

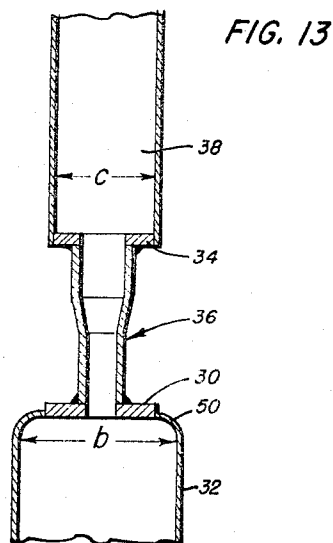
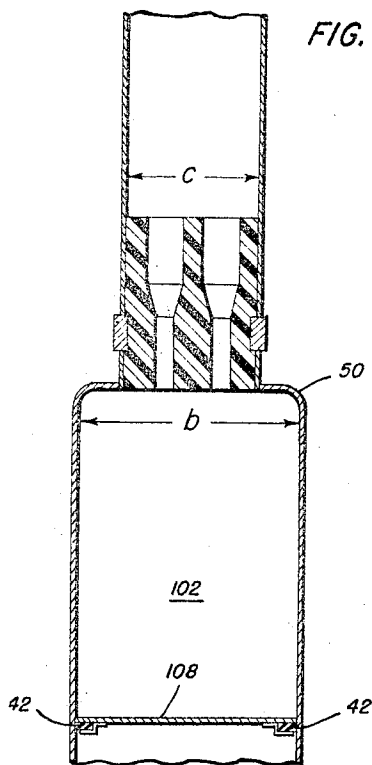
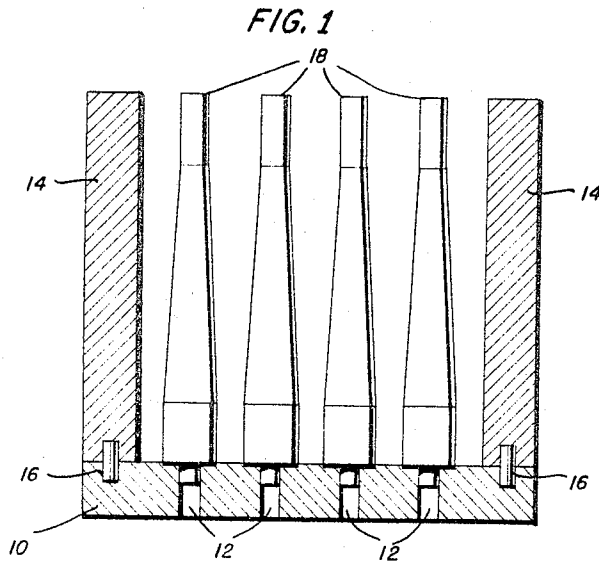
Sept. 13, 1966

A. D. TRUFITT
TAPER FLOW INLET

3,272,233

Filed March 8, 1963

3 Sheets-Sheet 1



INVENTOR

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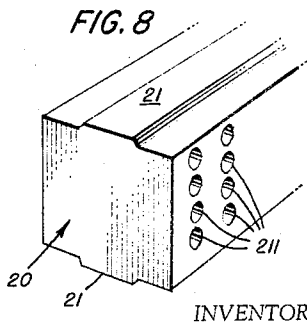
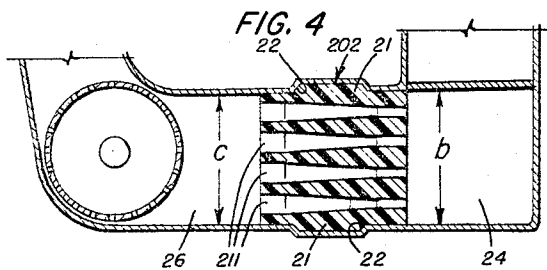
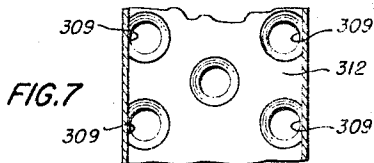
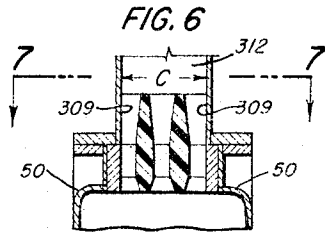
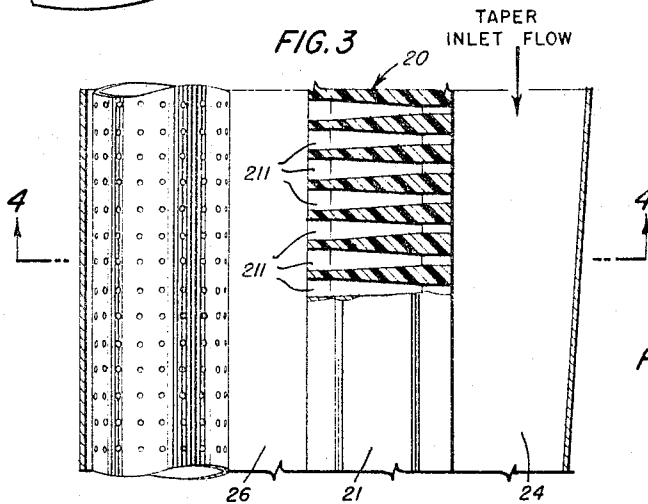
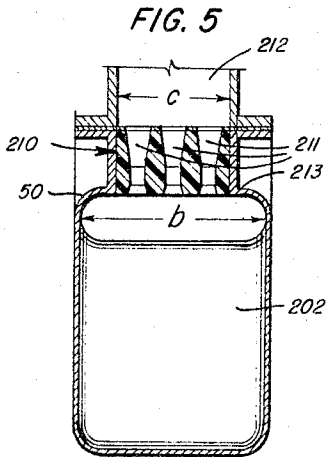
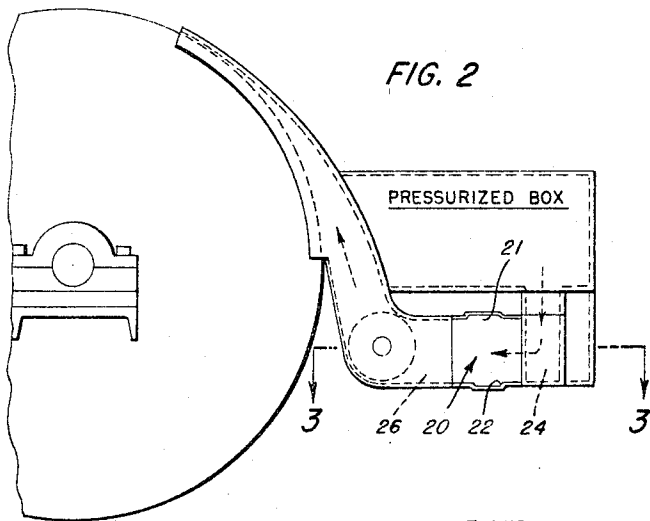
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A. D. TRUFITT
TAPER FLOW INLET

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3 Sheets-Sheet 2



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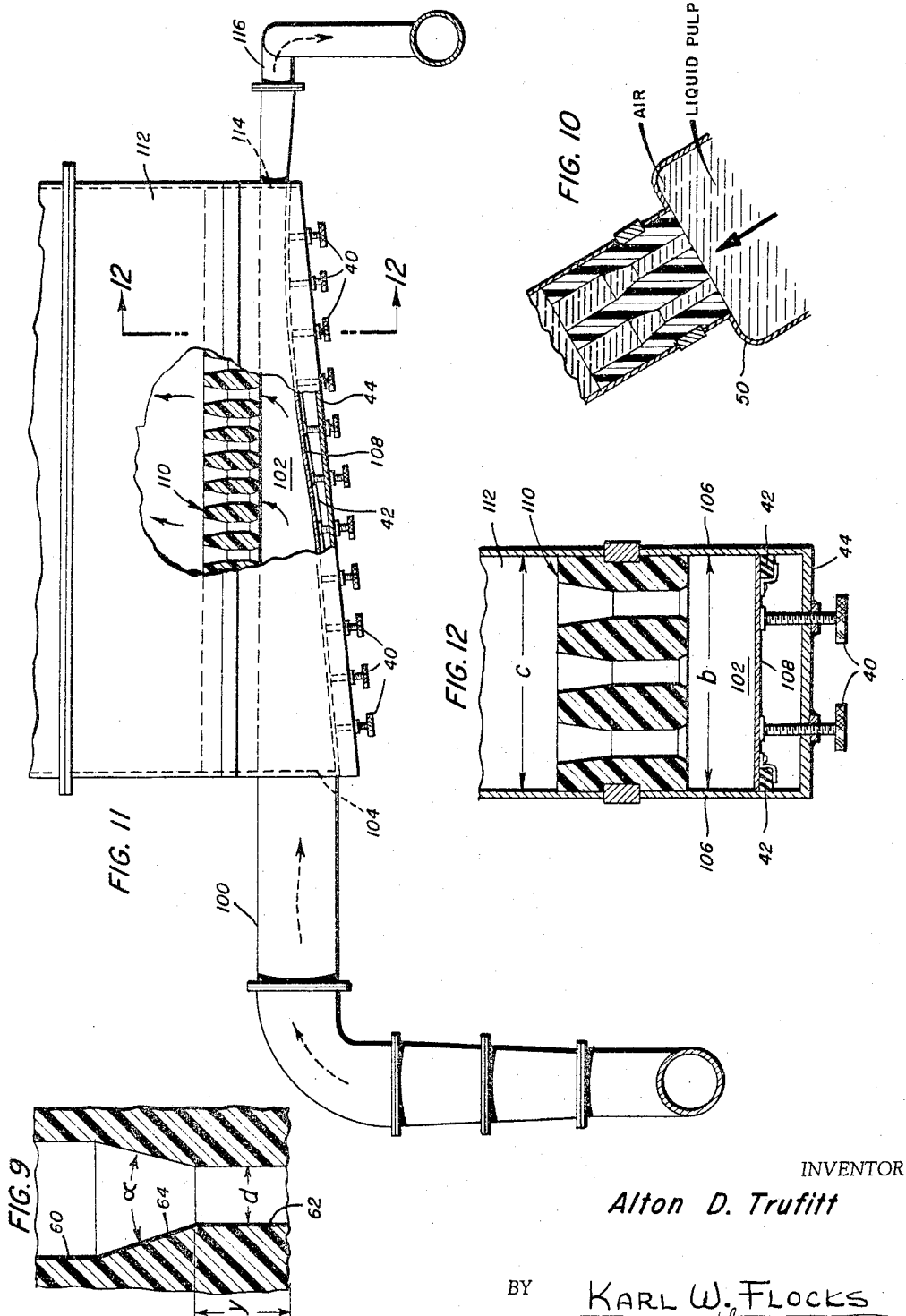
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A. D. TRUFITT
TAPER FLOW INLET

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3 Sheets-Sheet 3



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3,272,233

TAPER FLOW INLET

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Filed Mar. 8, 1963, Ser. No. 263,803

8 Claims. (Cl. 137—599)

This invention relates to a fluid flow distribution device and more particularly to a taper flow stock inlet for use in paper making machines.

There are many commercial activities where it is necessary and desirable in the feeding of fluids for various purposes to maintain an even distribution of flowing fluids, i.e. an even distribution of fluid across the device in which the fluid is flowing. In the manufacture of paper it is generally recognized that obtaining an even sheet of paper is dependent on the uniformity of the jet of paper pulp stock delivered across the length of the orifice or slice (the width of the machine). To obtain a uniform jet of stock to the slice it is necessary to maximize the uniformity of distribution of paper stock through the stock inlet of the headbox. Various attempts have been made in the prior art to obtain uniformity of flow of paper stock to the head box, but each attempt has suffered from numerous defects and nonuniformity of flow.

A basic manifold stock inlet consists of a constant diameter header having an inlet pipe at its center forming a T-shape. The header has several exit pipes along its length. These units often contain baffles and flow restriction devices to help smooth out the flow. However, these manifolds suffer from the defect of not producing equal flow in the exit pipes. Also the T type split at the header is inherently unstable and as a result, the flow to each side of the head of the T is continually varying so that it is not possible to eliminate irregularities with a stationary slice. These basic devices have been modified to attempt to overcome the disadvantages of the basic designs, but these modifications have been essentially unsuccessful. Some of the modifications have involved multiple dividing flow inlets involving a pyramiding of T type splits.

Another type of basic stock inlet are the side entry branch manifolds wherein the stock enters from the side rather than from the center as in the T-shaped manifolds. Cross flow inlets with continuous slots have been built with the hope that the cross-currents will cancel each other out; this has not happened. Each of these type systems have improved flow characteristics somewhat in one respect or another but for the most part they still suffer from the major disadvantages of the basic design.

The recently developed taper flow inlets such as shown in the patents to Mardon et al., #2,929,449, and Goumeniouk, #2,894,581, have, however, improved the uniformity of flow considerably. These basic taper inlet designs embody a side inlet, a header tapering in size down to an overflow outlet and a distributor running the length of the tapered header. This invention is an improvement of the basic taper flow inlet.

It is therefore an object of the present invention to overcome the disadvantages set forth above by the provision of new and improved taper flow inlets.

It is another object of the present invention to provide an apparatus for effecting uniform flow of stock across the length of the slice of a paper making machine.

It is another object of the present invention to provide an apparatus for delivering an even and uniform flow of fluid across the width of a fluid piping system.

It is another object of the present invention to provide a stock flow distributor for use with paper making machines which will avoid dead zones and the production of large scale uncontrolled turbulence.

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Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a cross section of apparatus for making a distributor plate of the present invention.

FIG. 2 is an elevation of an improved distributor in a paper making machine utilizing a pressurized box.

FIG. 3 is a section partly broken away taken along line 3—3 of FIG. 2 showing a distributor block.

FIG. 4 is a cross-section taken along line 4—4 of FIG. 3.

FIG. 5 is a cross-section of another embodiment showing a distributor block and outlet chamber of reduced width.

FIG. 6 is a cross-section of another embodiment similar to FIG. 5.

FIG. 7 is a cross-section taken along line 7—7 of FIG. 6.

FIG. 8 is an isometric of a distributor block of the present invention.

FIG. 9 is a detail in cross-section of a tapered hole in a distributor in accordance with the present invention.

FIG. 10 is a cross-section of another embodiment of the present invention.

FIG. 11 is an elevation partly broken away of a taper flow header of the present invention embodying an adjustable bottom.

FIG. 12 is a section taken along line 12—12 of FIG. 11.

FIG. 13 is a cross-section of another embodiment utilizing a tube distributor rather than a perforated block.

FIG. 14 is a cross-section of another embodiment of the present invention.

FIGS. 11 and 12 show the essential features of a taper flow inlet. An inlet pipe 100 is provided at one end to receive a pulp slurry under pressure from a fan pump. Inlet pipe 100 is attached to tapered header 102 at the inlet opening 104. The tapered header 102 is provided with two side walls 106 and a tapered bottom wall 108. The top wall of the tapered header 102 is defined by distributor 110. Above distributor 110 is outlet chamber 112 which is intermediate the taper flow inlet described and the head box (not shown). At the opposite end of the tapered header from the inlet opening 104, is an overflow outlet 114 which empties into a recirculation pipe 116.

Stock is forced into tapered header 102 from pipe 100 and then out through distributor 110 with a small percentage being recirculated through pipe 116. The purpose of the tapered header, the overflow outlet and the distributor is to provide a uniform flow of stock across the distributor (i.e. the width of the head box and slice) to assist in obtaining a uniform thick sheet of paper across the width of the paper sheet.

The taper flow inlets of the present invention provide a number of structural advances which assist in providing improved flow. These are:

(1) An adjustable sloping bottom on the tapered header;

(2) A fluid exit section or distributor narrower in width than the width of the header together with a narrow outlet chamber;

(3) The principle of tapered or stepped tubes or holes diverging on the downstream side of flow in the distributor;

(4) The area of the header inlet minus the area of the header overflow outlet to the area of the openings in the distributor being between 0.5 and 2, preferably between 0.5 and 1.0;

(5) The fixed block molded plastic distributor with diverging holes and having an area ratio of 0.5 to 2.0 times the net area of the tapered cross flow header;

(6) The concept of mounting the header in an inclined or horizontal position which provides space away from the distributor area to collect and carry away entrained air; and

(7) The concept of providing distributor tubes or holes which are intermediate in thickness and length between those shown by the patents to Goumeniouk and Marden et al. (referred to above).

One of the critical features in the present invention is the design of the holes in the distributor or fluid exit section of the taper flow inlet. In general, the hole sizes may be varied somewhat depending on the stock being used. For short fibers smaller holes can be used than for longer fibers since the longer fibers would tend to plug the smaller holes. Small holes are desirable because small holes promote small scale turbulence which is desirable to obtain the best formation. The hole size sets a physical limit to the scale of turbulence.

Small holes serve to act as a secondary screen and promote deflocking. It is recognized in the art that good formation is promoted by placing a screen close to the head box in order to break up flocks. The ideal condition is therefore to have this screen as part of the head box. The distributor of the taper flow inlet comes quite close to meeting these requirements, and by maintaining high velocities in the header with a high rate of overflow, the distributor can be kept clean.

A major disadvantage of a great number of small holes is the higher cost due in a large part to the drilling of several thousand holes plus the danger of plugging of small holes. This may be overcome in several different ways:

- (1) By forming the holes in another manner;
- (2) By reducing the number of holes;
- (3) By adapting the hole spacing to suit a particular machine with known flow conditions, and/or
- (4) By developing a suitable jig for indexing the distributor plate.

The present invention embodies the two expedients of: increasing the hole size and distributor thickness and in certain cases forming the distributor by plastic casting. Useful casting resins are epoxy resins, acrylic resins and polycarbonate resins. Other resins or rubber may be used in molding the distributor block.

FIG. 1 shows apparatus and a method for casting a distributor as a perforated block of plastic or rubber. A metal casting plate 10 is provided having the number of holes 12 desired in the plastic block distributor to be cast. Retaining walls 14 are placed about the periphery of plate 10 and are held in place by pegs 16. The walls 14 and bottom plate 10 define a casting cavity therebetween. Into each hole 12 is placed a mandrel which may be formed of plastic or steel to the desired shape of the hole to be formed in the cast plastic block. The mandrels may then be coated with a mold release agent and a suitable plastic resin then cast between walls 14. Upon hardening of the resin, walls 14 and mandrels 18 are removed from the formed plastic blocks thereby obtaining the plastic block with the desired holes. Block 20 shown in FIG. 8 may be formed in such a manner.

Other methods of forming block 20 however, may be utilized; for example, the distributor block could be cast in shorter lengths and joined after casting by reinforcing partitions using the casting procedure.

Mandrels 18 may be shaped in any desired manner to obtain the desired hole configuration in cast block 20. For example, mandrels 18 may embody a transition zone from a round cross section at the inlet side of the distributor to square or other polygonal cross section at the outlet chamber end. In this manner the open area at the outlet side of the distributor block can be increased considerably thereby resulting in less disturbance and uncontrolled turbulence downstream. The casting method eliminates expensive drilling as a manufacturing method for the distributor block.

FIG. 8 shows a detail of a distributor block 20. This structure may be cast from plastic using the apparatus of FIG. 1. Preferably the distributor block 20 is provided with ribs 21 which are keyed into grooves 22 (note FIG. 4) between the outlet chamber 26 and the tapered header 24.

FIGS. 2-4 show a distributor block 20 applied to a short forming length pressurized cylinder mold vat paper forming machine. In this arrangement the distributor block 20 is shown as a removable unit held in place by grooves 22. Providing a removable unit in such a manner simplifies cleaning the inlet as well as providing a locking mechanism to keep the block in place. Furthermore, the blocks are easily replaceable. If it is desired to modify the flow pattern, the block can be removed and certain groups of holes plugged or another block substituted therefore to obtain the correct flow. Such a procedure might be desirable upon a change in stock. With the arrangement described, the distributor occupies a very small space and it would be possible to construct the complete inlet in reinforced plastic without excessive deflection problems.

The distributor block containing the tapered holes could be made in yet another manner. In place of mandrel 18 in FIG. 1, separately shaped tubes could be placed in the mold and resin cast about these tubes to provide the desired block.

In order to obtain the flow conditions in small machines in which it may prove too expensive to justify the installation of the perforated block 20 described above, an alternate distributor construction is provided which gives great flow improvement at low cost. This device, shown in FIG. 13, utilizes a tubular distributor. The arrangement of the FIG. 13 embodiment is in general the same as that for the perforated block type of distributor previously described. The only major difference in fact is a different design of the actual distributor itself.

Instead of utilizing a single block with tapered holes, a double plate is provided, both parts of which are drilled with straight holes in the same pattern. The corresponding holes of one plate are joined by short pieces of tube to the holes in the other plate. The entire assembly is then fitted in place of the block as a distributor between the tapered header and the outlet chamber. Noting FIG. 13 the lower plate 30 is directly attached to the open wall in the taper flow header 32. Tubes 36 are attached such as by welding to plate 30 at the bottom and the plate 34 at the top downstream end adjacent outlet chamber 38. FIG. 13 shows only a single thickness of tubes. However, any number of tubes or rows of tubes that are desired or that may fit within the machine may be utilized.

A simple and convenient shape of stock entry is rectangular. This ordinarily means a transition section in the discharge pipe immediately before the inlet. The cross section of the rectangular entry is sized to give a stock velocity of approximately 10 feet per second. The volume of stock passing the entry will be that required at the slice, known for any given machine, plus the amount passing out the overflow outlet at the opposite end of the taper flow header. On tapered flow inlets constructed to date the volume of this overflow has been often set at 15% of the volume required at the slice. This percentage was chosen mainly because it is not so large that the size of the fan pump becomes too large. Having determined the cross sectional area of the inlet, the height of the inlet opening can be chosen.

This height may be set at from 10 to 16 inches, the larger size for larger machines of about 280 inches in length. This cross sectional area and height now defines the entry dimension.

One of the fundamental features of the taper flow type of inlet is that an even distribution of fluid pressure can be obtained along the entire length of the header. The calculation of the taper of the header is based on the as-

sumption that pressure along the length of the header from inlet to overflow outlet (which may be 15% of the size of the entry) is uniform. To obtain such uniform pressure, however, allowance must be made for frictional losses along the length of the tapered header. This is done by calculating the cross section of the header at regular intervals along its length. To date, the following empirical formula, which takes into consideration such frictional losses along the walls, has been found to be most accurate for determining the taper of a header.

$$Ax = A_o K_e \frac{fx}{8R}$$

Where Ax equals the sectional area of the inlet at any point X measured from entry; A_o equals the sectional area of entry; K_e equals

$$Kr + (1 - Kr) \left(\frac{1 - x}{1} \right)$$

Kr equals percent recirculation, expressed as a decimal; where 1 equals the length of the header (machine width); e equals 2.718; f , the friction factor, equals .015; and R , the hydraulic radius of a rectangular section at point x , equals

$$\frac{\text{the area at } X}{\text{perimeter at } X}$$

Since one wall of the cross section is always fixed by the distributor the dimension is made to conform to the equation by curving the tapering wall opposite the distributor. In computing the curve it is necessary to use a straight taper as a first approximation. When the curve is obtained the wall may be adjusted by screws 40 shown in FIG. 11 to give the desired curve to the tapering wall of the taper flow header inlet.

Providing an adjustable bottom to the tapered header, as shown in FIG. 11, is one of the important improvements of the present invention.

The cross section of the header is calculated at regular intervals along its length using the aforementioned equation. Since this formula is based on several factors which are by nature empirical, the calculated taper for the header is often somewhat in error. By making the bottom a separate construction with a number of individual adjustments 40 along its length, it is possible in which the flow distribution is improper can be corrected with the adjustments. Adjustment screws 40 turn in false bottom 44. Seals 42 are attached to the underside of adjustable bottom 108 at each side adjacent walls 106 to prevent leakage. One end of adjustable bottom 108 at either inlet 104 or outlet 114 is left free from restraint to allow for the change in length of bottom 108 due to the intentional warping by screws 40.

Another important feature of the present invention is the provision of structure such as diverging holes in the distributor so that the open area in the exit section to the outlet chamber is considerably higher than the 10 to 15% open area in the distributor plates of the prior art.

In the prior art of taper flow cross headers, the holes in the distributor are either straight or tapered on the inlet side (Mardon et al.) or merely change in cross sectional shape without changing in cross sectional area (Goumeniouk). The purpose of the inlet side taper is to straighten the jets so that they leave the distributor at an angle of 90°. The purpose of the change in cross sectional shape is to provide transition from round to rectangular flow side effects. Although both of these features may be incorporated into the present invention, significant improvements in flow are obtained not by these expedients, but by tapering or stepping the distributor holes towards the downstream or outlet chamber side. There are two major advantages which result from tapering the holes on the outlet side. These are:

(1) The percent open area of the distributor blocks

on the outlet or downstream side is increased. This is a major improvement in controlling the turbulence downstream and in aiding the jets to diffuse together more rapidly.

(2) By opening up the holes in the block as described the energy of the jets is decreased. Since the energy varies as the second power of the velocity, then doubling the area of the holes at the outlet reduces the energy of the jets by a factor of 4. This enables the whole of the outlet chamber to be made more compact and efficient since a large part of the energy dissipation is accomplished in the holes. Also if the taper of the holes (angle α in FIG. 9) is kept small, i.e., from 7° to 20°, a large part of the velocity energy is recovered as pressure energy and is not dissipated in the outlet chamber as it would be in the conventional design with straight holes.

FIG. 9 shows a straight section 62 followed by a tapered section 64 having an angle α . A section 60 of straight enlarged diameter is shown at the outlet end. This latter feature is optional and its value lies in increasing the energy recovery and giving improved or more level velocity profile in each hole before the expanded jet is discharged into the outlet chamber. The range of angle α may lie from 7° to 90° since in many cases a larger angle may be desirable to simplify manufacturing. FIG. 13 shows the principle applied using a distributor formed of tubes instead of holes in a block. Thus the principle described is applicable not only to mold distributor blocks but also to fabricated tube distributors.

The advantage of tapering holes to a greater downstream area and its corollary of a higher ratio of open area to closed area exiting from the distributor is as follows:

The devices of the prior art have a perforated distributor in which the ratio of hole area to plate area is between 10 and 15% and the stock velocity in these holes is approximately 10 feet per second. Therefore, on the downstream side of the plate where the volume increases by a factor of 10 the average stock velocity would decrease by the factor of 10 down to 1 foot per second. Thus the spouts issuing from each hole will require a great distance in which to dissipate and the turbulence downstream from the distributor will be uncontrolled. This will require the use of one or two rectifier rolls to bring this turbulence under control which is, of course, undesirable. From work done on rectifier rolls it is known that for a roll of open area substantially less than 50%, the turbulence downstream is uncontrolled; whereas for rolls over 50% open the turbulence downstream is controlled. Hence for this reason it would be desirable if the holes in the distributor arrangement could be constructed with the downstream open area relatively high, e.g. greater than 50%, which would result in controlled turbulence. Tapering the holes outwardly downstream provides the desired control and the desired high open area.

FIG. 5 shows another method of achieving high open area on the outlet side of the distributor. In this arrangement the perforated distributor block 210 does not occupy the full width of the rectangular manifold. As a result the holes 211 are more closely spaced although the percent open area on the inlet side of the distributor is still only 10 to 15% of the area on the top wall 213 of the tapered header 202. The outlet chamber 212 is thus reduced in width maintaining higher velocities to the head box; also, as a result of this construction, the thickness of the distributor block 210 can be reduced.

FIGS. 6 and 7 show an embodiment wherein the percent open area at the outlet of the perforated distributor block may be increased still further from the embodiment of the FIG. 5. In this arrangement the top part of the plastic block is machined away at the outside row of holes adjacent only the tapered part of the hole as at 309 and the outlet chamber 312 is further reduced in width. This practice increases the open area consider-

ably. The increased velocity along the walls, besides the improvements in uniformity of flow, will also help to insure cleanliness.

In the embodiments shown in FIGS. 2 through 4 as well as in FIGS. 11 and 12 the outlet chamber width c is the same as the inlet width b . By reducing the outlet chamber width c and providing a reduced outlet area by making the width smaller as described above, the ratio of open to closed area at the downstream end of the distributor is increased which results in decreased downstream uncontrolled turbulence. This feature is also disclosed in the embodiment of FIGS. 10, 13 and 14.

The header is rectangular in shape at the inlet and the depth is greater than the width. The area of the holes in the distributor blocks if the holes are straight (not tapered) or if tapered, on the upstream or taper header side of the distributor is much less than the area of the inlet minus the overflow outlet. If the holes are tapered toward the downstream end the outlet area of the distributor is increased relative to the area of the inlet minus the area of the overflow outlet of the taper flow header. If the outlet chamber width c is reduced in comparison with taper flow header width b the ratio of open to closed area on the downstream side of the distributor is further increased thereby further controlling turbulence. Reducing the width c of the outlet chamber requires that the width of the perforated block also be reduced and that the holes in the block be placed closer together. If the ratio of the solid distributor area to hole area, assuming straight holes, is reduced the velocity change of fluid material from the holes to the outlet chamber is reduced and consequently the uncontrolled turbulence is also reduced. In the devices of the prior art the ratio of distributor plate area to hole area is in the order of 10 and hence the velocity in the outlet chamber will be only $\frac{1}{10}$ of the velocity in the holes. In the present invention, however, by merely reducing width c by a factor of 2 the ratio of solid distributor area to hole area can be reduced by a factor of 2 and the reduction in velocity decreased to a change of 5 times rather than the 10 times change of the prior art. Therefore, for a 10 foot per second velocity in the inlet header the velocity in the outlet chamber will be 2 feet per second in the present invention as compared with 1 foot per second in the prior art. It is generally desirable to have the velocity at this point in an inlet equal to the higher velocity. The chamber width c has been found to preferably lie within the range $0.9b$ to $0.3b$, where b is the width of the tapered header.

Another advantage of the reduced width c and a corollary of increased velocity in the outlet chamber is the effect on the open area of the distributor at its outlet side. The smaller open area of the prior art will result in a more unstable condition downstream from the distributor plate and the turbulence resulting is therefore more uncontrolled. The higher the open area the more stable the flow with controlled turbulence; furthermore, the jets diffuse together more quickly so that the velocity profile downstream is smoother.

Yet another advantage resulting from making the outlet chamber narrower than the inlet width is shown in FIGS. 5, 6, 10, 13 and 14. Here, by providing the narrow width c the two top corners of the tapered header adjacent the distributors may be rounded as at 50. This will promote cleanliness of the inlet and prevent buildup of fibers and slime in the corners.

Another advantage is shown when the complete inlet is inclined slightly as shown in FIG. 10. In this case any air entrained in the supply lines will rise to the top corner and be carried out the overflow outlet rather than through the distributor and into the outlet chamber and headbox.

An important feature of the present invention is the discovery that the ratio of the area of the inlet of the tapered header minus the area of its overflow outlet to the holes in the distributor or exit section should preferably lie from $\frac{1}{2}$ to just less than 1. Existing designs have

values of the ratio equal to 1 or greater. This causes the fluid flow to accelerate into the holes so that the velocity in the holes is greater than the average velocity in the header. It has been discovered in the present invention, that a significant improvement in velocity distribution along the length of the distributor block occurs if the ratio is less than 1, i.e., if the flow decelerates into the holes so that the velocity in the holes is less than the mean velocity in the header. This is completely opposite to the practice in the prior art and the accepted understanding of the mechanics of flow in the tapered flow inlet. This principle is applicable with straight or tapered holes, although providing tapered holes is one manner of obtaining a ratio between $\frac{1}{2}$ and 1.

It is not to be understood that the ratio of the inlet area minus the outlet area to the hole area must be less than 1 but only that improved results ensure if such an expedience is exercised. The aforementioned ratio may be anywhere within the range of $\frac{1}{2}$ to 2.

The principle behind maintaining a low ratio of flow in the distributor to flow in the tapered header is that the pressure drop across the distributor should be kept small. The machines of the prior art attempt to achieve the reverse, i.e., they keep the pressure drop across the distributor very high.

It has been determined according to the present invention and contrary to the devices of the prior art that the length of the straight section of hole y should be kept within the range $1.5d$ to $8d$ (note FIG. 9). Due to the sudden contraction at the inlet to the holes combined with the effects due to the change in direction of flow from the header into the distributor holes, the flow in the holes is very turbulent within the range of 1.5 to 8 times the diameter of the hole. Below this length, the jet does not expand properly from the vena-contracta and the jet is not turbulent enough.

Above this length the contracted jet expands and established flow results thus reducing the intensity of turbulence. Turbulence is desirable during this stage to promote more diffusion of the jets after leaving the distributor, and to improve the spreading or expansion of the jets in the enlarging holes, i.e., within the diffusion section of the holes defined by the angle α . The provision of the length to diameter ratio of 1.5 to 8 is desirably independent of the provision of tapered holes or tubes; in other words even where straight holes or tubes are provided it is desirable that the length of the tube or hole be equal to 1.5 to 8 times diameter of the hole.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In a fluid distributing device for delivering an even and uniform flow of fluid across the width of a fluid piping system comprising a taper flow header, an inlet adjacent one end of said tapered header, an overflow outlet at the other end, and a distributor along its length having a multiplicity of relatively uniformly spaced openings therein to receive a major portion of fluid flow angularly from said inlet, the improvement comprising a relatively flat adjustable wall comprising the tapered wall of said taper flow header and seal means along said tapered wall at each of the sides thereof running the length of said wall.

2. A device in accordance with claim 1 wherein said adjustable wall is supported by adjusting screws which are independently movable to adjust said adjustable wall into the desired configuration, and wherein said seal means are located along the bottom exterior surface of said wall.

3. A fluid distributing device for delivering an even and uniform flow of fluid across the width of a fluid piping system comprising a taper flow header having generally

rectangular cross sections along its length, an inlet adjacent one end of said tapered header, an overflow outlet at the other end of said tapered header, a distributor section along the length of said header having a multiplicity of relatively uniformly spaced openings therein to receive and pass a major portion of fluid flow angularly from said inlet, and an outlet chamber on the downstream side of said distributor, said distributor section having a width narrower than the width of said generally rectangular tapered header and said outlet chamber having a width no greater than that of said distributor, the corners of the header walls adjacent said reduced width distributor section being rounded, and wherein said header is disposed angularly to provide at its uppermost section one of said rounded corners thereby providing a trap for air to permit the passage of air out through said overflow outlet rather than through said distributor.

4. In a fluid distributing device for delivering an even and uniform flow of fluid across the width of a fluid piping system comprising a taper flow header, an inlet adjacent one end of said tapered header, an overflow outlet at the other end of said tapered header, a distributor section along the length of said header having a multiplicity of a relatively uniform spaced openings therein to receive and pass a major portion of fluid flow angularly from said inlet, and an outlet chamber on the downstream side of said distributor, the improvement comprising providing said distributor section with a width narrower than the width of said tapered header and providing said outlet chamber with a width no greater than that of said distributor and wherein said tapered header comprises an adjustable tapered wall.

5. In a fluid distributing device for delivering an even and uniform flow of fluid across the width of a fluid piping system comprising a taper flow header, an inlet adjacent one end of said tapered header, an overflow outlet at the other end of said tapered header, and a distributor section along the length of said header having a multiplicity of relatively uniformly spaced openings therein to receive and pass a major portion of fluid flow angularly from said inlet, the improvement comprising means for controlling the fluid turbulence with said uniformly spaced openings to provide a contracted and very turbulent flow along the entire length there wherein said openings in said distributor are extended in length an amount equal to from 1.5 to 8 times their diameters, further wherein said openings in said distributor are tapered outwardly toward their downstream ends to provide a greater cross sectional area, the angle of taper lying between 7° and 90°, and wherein said tapered header comprises an adjustable tapered wall.

6. In a fluid distributing device for delivering an even and uniform flow of fluid across the width of a fluid piping system comprising a taper flow header, an inlet adjacent one end of said tapered header, an overflow outlet at the other end of said tapered header, and a distributor section along the length of said header having a multiplicity of relatively uniformly spaced openings therein to receive and pass a major portion of fluid flow angularly from said inlet, the improvement comprising means for controlling the fluid turbulence within said uniformly spaced openings to provide a contracted and very turbulent flow along the entire length thereof wherein said openings in said distributor are extended in length an amount equal to from 1.5 to 8 times their diameters, and wherein the ratio of the area of said inlet minus the area of said overflow outlet to the area of said openings in said distributor lies from 1/2 to just under 1.

7. A device in accordance with claim 6 wherein said tapered header comprises an adjustable tapered wall.

8. A device in accordance with claim 4, wherein said openings in said distributor section are extended in length an amount equal to from 1.5 to 8 times their diameter and wherein said openings in said distributor section are tapered outwardly toward their downstream ends, the angle of taper lying between 7° and 90°.

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