Jan. 30, 1962 F. B. LOPPNOW 3,018,757

PAPERMAKING MACHINE

Filed June 1, 1959 4 Sheets-Sheet 1

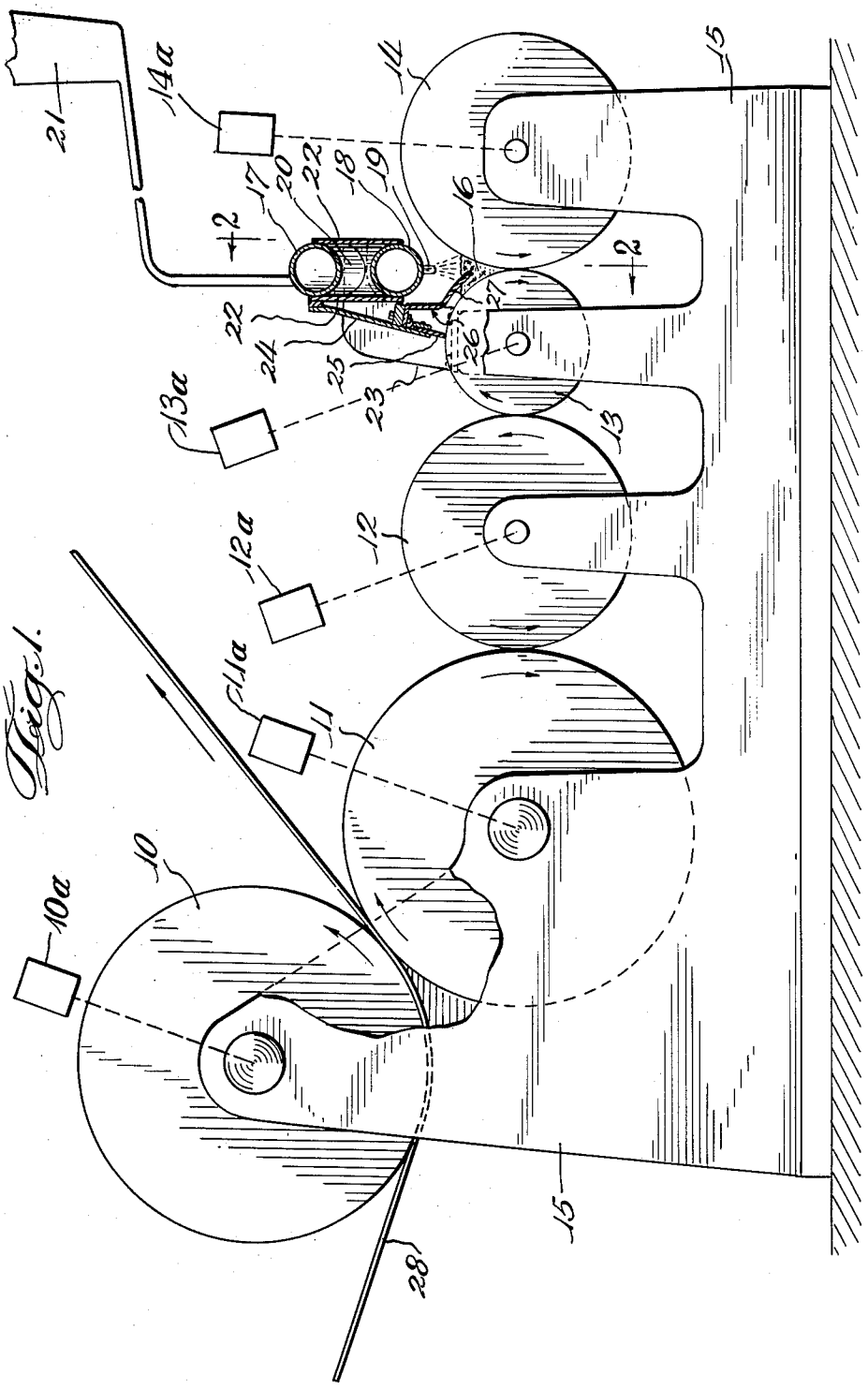



Fig. 1.

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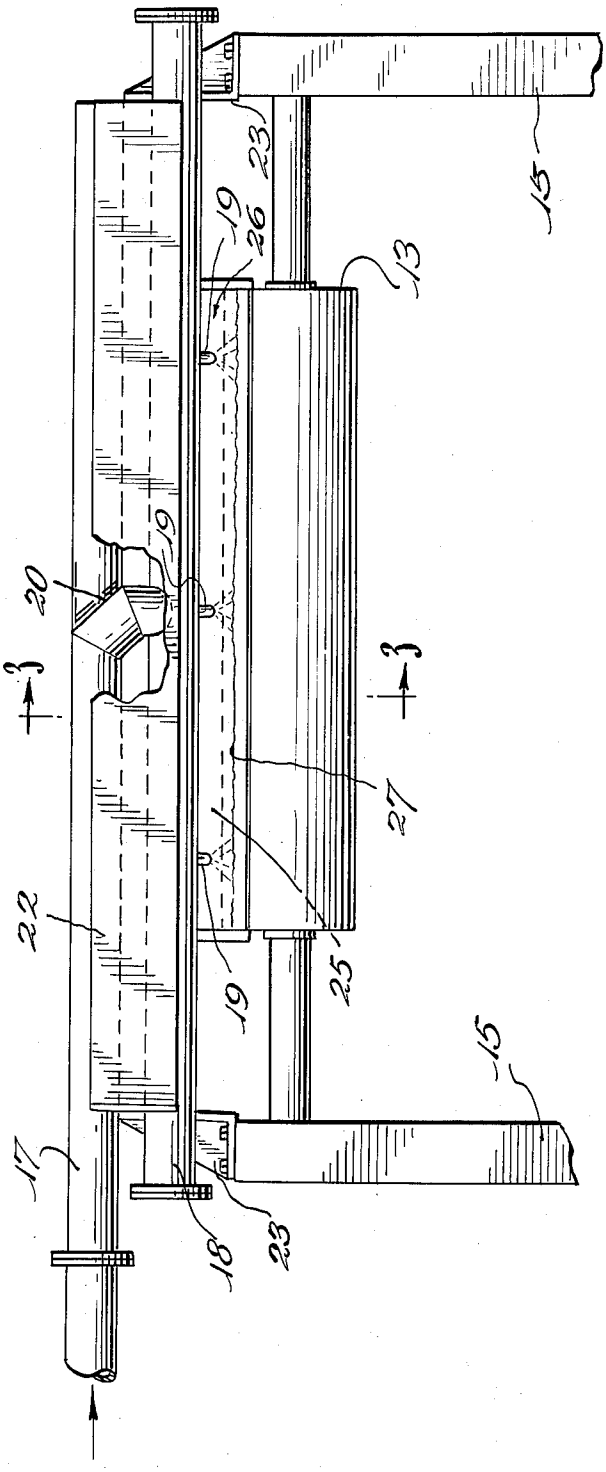



Fig. 2.

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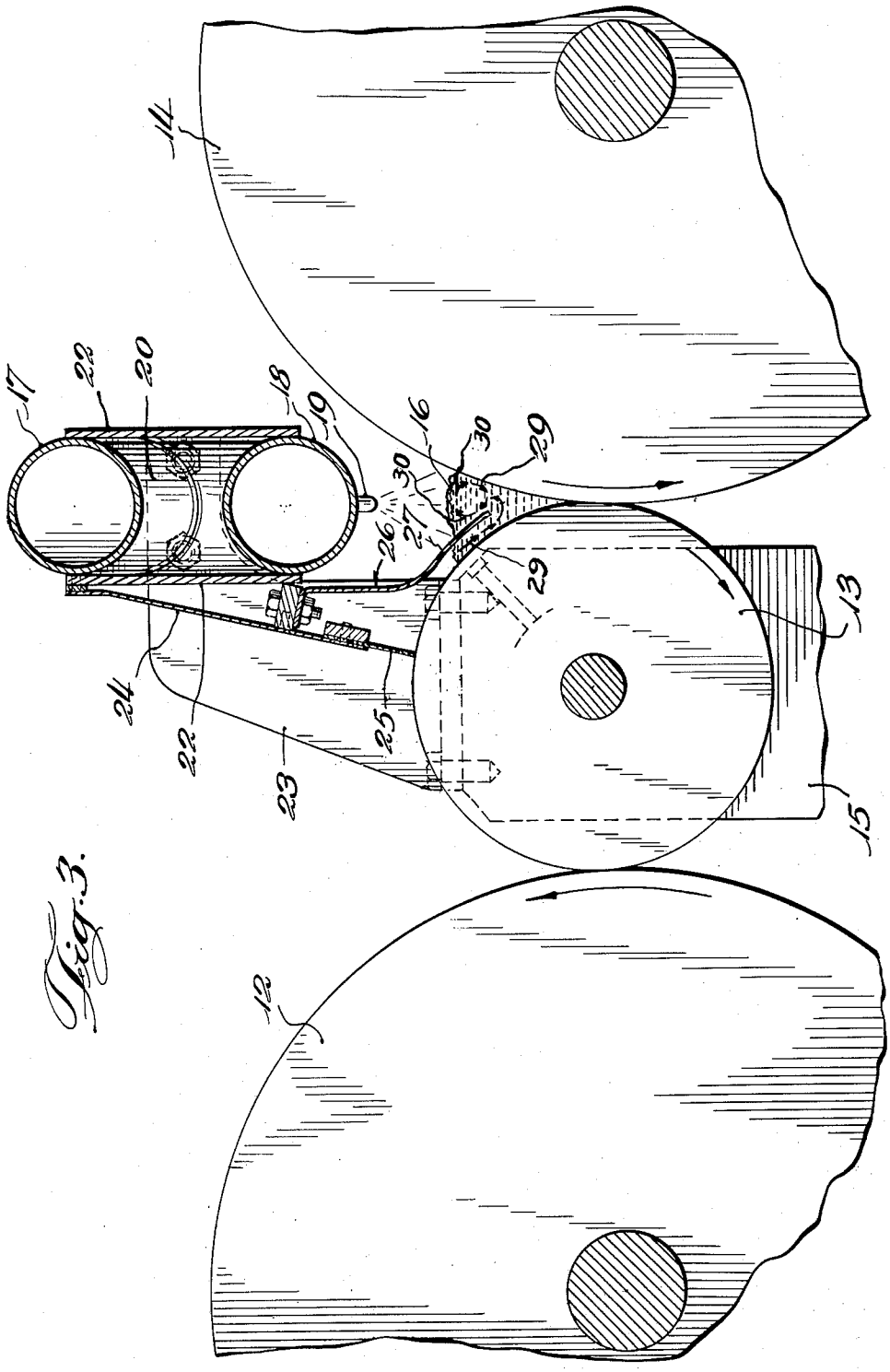


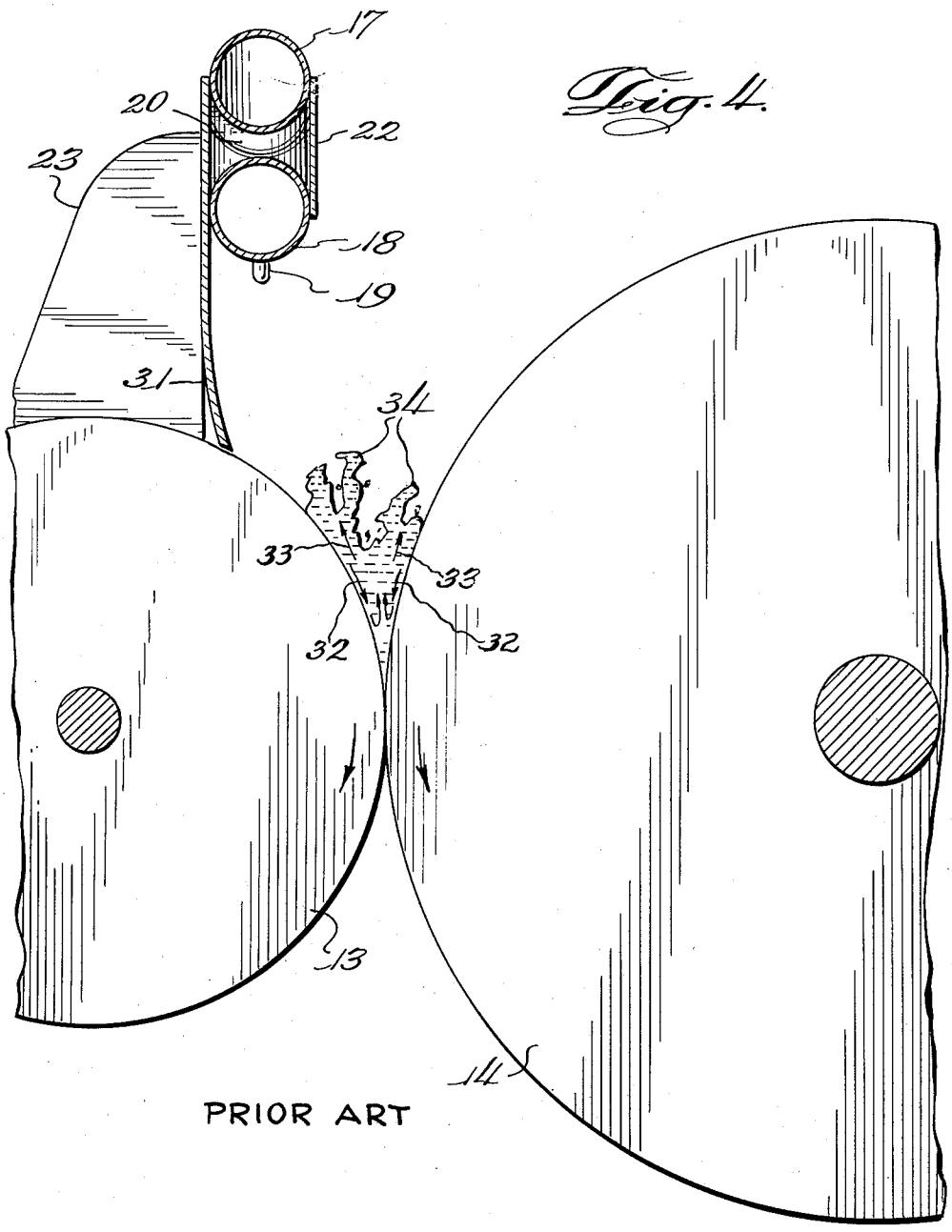

Fig. 3.

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Fig. 4.




PRIOR ART

United States Patent Office 3,018,757 Patented Jan. 30, 1962



3,018,757

# PAPERMAKING MACHINE

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8 Claims. (Cl. 118—262)

This invention relates to paper coating machines and particularly to mechanism for reducing turbulence and splashing in coating ponds of these machines when the machines are operated at high speeds.

Paper coating machines of a well known type may comprise a train of two or more rotating rolls which act to transfer a uniform, metered film of coating to an applicator roll, which in turn applies a film of coating to a paper web. The liquid coating, which may be of a conventional mineral-adhesive type, is supplied from a pond of coating material maintained in a nip formed by a metering roll and a backup roll included in the roll train. During operation this pond of coating, encompassed by the metering and backup rolls, eventually becomes violently agitated as the speed of rotation of the rolls increases. To prevent splashing of globules of the fluid coating onto the applicator roll or some other intermediate rolls of the roll train, disrupting the uniformity of the film supplied to the applicator roll and thus to the web, prior constructions have provided a partition or splash guard of some stiff material, such as heavy canvas interposed on that edge of the coating pond which is more adjacent the applicator roll. The partition extends downwardly almost touching the surface of the metering roll and acts to intercept such globules of coating. The splash guard, however, does not reduce the splashing and turbulence present in the coating pond, and the consequent entrainment of large quantities of air by the coating. Such entrainment changes the physical properties of the coating, including the metering properties, and results in a non-uniform coating. Extreme cases of entrainment produce coatings displaying a crater-like appearance under high magnification. Entrainment of air in the coating also results in a progressive loss of viscosity by the coating causing the coating to be increasingly responsive to the agitation induced by the rotating rolls, the agitation eventually expelling splashes of coating from the pond in all directions and possibly reducing the coating in the pond to a point where a portion of the nip may not be adequately supplied with coating.

It is, therefore, an object of the present invention to minimize the turbulence and splashing ordinarily encountered in the reservoir of liquid coating during high speed operation with a coater of the above mentioned type.

It is a further object of the invention to decrease the quantity of air entrained by the liquid coating by reducing such turbulence and splashing, thus maintaining the coating at a uniform viscosity and insuring efficient operation and a high grade of product.

More particularly, it is an object of the invention to introduce a coating deflector into the coating pond for the purpose of hydraulically stabilizing the pond. It is contemplated that with the improved mechanism of the present invention, a roll coater can operate at considerably higher speeds than heretofore possible with existing constructions.

Briefly, my improved mechanism for reducing turbulence and minimizing splashing may comprise, in a preferred form, a rigid coating deflector extending downwardly into the coating nip adjacent the metering roll and conforming to the curvature of the metering roll.

The invention consists of the novel constructions, arrangements and devices to be hereinafter described and claimed for carrying out the above stated objects, and such



other objects, as will be apparent from the following description of a preferred form of the invention, illustrated with reference to the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of a paper coating press embodying principles of the present invention;

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is a sectional view on an enlarged scale taken along line 3—3 of FIGURE 2; and

FIGURE 4 is a view similar to FIGURE 3 of a prior art structure.

Like characters of reference designate like parts in the several views.

Referring now to FIGURE 1, the illustrated coating press includes a backing roll **10**, an applicator roll **11**, a transfer roll **12**, a metering roll **13**, and a backup roll **14** rotatably mounted on a frame **15** and spaced so that a nip is formed at the line of contact between neighboring rolls. Rolls **10**, **11**, **12** and **14** may be rubber covered, while roll **13** is preferably a chrome plated steel roll.

A pond of liquid coating **16** is provided in the nip formed by the metering roll **13** and the backup roll **14**. A coating inlet pipe **17** extends laterally with respect to the rolls and is positioned above the pond of coating **16** as seen in FIGURES 2 and 3. A manifold pipe **18** supplied with multiple outlets **19** lies beneath the inlet pipe **17**, and the two pipes are joined by a vertical connecting pipe **20**. A coating supply **21** is connected to the coating inlet pipe **17**, supplying coating from the left in the pipe **17** as seen in FIGURE 2, and the right end of the pipe **17** is partitioned off internally so that it simply acts as a support.

Sheet metal shrouds **22** are attached in any suitable manner to the sides of the pipes **17** and **18**, and the pipe-shroud structure is suspended over the pond **16** by means of support brackets **23** anchored to the frame **15**.

A sheet metal guard holder **24** is coextensive transversely of the machine with a shroud **22** to which the holder **24** is rigidly attached, and a guard **25** of hard rubber or other rigid material is attached to the holder **24**, so that the lower edge of the guard **25** is in close proximity to the surface of the metering roll **13**.

A coating deflector baffle **26** of some thin sheet material, preferably stainless steel, is attached in any suitable manner to one side of the holder **24**. The arcuate portion **27** of the coating deflector **26** is shaped to concentrically conform to the surface of the metering roll **13**, and the portion **27** extends downwardly into the coating pond **16** and is so positioned as to provide a substantial clearance above the nip formed by the rolls **13** and **14**.

In the operation of the coating press described above, the backing roll **10**, the applicator roll **11**, the transfer roll **12**, the metering roll **13**, and the backup roll **14** are mounted on the frame **15**; and one or more of the rolls is driven by driving mechanism such as by driving motors **10***a*, **11***a*, **12***a*, **13***a* and **14***a* for the rolls **10**, **11**, **12**, **13** and **14**, respectively, shown schematically in FIG. 1, so that each of the rolls rotates counter-directionally with respect to the roll or rolls with which it is in contact.

Liquid coating of suitable composition and viscosity flows from the source of supply **21** and passes through the inlet pipe **17** and the connecting pipe **20** into the manifold pipe **18**, and thence is uniformly distributed from the multiple outlets **19** to form the coating pond **16** between the metering roll **13** and the backup roll **14**.

As seen in FIGURE 3, the metering roll **13** is driven in the clockwise direction and the backup roll **14** is driven in the counter-clockwise direction. The peripheral surfaces of the metering roll **13** and the backup roll **14** move in convergent paths above the nip and describe, and are in contact with, the coating pond. A quantity of coating adheres to the surfaces of the rolls **13** and **14** as they pass through the nip between the rolls; and as these rolls con-

tinue to rotate, the peripheral surfaces below the nip diverge to split the coating, leaving a thin, well distributed film adhering to the surface of each of the rolls **13** and **14**. As the metering roll **13** continues to revolve, the thin layer of coating on its surface is carried to the nip between the rolls **12** and **13**, where a further coating split is effected, leaving on the surface of the transfer roll **12**, a portion of the coating which is smoother and more evenly distributed than that coating carried to the nip by the roll **13**. Roll **12** rotates in contact with the applicator roll **11** and transfers thereon, by similar action, a further divided portion of coating film, which film in turn is split by the roll **11** acting on the paper web **28** to deposit a highly uniform coating on the web **28** as it passes beyond the nip formed by the rolls **10** and **11** in the direction indicated in FIGURE 1.

During operation at web (roll surface) speeds of 200 to 500 feet per minute, the coating pond **16** is substantially placid when coatings of a suitable viscosity are employed. As the speed of operation increases, however, the coating in the pond **16** becomes agitated, and the present invention resides in the attachment to the guard holder **24** of a coating deflector **26**, the arcuate portion **27** of which extends downwardly into the coating pond **16**, to minimize any turbulence and splashing tending to occur in the coating pond **16** at the higher operational speeds. Experience has proven that the arcuate portion **27** of the coating deflector **26** should preferably conform to and be stationed adjacent the smaller metering roll **13** and at a distance from the roll in excess of one-tenth of the radius of the roll **13**, permitting some flow of coating between the arcuate portion **27** and the roll **13**, and that the bottom edge of the arcuate portion **27** should not extend downwardly into the pond **16** substantially more than two-fifths of the distance from the top of the metering roll **13** to the center of the nip between the rolls **13** and **14**.

The rolls **13** and **14** operating at high speeds generate currents, shown by the arrows **29** in FIGURE 3, originating adjacent the roll surfaces at the sides of the coating pond **16**. Those coating currents adjacent the surface of the metering roll **13**, which is considerably smaller in diameter than the backup roll **14**, are somewhat more swift and are directed more laterally than the currents adjacent the roll **14** due to the different roll diameters. These swifter currents **29** adjacent the smaller metering roll **13** are reduced in effect by being shielded from the main body of the coating **16** between the rolls **13** and **14** by the arcuate portion **27** in close proximity to the roll **13**. As for the currents generated by the backup roll **14**; in travelling through the pond **16**, these currents encounter the arcuate portion **27** and are deflected so as to largely isolate the currents **29** generated by the roll **13** from the currents generated by the roll **14**. Where these currents do come together, below the end of the arcuate portion **27**, they initiate an orderly rolling motion of coating in the pond as shown by the arrows **30** and thus minimize splashing and turbulence within the pond **13**.

Any small splashes of coating that may occur between the metering roll **13** and the arcuate portion **27** are prevented from travelling in the direction of the applicator roll **11** by the guard **25**.

FIGURE 4 shows the conditions that exist using prior art constructions and has been included for the purpose of contrasting the present invention with such prior constructions. The splash guard **31**, normally fabricated of heavy canvas or some other semi-rigid material, is positioned with its lower edge close to the surface of the metering roll **13**, but substantially above the surface of the pond **16**, and is provided solely for the purpose of intercepting any splashes of coating moving in the direction of the applicator roll **11**. Currents, as shown by arrows **32**, are generated adjacent the rotating rolls **13** and **14**, and since they are not deflected, they reverse and combine to form reinforced upward currents, shown by arrows **33**, which eventually produce splashes **34** of coating. The turbulence and splashing mounts rapidly as the rotational speeds of the rolls increase, and eventually a speed is reached at which the coating press no longer can be operated satisfactorily, both because entrained air has impaired the uniformity of the coated product and because the pond may be so agitated that sufficient coating may not be available to all portions of the nip.



My invention is a simple and inexpensive addition to available coating press equipment permitting the production of a uniform product at considerably higher rates of operation than heretofore practicable. The problems of air entrainment in the coating and splashing of the coating are greatly reduced, contributing to improved cleanliness of operation and increased efficiency.

I wish it to be understood that the invention is not to be limited to the specific constructions and arrangements shown and described, except only insofar as the claims may be so limited, as it will be understood to those skilled in the art that changes may be made without departing from the principles of the invention.

I claim:

1. A device for coating a web of sheet material comprising a pair of rotatable rolls having a nip between them for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from one of said rolls to a web of sheet material, and a coating deflector baffle extending downwardly toward said nip and into and below the surface of said pond for minimizing turbulence in the pond of coating as said rolls rotate.

2. A device for coating a paper web comprising a pair of rotatable rolls having a nip between them for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from one of said rolls to a paper web, a splash guard positioned in close proximity to said last mentioned roll so as to be interposed between said pond of coating liquid and said web of paper, and a coating deflector baffle extending downwardly toward said nip and into and below the surface of said pond for minimizing turbulence in the pond of coating as said rolls rotate.

3. A device for coating a paper web comprising a pair of rotatable rolls having a nip between them for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from one of said rolls to said paper web, and a coating deflector baffle extending downwardly toward said nip and into and below the surface of said pond and having a lower arcuately shaped portion concentrically conforming to and adjacent to one of said pond confining rolls for the purpose of minimizing turbulence and splashing in the pond of coating as the rolls rotate.

4. A device for coating a paper web comprising a pair of rotatable rolls of unequal size having a nip therebetween for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from the smaller of said rolls to said web of paper and a coating deflector baffle extending downwardly toward said nip and into and below the surface of said pond and having a lower arcuately shaped portion concentrically conforming to and adjacent to the periphery of the smaller of said pond confining rolls for the purpose of minimizing turbulence and splashing in the pond as the rolls rotate.

5. A device for coating a paper web comprising a pair of rotatable rolls of unequal diameter having a nip between them for confining a pond of coating, means for driving said rolls in counter-rotation, a coating inlet pipe adapted to be connected to a supply of coating, a manifold pipe connected to receive coating from said inlet pipe and having a plurality of outlets for distributing the coating across said pond, a coating applicator roll and a backup roll having a nip between them and being adapted to pass the paper web between them and through the nip, means for transferring coating to said applicator

roll from the smaller of said pond confining rolls and including a transfer roll in contact with one of these rolls, a splash guard positioned in close proximity to said smaller roll so as to be interposed between said pond of coating liquid and said web of paper, and a coating deflector baffle extending downwardly toward said first named nip and into and below the surface of said pond and having a lower arcuately shaped portion concentrically conforming to and adjacent to the periphery of said smaller roll for the purpose of minimizing turbulence and splashing in the pond as the rolls rotate.

6. A device for coating a web of sheet material comprising a pair of rotatable rolls having a nip between them for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from one of said rolls to the web of sheet material, and a coating deflector baffle extending downwardly toward said nip and being located adjacent one of said rolls but at a distance from the roll in excess of one-tenth of the radius of the roll and into and below the surface of the pond for minimizing turbulence in the pond of coating as said rolls rotate.

7. A device for coating a web of sheet material comprising a pair of rotatable rolls having a nip between them for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from one of said rolls to the web of sheet material, and a coating deflector baffle extending toward said nip not more than two-fifths of the distance



from the top of one of the rolls to the center of said nip so as to extend below the surface of the pond and being located adjacent said last named roll and extending about the peripheral surface of said last named roll but at a distance in excess of one-tenth the radius of said last named roll.

8. A device for coating a paper web comprising a pair of rotatable rolls of unequal size having a nip between them for confining a pond of coating liquid, means for driving said rolls in counter-rotation, means for transferring coating from the smaller of said rolls to the paper web, a splash guard positioned in close proximity to said smaller roll so as to be interposed between said pond of coating liquid and the web of paper, a stationary support extending lengthwise of said rolls for holding said splash guard, and a coating deflector baffle held by said support and extending close to but spaced from the surface of said smaller roll and downwardly toward said nip and into and below the surface of the pond for minimizing turbulence in the pond as said rolls rotate.

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