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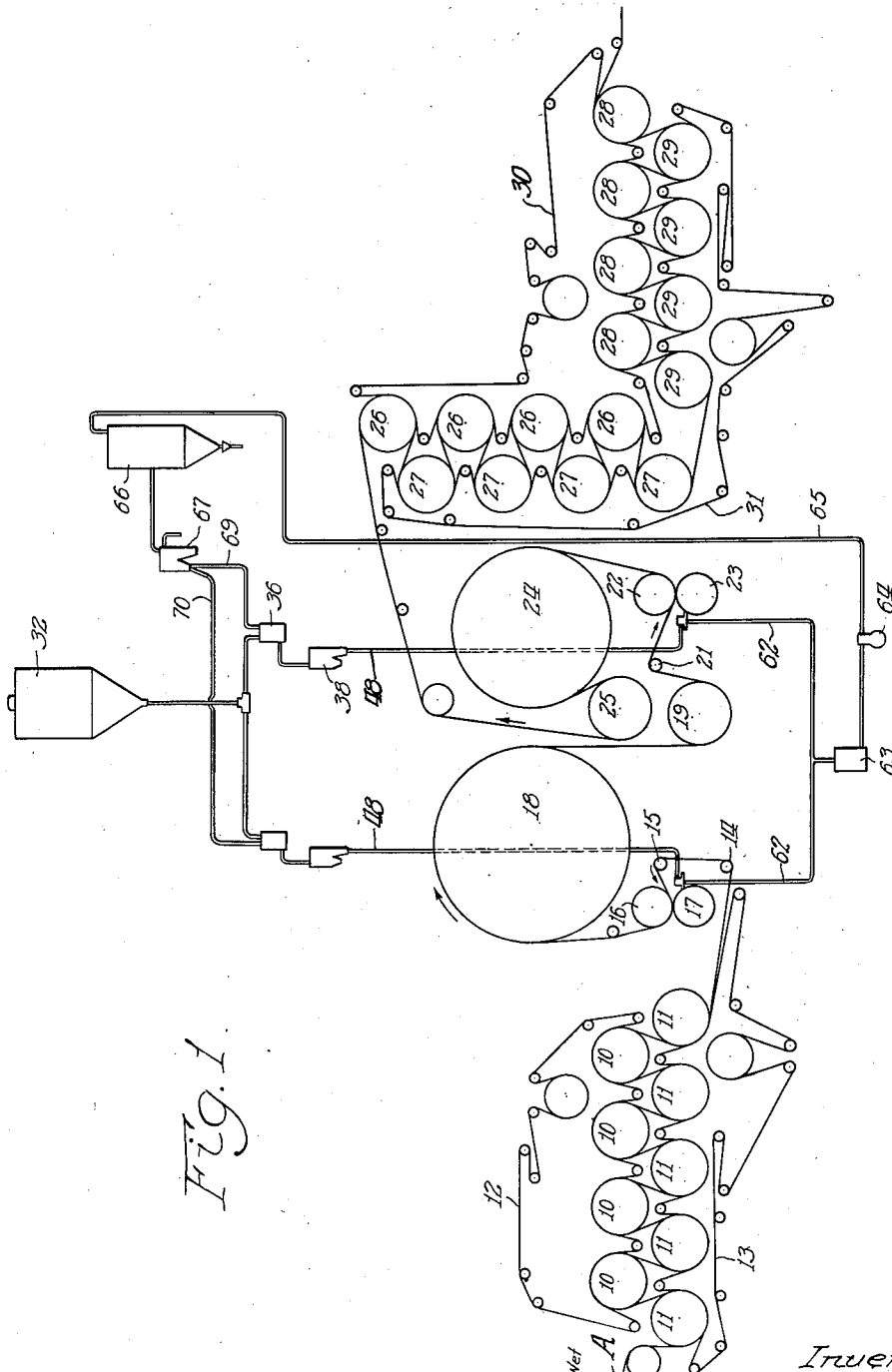
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METHOD OF AND APPARATUS FOR MAINTAINING UNIFORMITY IN PAPER COATINGS

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4 Sheets-Sheet 1




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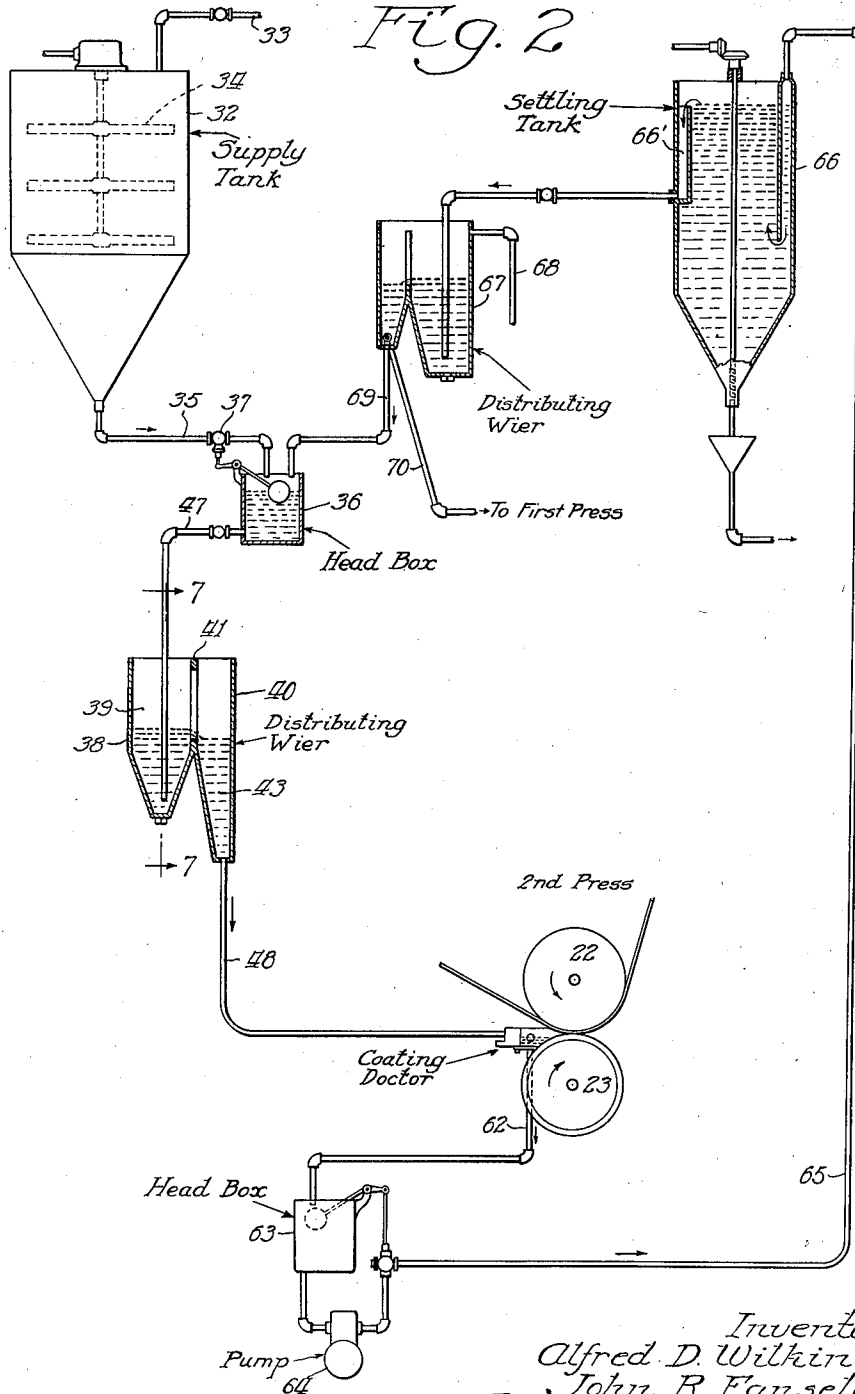
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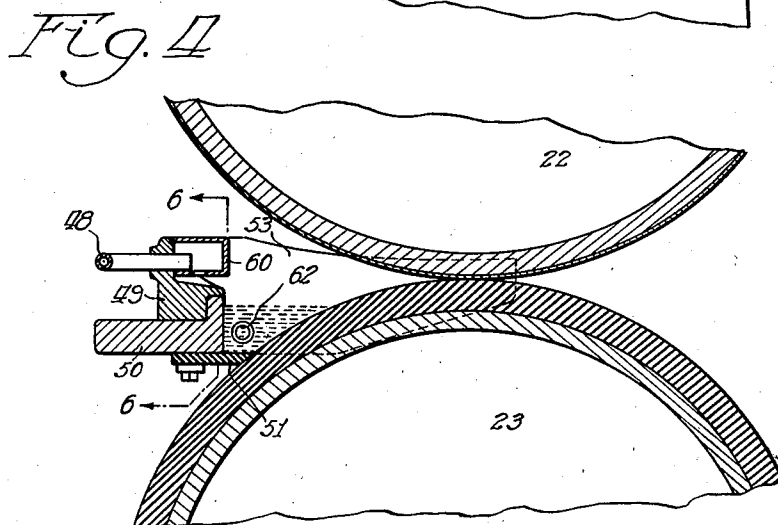
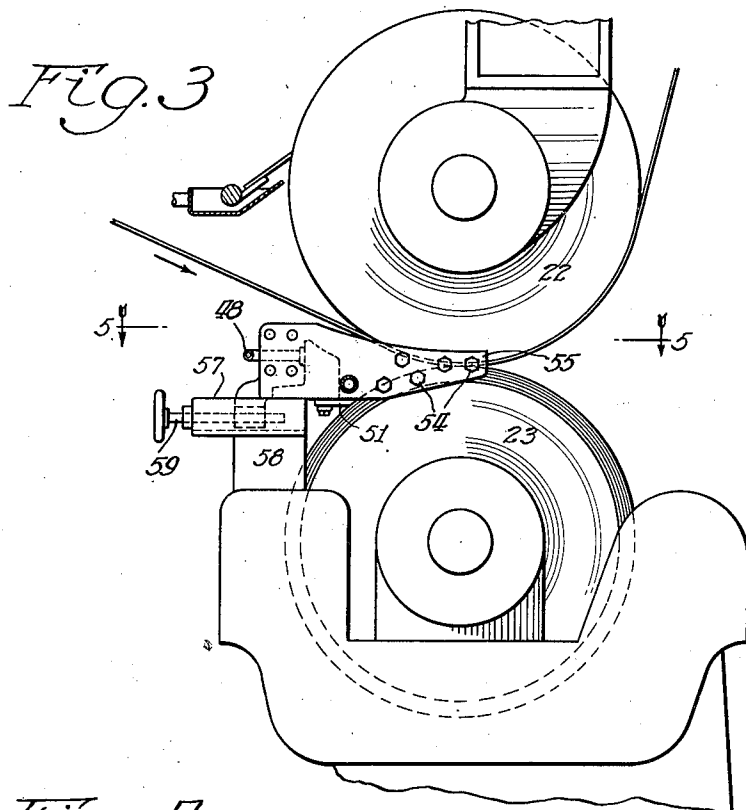
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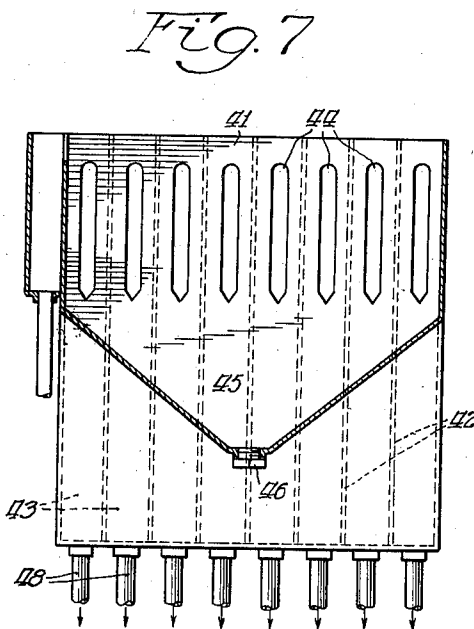
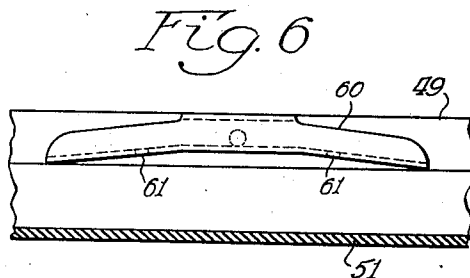
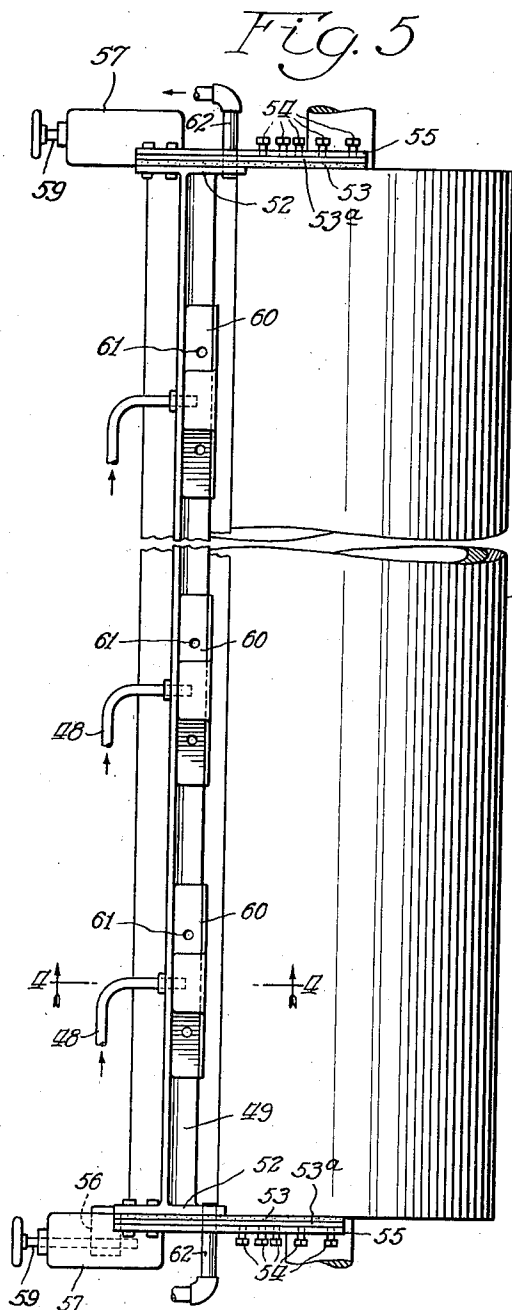
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UNITED STATES PATENT OFFICE

2,064,776

METHOD OF AND APPARATUS FOR MAINTAINING UNIFORMITY IN PAPER COATINGS

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6 Claims. (Cl. 91—49)

This invention relates to the general art of paper manufacture, and has reference more particularly to that class of papers which are surface filled or processed with a material carrying a comparatively high percentage of mineral, such as China clay.

According to U. S. Patent 1,918,095, such filler or coating has been applied to the surface of the web through the agency of a pair of coating rolls, between which the paper or web passes, the lower roll dipping in a pan or basin containing the filling or coating solution.

Under certain conditions, in making paper by the process and apparatus disclosed in the said U. S. Letters Patent, it was found that there was a tendency toward a progressive deterioration of the product. A lack of uniformity, and particularly streakiness or unevenness of the coating was observed. It was discovered that this tendency toward off-quality in the finished result was caused by a gradual degeneration of material in the coating trough or pan and in order to restore the quality of the paper, it became necessary, after suitable intervals from time to time to dump the contents of the pan and re-fill with new material. Obviously this resulted in an increase in the expense of the process.

After various causes were assigned to this difficulty, and after making numerous tests and experiments, it was discovered that the clay or other mineral used for the processing material was of different degrees of fineness and, furthermore, that the ratio between fine and coarse particles in a pan of material which had become unfit for the production of high quality paper, was different from that present in a new batch of material in that the used or worn out material contained a much larger percentage of coarse particles than did the original material. Evidently this phenomenon is due to some classifying action which takes place in the nip of the press rolls when applying the coating material to the paper, the rolls passing the fine particles and rejecting the coarse particles which flow back into the coating trough or pan.

Further experiments indicated the possibility of salvaging most of the "worn out" coating material if the excess of coarse particles could be removed in some way from the bath. This method appeared to be more practical than to separate the coarse particles from the new material before supplying it to the machine.

An object of the present invention is to provide an improved method of and apparatus for applying a filler or coating that will eliminate

this fault, and the invention operates on the principle of maintaining uniformity of the physical structure of the coating or filling supplied to the coating roll; and this object we accomplish by a novel method and apparatus whereby we abstract from the coating, preferably at the coating roll itself, the coarse mineral particles, so that the portion of the coating mixture that is applied to the paper or web is of substantially uniform consistency and free from particles of such size as cause the "streakiness" referred to.

In said Letters Patent 1,918,095 there is disclosed a process and apparatus for the manufacture of high grade printing paper, in connection with which the subject matter of the present application was developed as an improvement; and in the accompanying drawings we have illustrated the present improvement as applied to a machine such as is disclosed in the aforesaid Letters Patent, but it is to be understood that the present improvements may be equally capable of application, with beneficial results, to other machines and processes of the same general character.

In order to facilitate a clear understanding of the present invention by persons skilled in the art, we have illustrated one practical form thereof in the accompanying drawings, in which:—

Fig. 1 is a diagrammatic side elevation of a web filling machine similar to that disclosed in the Letters Patent above identified, showing diagrammatically an application of our present improvements thereto.

Fig. 2 is a side elevation, partly in vertical section, of a flow system for the coating applied to one of the two press rolls shown in Fig. 1.

Fig. 3 is an enlarged end elevation of a pair of press rolls, showing an improved form of doctor employed in connection therewith.

Fig. 4 is a further enlarged vertical section through the doctor and the adjacent portions of the press rolls.

Fig. 5 is an enlarged top plan view of the doctor and the lower press roll taken on the line 5—5 of Fig. 3.

Fig. 6 is a fragmentary longitudinal section through the doctor, showing one of a plurality of distributing heads therefor, taken on the line 6—6 of Fig. 4.

Fig. 7 is a vertical section, enlarged, on the line 7—7 of Fig. 2, through the distributing weir.

First briefly describing the processing apparatus, and referring to Fig. 1, the paper web A as it comes from the wet end of the paper making machine, is preferably first passed through a

series of drying cylinders 10 and 11 illustrated at the left of Fig. 1, preferably in association with upper and lower felts 12 and 13 respectively, that press the wet web into intimate contact with the cylinders. From the last cylinder 11 the partly dried web, supported on the upper lap of the felt 13, passes over driven rolls 14 and 15 into the nip of a pair of press rolls 16 and 17, by which one side is given a dressing of a suitable finishing material, such, for instance, as a water solution of casein or starch with an insoluble or inorganic filler, such as China clay, satin white, chalk or other suitable mineral.

From the press rolls 16, 17, the web, processed on one side, passes over a large diameter heating drum 18, and thence beneath a heating cylinder 19 and over a driven roll 21 to and between a similar pair of press rolls 22, 23, by which the dressing is applied to the other side of the web, the latter passing thence over a second large drying drum 24 and a drying cylinder 25 to a second substantially vertical series of heating cylinders 26 and 27, and thence over a horizontal series of heating cylinders 28 and 29 that are practically continuous with the lower end of the vertical series 26 and 27.

The web, while traversing the heating cylinders 26, 27, 28 and 29, is preferably pressed into intimate contact with said cylinders by suitably guided felts 30 and 31. By the first group of drying cylinders the wet web from the paper making machine is sufficiently dried to receive and absorb the first surface filling on one side thereof; by the large drying drum 18 and cylinder 19 the web is sufficiently dried to receive and absorb the second surface filling on the other side thereof; and the final drying of the fully treated and finished web is effected by the large drying drum 24 and the cylinders 25, 26, 27, 28 and 29.

Coming now to a description of an equipment well adapted to effectuate the stated purposes of the invention, 32 designates a storage tank in the paper machine room, to which the complete coating solution may be pumped through a pipe 33 from the coating preparation department. This tank 32 is preferably equipped with a rotary agitator 34 by which the contents are maintained in a substantially uniform condition as to consistency. From the bottom of the tank 32 the solution flows by gravity through a pipe 35 into a head box 36, the level of the solution in the latter being maintained substantially constant by means of an ordinary float-controlled valve 37, so that a properly proportioned amount of fresh material from the supply tank 32 is added to the recovered material from the settling tank 66, later described, so that the desired constant amount of coating material will go to a distributing weir and from the latter to the coating doctor.

From the head box 36 the coating flows into a distributing weir designated as an entirety by 38. As shown in Figs. 2 and 7, this distributing weir is made with two compartments 39 and 40 located side by side and divided by a vertical partition 41. The deeper compartment 40 is preferably sub-divided by vertical partitions 42 into a plurality of individual wells 43, and the partition 41 is formed with narrow vertical openings 44 (Fig. 7), the lower ends of which are of uniform height, so as to make uniform the flow of coating across the entire width of the weir. The compartment 39 is preferably formed with

a hopper-shaped lower portion 45, the lower end of which is closed by a clean-out plug 46. The coating flows from the head box 36 through a pipe 47 into the lower end of the weir compartment 39, and the chief function of this latter compartment is to maintain a uniform height and head of the liquid approaching the weirs 44.

From the wells 43 the coating flows through a group of pipes 48 to a trough or pan (sometimes called a "doctor"), that is associated with the lower press roll 23. The preferred structure of this trough is best illustrated in Figs. 3, 4, 5, and 6, the same being built up as follows.

The numeral 49 designates a metal bar preferably having a cross section shown in Fig. 4 15 that extends parallel with the axis of the lower press roll 23 opposite the surface thereof, and has attached to its under side a bar 50, to the lower side of which is adjustably secured a rubber strip 51 that constitutes the bottom of the pan and is formed with a beveled inner edge that engages with the surface of the roll 23 and prevents leakage of the coating material. The bar 49 is formed with heads 52 (Fig. 5), to the outer sides of which are attached rubber strips 53 that form the side walls of the pan and overlap and are pressed against the ends of the roll 23 by a plate 53a acted upon by a plurality of screws 54 mounted in cover plates 55 that are also secured at their inner ends to the heads 52. The heads 52 are also formed with downwardly and outwardly offset lugs 56 that are slidably supported on the bottoms of a pair of adjustment boxes 57, these latter in turn being mounted on blocks 58 (Fig. 3) secured to and supported by the end frames which carry the journals of the roll 23. Rods 59 journaled in the outer ends of the boxes 57 have screw engagement with the lugs 56, this construction providing a simple means for adjusting the doctor bodily toward and from the press roll and thus maintaining a sealed joint with the roll at the bottom of the trough.

Mounted at intervals along the bar 49 are a plurality of hollow distributor boxes 60, each formed with holes 61 in its bottom wall for delivering the coating solution from the box 60 onto the portion of the periphery of the roll 23 closed by the bottom and end walls of the trough.

It will be understood that the coating supply mechanism thus far described is located at one side of the web drying cylinders and rolls and the press rolls of the machine, and consequently the pipes 48 leading from the distributing weir 38 are bent inwardly to connect with the trough, as indicated in Fig. 5.

This supply trough is constructed so as to provide sufficient material to the coating press roll to form a continuous layer of coating indicated by dotted lines in Fig. 4 across the surface of the roll. The quantity of coating material carried in the trough may be varied from no over-flow at all to any amount of over-flow desired. This can be controlled either by a float valve or by a hand valve. Hand regulation is satisfactory where over-flow is carried. The coarser mineral particles in the coating material tend to settle in the lower portion of the trough or doctor.

Referring to Figs. 2, 4, and 5, through the lower portion of the end walls of the doctor extend over-flow pipes 62 which deliver the over-flow carrying the coarser particles into a float-controlled head box 63, which provides a means of operating a float-controlled valve in the discharge

of a pump 64 to prevent the latter pumping out at greater capacity than the amount of coating material overflowing from the coating doctor war-rants, and, from the latter, the over-flow liquid is transmitted by a pump 64 and flow line 65 into the upper end of an overhead settling tank 66, the preferred structure of which is clearly shown in Fig. 2. The coarse fraction is discharged at the bottom of the over-flow settling tank 66, the latter being preferably equipped with a positively driven screw to facilitate the discharge, and the desired usable part over-flows to an outlet chamber 66', whence it flows to an over-flow distributing weir 67 that is structurally similar to the weir 38. The weir 67 is preferably equipped with an over-flow pipe 68 to take care of any excess, and from the weir 67 the selected usable part of the liquid is returned by a pipe 69 to the head box 36 where it mingles with the original supply from the tank 32. The over-flow weir 67 may serve in common for the flow systems serving both the press rolls 22, 23 and 16, 17, the head box serving the latter press rolls receiving its portion of the re-claimed liquid through a pipe 70. The finally rejected portion of the filling material from the described process is only a small percentage of the total amount used, and can be salvaged for various other purposes as, for instance, filler in the base sheet.

We claim:

1. Apparatus for maintaining uniformity in a paper coating mixture containing an insoluble ingredient, comprising, in combination with a pair of press rolls, a supply trough associated with one of said press rolls, a supply tank for the coating mixture, a gravity flow line including a float-controlled head box leading from said tank to said trough, an overhead settling tank equipped with a sediment discharge device, an over-flow line including a head box leading from said trough to said settling tank, a pump in said over-flow line beyond and controlled by said last-named head box, and a flow line leading from said settling tank to said first-named head box.

2. Apparatus for maintaining uniformity in a paper coating mixture containing an insoluble ingredient, comprising, in combination with a pair of press rolls, a doctor pan associated with one of said press rolls, a supply tank for the coating mixture, a gravity flow line including a float-controlled head box and a distributing weir leading from said tank to said pan, an overhead

settling tank, an over-flow line including a head box having a float and a pump controlled by said float leading from said pan to said settling tank, and a flow line leading from said settling tank to said first-named head box.

3. Apparatus for maintaining uniformity in a paper coating mixture containing an insoluble ingredient, comprising, in combination with a pair of press rolls, a doctor pan associated with one of said press rolls, a supply tank for the coating mixture, a gravity flow line including a float-controlled head box and a distributing weir leading from said tank to said pan, an overhead settling tank, an over-flow line including a head box having a float and a pump controlled in its discharge side by said float leading from said pan to said settling tank, a flow line leading from said settling tank to said first-named head box, and a distributing weir in said last-named flow line.

4. The improvement in the art of coating paper with a fluid mixture containing in suspension solid particles varying in size, which consists in maintaining a continuous flow of the coating mixture, continuously removing by sedimentation and overflow coarser particles from the mixture, continuously abstracting by sedimentation and overflow the coarser particles from the overflow, and continuously returning the residue to the original stock of coating mixture.

5. The improvement in the art of coating paper with a fluid mixture containing in suspension solid particles varying in size, which consists in maintaining a continuous flow of the coating mixture, continuously removing by sedimentation and overflow coarser particles from the mixture at the point of application of the latter to the paper, continuously abstracting by sedimentation and overflow the coarser particles from the over-flow, and continuously returning the residue to said point of application.

6. Apparatus for maintaining uniformity in a paper coating mixture containing an insoluble ingredient, comprising, in combination with a pair of press rolls, a supply trough associated with one of said press rolls, a supply tank for the coating mixture, a supply line leading from said tank to said trough, a settling tank having an over-flow, a line leading from said trough to said settling tank, and a flow line leading from said settling tank over-flow to the supply line.

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