indicated fragmentarily at 15. The wall portions at the rearward end of the inlet are constructed to form a pair of oppositely tapering conduits 20 and 21 arranged one above the other and extending transversely across the full width of the machine. The larger end of the upper conduit 20 is connected at 22 with a stock supply pipe, and the larger end of the lower conduit 21 is similarly connected at 23 with a stock supply pipe. The smaller ends of the conduits are similarly provided with connections 24 and 25 for returning a restricted flow of stock to the main supply system or to the larger ends of the other conduits in order to prevent possible stagnation at any point in the inlet.

The forward or wet end of the inlet includes a flow passage 30 or nozzle for delivering the stock directly to the forming wire 10, this passage 30 being formed by a lower wall portion 31 and an upper wall portion 32 which includes an adjustable slice lip 33 of the usual type, which is shown as provided with multiple adjusting screws 35 on brackets 36 carried by the upper structural portions of the inlet frame.

The inner or upstream end of the flow passage 30 forms a slot orifice 40 for receiving the stock from both of the conduits 20 and 21, and provision is made for separately delivering the stock from each of these conduits to the orifice 40 to form a merged flow to the forming member. This orifice 40 is of materially restricted cross-sectional area with respect to the conduits 20 and 21 in order to maintain the velocity of flow therethrough and through the passage 30 substantially higher than the velocity of flow of stock in the conduits themselves. In addition, since the stock flow in conduits 20 and 21 is initially pri-

marily crosswise of the machine, the material acceleration of the flow velocity of the stock in entering the orifice 40 and passage 30 results in substantial straightening of the flow into the machine direction and correspondingly reduces the velocity components in other angular directions. If the relative proportions of these conduits and passages are properly selected, and also if the initial flow velocity in the tapered conduits is sufficiently low, cross-machine velocities in the stock flow through passage 30 may be reduced sufficiently to be unobjectionable, and the present invention is primarily directed to a construction of the inlet such that even these minimum values of cross-machine velocities are practically extinguished.

This result is obtained in accordance with the invention by providing a separate perforated roll for each tapered conduit in the path of flow of the stock to the slot orifice 40 in such position that substantially all the stock from each of the tapered conduits flows through a perforated roll before reaching the orifice where it merges with the stock from the other conduit. This arrangement has the further advantage that with a separate perforate roll for each conduit, the two rolls can be rotated in opposite directions in order to neutralize rotational currents in the merged stock flow. In addition, it has been discovered that improved results are obtained in the practice of the invention if each of the tapered conduits is provided with a separate slot orifice spaced upstream from both the main slot orifice and also from the associated perforate roll. With such an arrangement, the stock as initially discharged from each tapered conduit has its velocity components primarily straightened into the machine direction, and if cross-machine velocities are present, they are suppressed and straightened by passage of the stock through the perforated roll before it reaches the main slot orifice and merges with the similarly straightened stock flow from the other conduit and perforate roll.

As shown in Fig. 1, the perforated rolls 44 and 45 for the respective tapered conduits 20 and 21 are mounted on either side of a baffle 46 which forms a partition between upper and lower chambers 50 and 51 connecting the respective tapered conduits 20 and 21 with the flow passage 30, and the baffle 46 extends forwardly into the slot orifice 40 to separate the flows from the two tapered conduits until they meet and merge as they enter passage 30 at the orifice 40. Each chamber 50 and 51 is in turn connected by a separate slot orifice 52 and 53 respectively with its associated one of the tapered conduits 20 and 21, so that the stock from each tapered conduit is discharged first through one of the separate slot orifices 52 or 53 into the chamber 50 or 51 where it impinges upon and flows through the perforate roll 44 or 45 before meeting and merging with the flow from the other tapered conduit at the main slot orifice 40.

Provision is made for continuously rotating the two perforate rolls 44 and 45, preferably in opposite directions in order to neutralize any rotation effects which they may set up in the stock, and these rolls are also shown as adjustable horizontally in their associated chambers 50 and 51 as may be desired for this flow condition. Referring particularly to Figs. 3 and 4, the journal 60 at one end of the roll 44 extends through a sealed bearing unit 61 mounted for sliding movement in a slot in the end wall of the chamber 50, and this journal is connected by universal couplings and a shaft 62 with a drive motor 63. The journal 65 of perforated roll 45 extends through a similar slidable sealed bearing unit 66 for connection by means of a similar shaft and universal coupling unit 67 with a second drive motor (not shown). The journals at the opposite ends of the two rolls are similarly mounted in slidable sealed bearing units as indicated generally at 68 in Fig. 3, it being readily apparent that these mounting arrangements are subject to variation as may be required to suit particular installations without in any way affecting the operation of the perforate rolls for the purposes of the present invention.

Each of the separate slot orifices 52 and 53 extends across the full width of the machine and is of materially restricted cross-sectional area with respect to its own associated tapered conduit so that as the stock is discharged through these orifices into the chambers 50 and 51, its rate of flow is materially accelerated, and also this acceleration is effectively uniform across the width of the machine. For example, it is desirable that the relative effective flow areas of the tapered conduits and their respective orifices be such that an acceleration of 4 or 5 to 1 or even higher is obtained, in order to reduce cross-machine velocity components to a minimum. The stock is thus substantially straightened in the machine direction as it enters the chambers 50 and 51, and since it then impinges upon and passes through one of the perforate rolls 44 and 45, such cross-machine velocities as may still remain are further suppressed and straightened so that completely uniform uni-directional flow is established before the two flows meet and merge to the main slot orifice 40 for delivery through flow passage 30 to the forming wire. As noted, with the perforate rolls rotating in opposite directions, if rotational currents do develop within the chambers 50 and 51, they will be in opposite directions so that they will effectively neutralize each other as the two stock flows merge.

Fig. 5 shows an inlet construction generally similar to that of Figs. 1-4 and providing similar operating advantages. The inlet casing in Fig. 5 is formed to define the two tapered conduits 71 and 72, and the central wall 75 forms the partition between these conduits as well as between the supplemental chambers 76 and 77 through which the stock flows to the slot orifice 80 at the upstream end of the flow passage 81 in the slice indicated diagrammatically at 82. The tapered conduits 71 and 72 are connected with the respective chambers 76 and 77 by separate slot orifices 85 and 86, and the perforate rolls 87 and 88 correspond to the similar parts 44 and 45 in the other views. It will be apparent that this inlet construction provides essentially the same mode of operation as already described in connection with Figs. 1-4, with the stock from each tapered conduit being discharged first through a separate slot orifice against a rotating perforate roll before it merges with the similar flow from the other tapered conduits at the main slot orifice and flow passages to the wire.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A stock inlet for the traveling forming member of a paper making machine comprising a pair of oppositely tapered conduits arranged transversely across said machine and each adapted to be supplied at the larger end thereof with stock under pressure, means including a baffle forming a slot orifice common to said pair of conduits and extending across the full width of said machine through which said stock is discharged simultaneously from both said conduits to form a merged flow to said forming member, said orifice being of restricted cross-sectional area relative to said conduits to maintain the velocity of flow therethrough substantially higher than the velocity of flow of said stock in said conduits and also to reduce the velocity components of the flow from each said conduit transversely of said machine, and a pair of rectifier rolls located in radially spaced side by side relation on opposite sides of said baffle and each in the separate path of flow from the associated said conduit to said orifice to suppress and straighten said transverse velocity components in the stock discharged from each said conduit in advance of the merger of said stock at said orifice with the stock discharged from the other said conduit.

2. A stock inlet for the traveling forming member of a paper making machine comprising a pair of oppositely

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tapered conduits arranged transversely across said machine and each adapted to be supplied at the larger end thereof with stock under pressure, means including a baffle forming a slot orifice common to said pair of conduits and extending across the full width of said machine through which said stock is discharged simultaneously from both said conduits to form a merged flow to said forming member, said orifice being of restricted cross-sectional area relative to said conduits to maintain the velocity of flow therethrough substantially higher than the velocity of flow of said stock in said conduits and also to reduce the velocity components of the flow from each said conduit transversely of said machine, and a pair of rectifier rolls located in radially spaced side by side relation on opposite sides of said baffle and each in the separate path of flow from the associated said conduit to said orifice to suppress and straighten said transverse velocity components in the stock discharged from each said conduit in advance of the merger of said stock at said orifice with the stock discharged from the other said conduit, and a drive for rotating said rolls in opposite directions to establish substantially uniform flow conditions in said merged stock flow.

3. A stock inlet for the traveling forming member of a paper making machine comprising a pair of oppositely tapered conduits arranged transversely across said machine and each adapted to be supplied at the larger end thereof with stock under pressure, means forming a slot orifice common to said pair of conduits and extending across the full width of said machine through which said stock is discharged simultaneously from both said conduits to form a merged flow to said forming member, said orifice being of restricted cross-sectional area relative to said conduits to maintain the velocity of flow therethrough substantially higher than the velocity of flow of said stock in said conduits and also to reduce the velocity components of the flow from each said conduit transversely of said machine, walls defining a pair of separate chambers associated with said pair of conduits respectively and each of greater effective flow area than said orifice, each of said chambers being located in the path of flow from its associated said conduit to said orifice, and a perforate roll located within each said chamber and upstream from said orifice for suppressing and straightening said transverse velocity components in the stock discharged from each said conduit in advance of the merger of said stock at said orifice with the stock discharged from the other said conduit.

4. A stock inlet for the traveling forming member of a paper making machine comprising a pair of oppositely tapered conduits arranged transversely across said machine and each adapted to be supplied at the larger end thereof with stock under pressure, means forming a slot orifice common to said pair of conduits and extending across the full width of said machine through which said stock is discharged simultaneously from both said conduits to form a merged flow to said forming member, said orifice being of restricted cross-sectional area relative to said conduits to maintain the velocity of flow therethrough substantially higher than the velocity of flow of said stock in said conduits and also to reduce the velocity components of the flow from each said conduit transversely of said machine, walls defining a pair of separate chambers associated with said pair of conduits respectively and each of greater effective flow area than said orifice, each of said chambers being located in the path of flow from its associated said conduit to said orifice, a perforate roll located within each said chamber and upstream from said orifice for suppressing and straightening said transverse velocity components in the stock discharged from each said conduit in advance of the merger of said stock at said orifice with the stock discharged from the other said conduit, and a drive for rotating said rolls in opposite directions to establish substantially uniform flow conditions in said merged stock flow.

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5. A stock inlet for the traveling forming member of a paper making machine comprising a pair of oppositely tapered conduits arranged transversely across said machine and each adapted to be supplied at the larger end thereof with stock under pressure, means defining a flow passage positioned to receive stock from both of said conduits for delivery to said forming member, said flow passage being of restricted cross-sectional area at the upstream end thereof to form a main slot orifice extending across the full width of said machine, means forming a separate slot orifice for each said conduit spaced upstream from said main slot orifice and each of restricted cross-sectional area relative to the associated said conduit to maintain the velocity of flow therethrough substantially higher than the velocity of flow in said conduit and also to reduce the velocity components of the flow from each said conduit transversely of said machine, a separate chamber connecting each said separate slot orifice with said main slot orifice and each of greater effective flow area than either said slot orifice for delivering the stock from each said conduit to said main slot orifice to form a merged flow into said flow passage, and a pair of rectifier rolls located in radially spaced side by side relation each in a separate one of said chambers and upstream therein from said main slot orifice for suppressing and straightening said transverse velocity components in the stock discharged through each said separate slot orifice in advance of the merge of said stock at said main slot orifice with the stock discharged from the other said conduit.

6. A stock inlet for the traveling forming member of a paper making machine comprising a pair of oppositely tapered conduits arranged transversely across said machine and each adapted to be supplied at the larger end thereof with stock under pressure, means defining a flow passage positioned to receive stock from both of said conduits for delivery to said forming member, said flow passage being of restricted cross-sectional area at the upstream end thereof to form a main slot orifice extending across the full width of said machine, means forming a separate slot orifice for each said conduit spaced upstream from said main slot orifice and each of restricted cross-sectional area relative to the associated said conduit to maintain the velocity of flow therethrough substantially higher than the velocity of flow in said conduit and also to reduce the velocity components of the flow from each said conduit transversely of said machine, a separate chamber connecting each said separate slot orifice with said main slot orifice and each of greater effective flow area than either said slot orifice for delivering the stock from each said conduit to said main slot orifice to form a merged flow into said flow passage, a pair of rectifier rolls located in radially spaced side by side relation each in a separate one of said chambers and upstream therein from said main slot orifice for suppressing and straightening said transverse velocity components in the stock discharged through each said separate slot orifice in advance of the merger of said stock at said main slot orifice with the stock discharged from the other said conduit, and a drive for rotating said rolls in opposite directions to establish substantially uniform flow conditions in said merged stock flow.

References Cited in the file of this patent

UNITED STATES PATENTS

952,808	English	Mar. 22, 1910
1,841,693	Aldrich et al.	Jan. 19, 1932
2,344,282	Berry et al.	Mar. 14, 1944
2,347,717	Staeger	May 2, 1944
2,347,850	Staeger	May 2, 1944
2,381,286	Hornbostel et al.	Aug. 7, 1945
2,566,450	Hornbostel	Sept. 4, 1951
2,619,011	Staeger	Nov. 25, 1952

FOREIGN PATENTS

356,294	Great Britain	Sept. 10, 1952
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