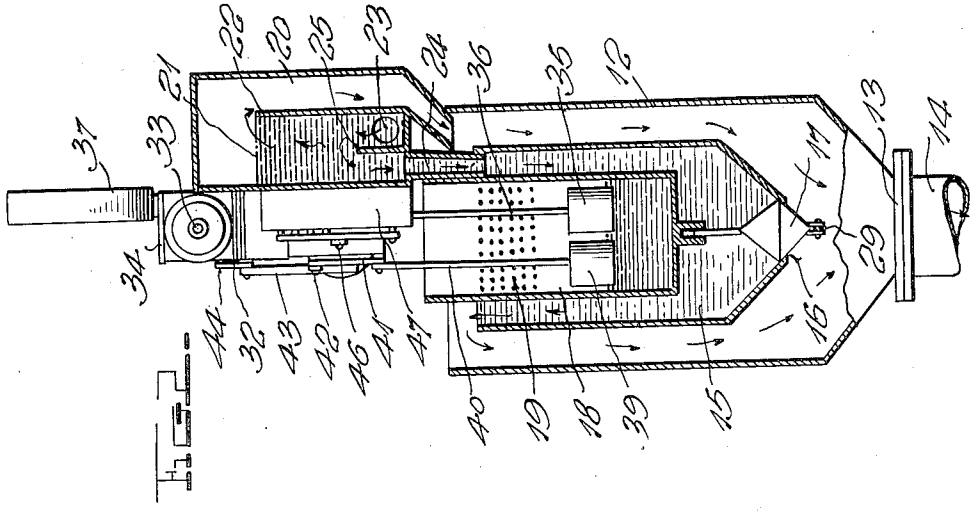
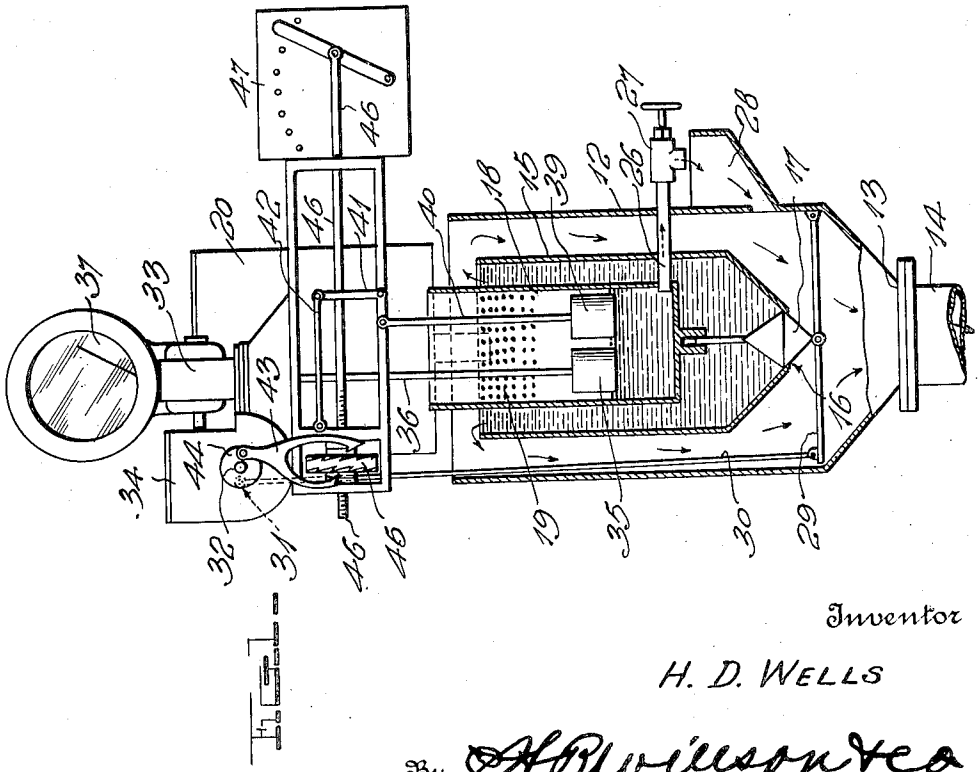
Jan. 14, 1936. H. D. WELLS 2,027,660

FREENESS DETECTOR

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FREENESS DETECTOR

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Fig. 3.

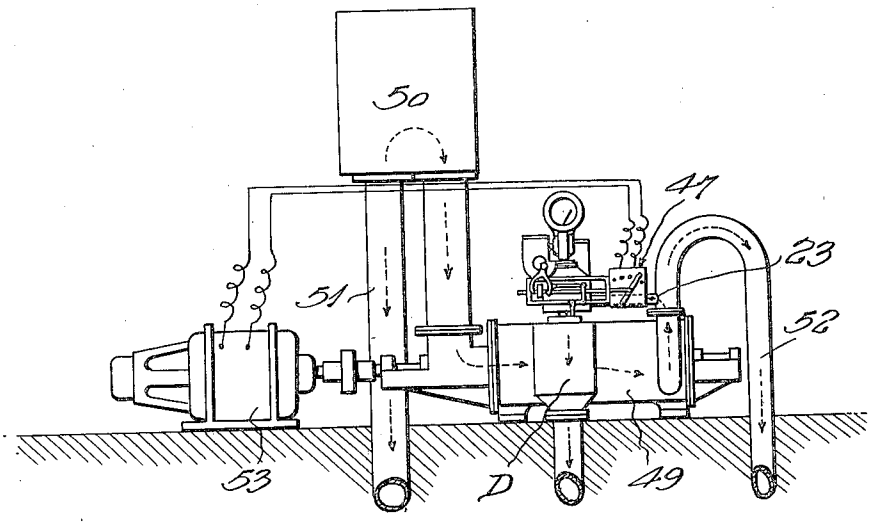
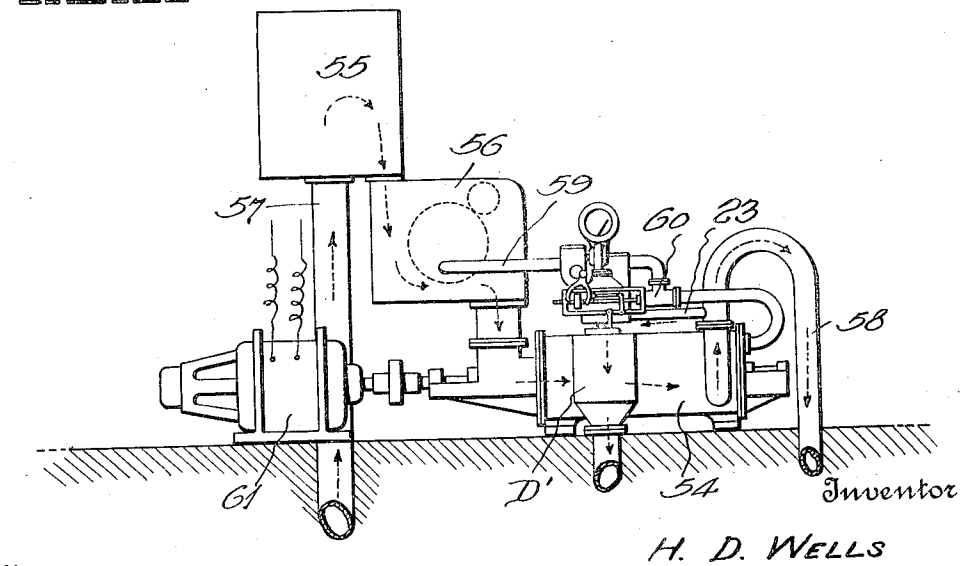


Fig. 4.



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Fig. 5.

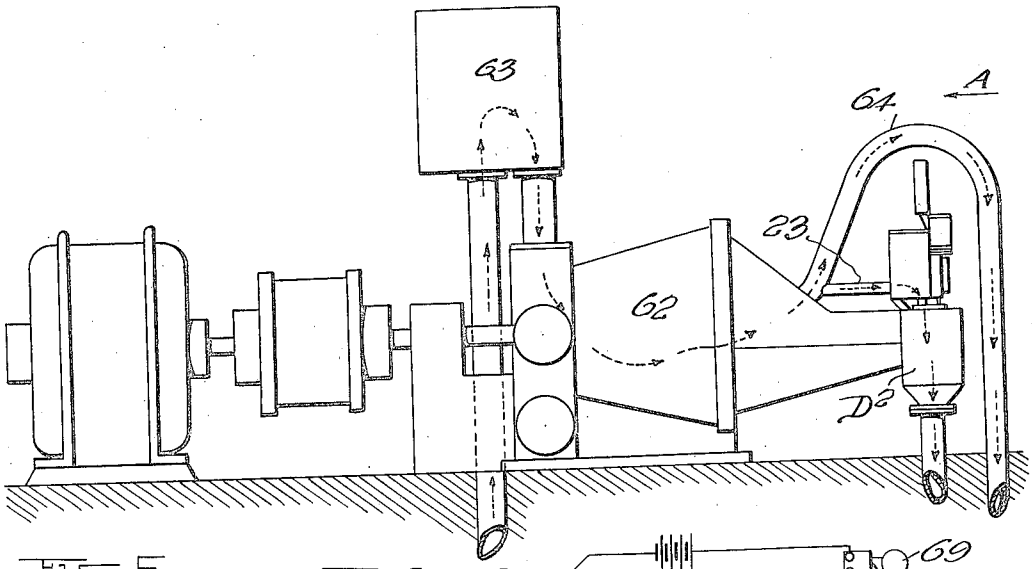


Fig. 6.

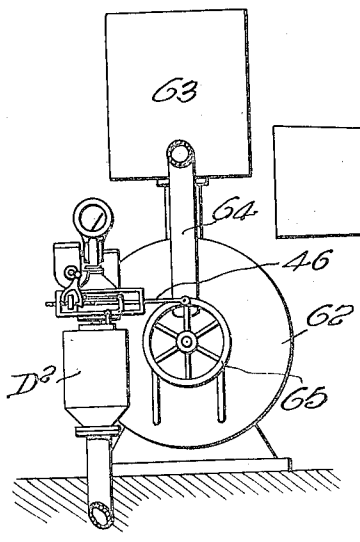


Fig. 8.

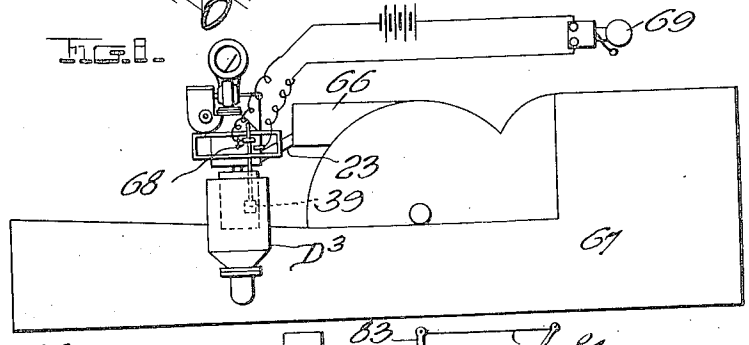
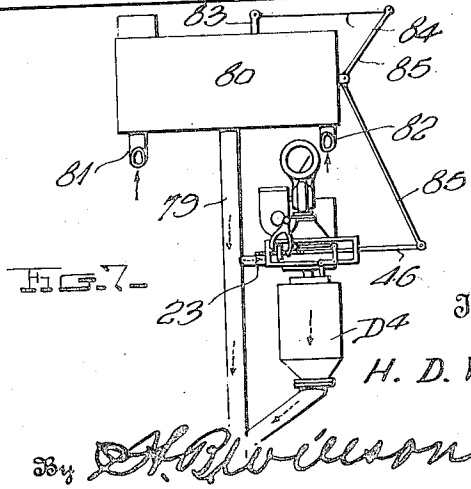


Fig. 7.



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2,027,660

UNITED STATES PATENT OFFICE

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FREENESS DETECTOR

Harold Donald Wells, Glens Falls, N. Y.

Application July 16, 1934, Serial No. 735,543

11 Claims. (Cl. 92—38)

The invention relates to an apparatus and method for determining the freeness of paper stock or pulp, that is, its ability to release the major portion of its liquid content through a screen. It is quite customary to use both "freeness" and "slowness" with reference to this characteristic of the stock, but in view of the fact that "slowness" may be considered merely as a degree of "freeness", only "freeness" will be herein used.

One object of the invention is to provide a novel apparatus which will function to continuously detect the "freeness" of a constantly flowing stream of pulp or stock.

Another object is to provide a novel continuous freeness detector which may be made to perform various kinds of work, for instance, operate an indicator, recorder or alarm, or so control a stock handling apparatus as to regulate the freeness of the stock in accordance with the needs shown by the sample stream which is continuously conducted to the detector.

A still further object is to provide a novel freeness detecting apparatus and method which will eliminate the human element and the time element, both of which have heretofore caused considerable trouble and inaccuracy.

With the foregoing in view, the invention resides in the novel subject matter hereinafter described and claimed, the description being accomplished by reference to the accompanying drawings.

Fig. 1 is a front elevation partly in vertical section showing a freeness detector constructed in accordance with the invention.

Fig. 2 is a side elevation partly in vertical section.

Fig. 3 is a side elevation showing a combination in which the detector operates a rheostat to control the speed of an electric motor which drives a refiner and hydrator to regulate the freeness of the stock.

Fig. 4 is a side elevation showing a combination in which the freeness detector controls a liquid valve for regulating the freeness of the stock.

Fig. 5 is a side elevation showing a combination in which the freeness regulator adjusts the usual control wheel of a Jordan.

Fig. 6 is an end elevation of Fig. 5 looking in the direction of the arrow A.

Fig. 7 is a side elevation showing an arrangement in which the freeness detector automatically adjusts a proportioner for free and slow stock.

Fig. 8 is a side elevation showing an arrangement in which the freeness regulator is associated with a beater to operate an alarm according to the freeness of the stock.

The structural characteristics of the continuous freeness detector are shown in Figs. 1 and 2 and will first be described, after which various ways of combining said detector with stock handling apparatus to automatically and continuously regulate the freeness of the stock or operate an alarm, will be explained.

An outer container 12 providing a stock receiving chamber for detected stock is provided, said container having a flanged stock outlet 13 in its bottom to be coupled to any desired pipe 14, leading for instance to a chest.

Mounted within and preferably concentric with the outer container 12, is a stock sample receiving, undulation container 15 which is preferably open at its top and is provided with a stock outlet 16 in its bottom, a discharge valve 17 being provided for said outlet 16.

Within and preferably concentric with the undulation container 15, is a detection container 18, part of the dividing side wall between said detection container 18 and said container 15 being formed by a screen 19.

Mounted upon the outer container 12 is a small vat or the like 20 having a constant level chamber 21 and a spill-over dam 22 forming one wall of said chamber 21. A stock inlet 23 is provided for the chamber 21, a stock discharge orifice or passage 24 leads from said chamber 21 into the undulation container 15, and a surge deflector 25 is provided between said inlet 23 and said orifice or passage 24.

Stock fed into the container 15 rises therein and liquid from this stock passes through the screen 19 into the detection container 18, and the liquid while standing in some quantity in this container 18, continuously discharges from it by gravity through an outlet passage 26 having a regulatable needle valve 27. The speed with which the liquid passes through the screen 19 is, of course, indicative of the freeness of the stock and when said liquid enters said container 18 more rapidly than it discharges therefrom, the liquid level in said container will of course rise. When the liquid flows through the screen into the container 18 more slowly, the liquid level in said container lowers. The rise and fall of liquid in the container 18 is thus also indicative of the freeness of the stock, and I preferably make provision whereby variance of this liquid level is made to perform work, as will be hereinafter explained.

The liquid discharged through the valve 27

flows through a spout 28 into the outer container 12, and provision is made for alternately opening and closing the valve 17 so that the thick stock in the undulation container 15 will not collect in the latter but on the contrary will intermittently discharge into said container 12. This alternate opening and closing of valve 17 also causes vertical undulation of the stock in the container 15 to keep the stock moving upwardly and downwardly across the screen 19 so that the latter will remain clean.

In the present showing, the valve 17 is connected to a lever 29 fulcrumed in the outer container 12, and an operating link 30 rises from said lever to a crank 31 on one end of a shaft 32, said shaft being driven by an electric motor 33 through the instrumentality of reduction gearing within a gear case 34.

I have shown a float 35 in the detection container 18, said float being operatively connected at 36 with a recording gauge 37. Another float 39 is located in the container 18 and is linked at 40 to a bell crank 41. This bell crank is linked at 42 to a bifurcated pawl 43, which pawl is continually raised and lowered by a crank 44 on the shaft 32. The pawl 43 straddles a wheel 45 which is threaded upon a slidably mounted rod 46. When float 39 ascends, one end of pawl 33 engages wheel 45 and rotates it in one direction, thereby causing said wheel to shift the rod 46 in one direction. When the liquid level lowers however, and the float 39 descends, the other end of the pawl 33 engages the wheel 45, reversely rotating the latter so that it moves the rod 46 in the other direction. This rod may be utilized for performing various duties, and in Fig. 1 it is shown operatively connected with a rheostat 47.

While the operation of the detector would probably be clear from the foregoing, it may be briefly stated as follows. A continuous sample stream of the stock enters the chamber 21 through the inlet 23, substantially a constant level being maintained in said chamber 21 and any excess spilling over the dam 22 and flowing through a passage 48 into the stock collection container 12. The stock enters the undulation container 15 at a uniform rate through the passage 24 and as the valve 17 is alternately opened and closed, the stock in said container 15 is caused to vertically pulsate. Liquid from this stock enters the detection container 18 through the screen 19 and accumulation of thick stock in the container 15 is prevented by repeatedly opening the valve 17. While a quantity of the liquid stands in the inner container 18, liquid constantly discharges from said container through the passage 26 and valve 27 and flows into the outer container 12. The liquid level in the container 18 varies in accordance with the freeness of the stock, and such liquid level variance is made to perform work. For illustrative purposes, I have shown the float 35 riding on the liquid for operating a recording gauge 37 and have also shown the float 39 and parts controlled thereby for effecting movement of the rod 46 with any rise or fall of the liquid level.

The apparatus continuously carries out a freeness detection method from which both the human element and the time element have been removed so that less trouble and more accuracy exist.

In Fig. 3, a freeness detector D constructed as above is operatively connected with a refiner and hydrator 49. Stock is fed to this refiner and hydrator through a consistency regulator 50 which it enters through a pipe 51. The refiner and hydrator 49 discharges through a pipe 52 and the inlet 23 for the detector D is connected with this pipe. Thus, as long as the refiner and hydrator 49 is operating, a sample stream of the outgoing stock is conducted to the detector D which is constructed as above described. This detector operates the rheostat 47 and the latter controls the driving motor 53 of the refiner and hydrator 49. Thus, the speed of the refiner and hydrator which controls the freeness of the stock, is under control of the detector D, with the result that the freeness of the stock will be regulated according to requirements, the regulation being entirely automatic.

In Fig. 4, the automatic continuous detector D' is associated with a refiner and hydrator 54, a consistency and quantity regulator 55 and a thickener 56. The stock enters the regulator 55 through a pipe 57, flows from said regulator to the thickener 56 and enters the hydrator 54 from said thickener. From the hydrator, the stock discharges through the pipe 58. The stock inlet 23 of the detector D' connects with the pipe 58 to supply a sample stream to said detector. An effluent pipe 59 leads from the thickener 56 into the hydrator 54 and is provided with a control valve 60 for regulating the flow of effluent therethrough. This valve is connected with and operated by the rod 46 above described. The valve 60, being responsive to rise and fall of liquid in the detection chamber of the detector D', controls the amount of effluent which reaches the refiner and hydrator 54 from the thickener 56, so as to regulate the freeness of the stock. Both the pipe 58 and the discharge pipe 14 of the detector D' may lead to a chest or to other destination.

The refiner and hydrator 54 is driven by an electric motor 61 and if desired, this motor could be automatically controlled in the same manner as shown in Fig. 3.

In Figs. 5 and 6, the freeness regulator D^2 is associated with a Jordan 62 which receives the stock from a consistency and quantity regulator 63. The stock discharges from the Jordan through a pipe 64 and the inlet 23 of the detector D^2 branches from said pipe 64 so as to continuously direct a sample of the stock to said detector D^2. The rod 46 of the detector is directly connected to the usual Jordan controlling wheel 65 for adjusting the latter in accordance with stock requirements to regulate the freeness of the stock. Both the pipe 64 and the detector outlet pipe 14 may lead to a chest or other destination.

In Fig. 8, the detector D^3 has its inlet 23 connected with the outlet 66 of a beater 67 to continuously receive a sample therefrom. In this association, the float 39 instead of controlling a pawl such as 43 above described, operates a switch 68 for making or breaking the circuit of an alarm 69 according to the freeness of the stock discharging from the beater.

In Fig. 7, the inlet 23 of the detector D^4 is connected with the outlet 79 of a proportioning machine 80 which mixes slow stock entering at 81 with free stock entering at 82. The machine 80 is provided with an adjusting lever 83 which must be moved in one direction to increase the freeness of the stock and in the other direction to decrease said freeness. This lever 83 is linked at 84 to another lever 85 which is connected with the rod 46 of the detector D^4. The lever 83 will thus be moved in accordance with any rise or fall of the liquid level in the detection

chamber of the detector D^4 so that the proportioning machine 80 will proportion and regulate the stock in accordance with requirements.

Excellent results may be obtained from the construction and combination shown and described, but it is to be understood that the invention is not restricted to the exact disclosure herein made. Moreover, the continuous method of detecting the freeness of stock may be effected by apparatus other than herein shown. For these reasons, the present disclosure is to be considered as illustrative rather than limiting.

The consistency and quantity regulator may be considered as being of the type shown in U. S. Patent 1,890,799; the refiner and hydrator as in U. S. Patent 1,897,157; the thickener of the general type shown in U. S. Patent 1,685,736 and the proportioner of the general form shown in U. S. Patent 1,862,643, all issued to me.

I claim:—

1. A freeness detector comprising an undulation chamber, means for continuously conducting stock to said undulation chamber, a discharge screen through which liquid may flow continuously from the stock in said undulation chamber, means for producing undulation of the stock in said undulation chamber to keep said screen clean and prevent accumulation of thick stock in said undulation chamber, and a freeness detection chamber positioned to receive the liquid discharging through said screen, said freeness detector chamber being provided with an outlet through which the liquid continuously discharges therefrom, the variance of the liquid level in said freeness detection chamber being indicative of the freeness of the stock.

2. A freeness detector comprising a stock receiving container, means for continuously conducting the stock to said receiving container, a screen through which liquid may continuously dicharge from the stock in said receiving container, a freeness detection container to receive the liquid discharging through said screen, one of said containers being within the other, said freeness detection container being provided with an outlet through which the liquid continuously discharges therefrom, a float in said freeness detection chamber, means actuated by said float for performing work, and means for preventing accumulation of thick stock in said receiving container.

3. A freeness detector comprising an undulation chamber, means for continuously conducting stock to said undulation chamber, a vertical discharge screen through which the liquid may flow continuously from said undulation chamber, a stock discharge valve for said undulation chamber, means for alternately opening and closing said discharge valve to prevent thick stock from accumulating in said undulation chamber and to cause vertical undulation of the stock to keep said screen clean, and a freeness detection chamber positioned to receive the liquid discharged through said screen, said freeness detection chamber being provided with a liquid outlet through which the liquid continuously discharges therefrom, the variance of the liquid level in said freeness detection chamber being indicative of the freeness of the stock.

4. A freeness detector comprising an undulation container and means for continuously conducting stock thereto, said undulation container being provided at its bottom with a stock discharge valve, a freeness detection container within said undulation container and having a screen forming part of its side wall to allow liquid from the stock in said undulation container to enter said freeness detection container, means for alternately opening and closing said stock discharge valve to prevent accumulation of thick stock in said undulation container and to cause undulation of the stock in said undulation container to keep said screen clean, and means for continuously conducting liquid from said freeness detection container, the variance of the liquid level in said freeness detection container being indicative of the freeness of the stock.

5. A freeness detector comprising a stock collecting container having a stock outlet, an undulation container within said stock collecting container, said undulation container being provided at its bottom with a stock discharge valve, a stock receiving vat above said containers having a constant level chamber and a spill-over dam for said constant level chamber, a stock inlet into said constant level chamber, a stock passage from said constant level chamber to said undulation container, a second stock passage from said spill-over dam to said stock collecting container, a freeness detection container within said undulation container and having a screen in its side wall to allow liquid from the stock in said undulation container to enter said detection chamber, means for alternately opening and closing said stock discharge valve to prevent accumulation of thick stock in said undulation container and to cause undulation of the stock in this container to keep said screen clean, and means for continuously conducting the liquid from said detection chamber, the variance of the liquid level in said detection chamber being indicative of the freeness of the stock.

6. In a freeness detector in which liquid continuously screened from sample stock is utilized to indicate the freeness of the stock; an undulation chamber having a stock outlet, means for continuously conducting sample stock to said undulation chamber, said undulation chamber having a vertical screen through which the freeness indicating liquid may continuously flow from the stock, and means for producing undulation of the stock in said undulation chamber to keep said screen clean and to prevent the accumulation of thick stock in said undulation chamber.

7. In a freeness detector in which liquid continuously screened from sample stock is utilized to indicate the freeness of said stock; an undulation chamber having a stock outlet in its bottom and a valve for said outlet, means for continuously conducting sample stock to said undulation chamber, said undulation chamber having a vertical screen through which the freeness indicating liquid may continuously flow from the stock, and means for alternately opening and closing the valve to cause undulation of the pulp in said undulation chamber, thereby keeping said screen clean and preventing accumulation of thick stock in said undulation chamber.

8. A freeness detector comprising an undulation chamber, means for continuously conducting a stock sample to said undulation chamber, a vertical discharge screen through which liquid may flow continuously from the stock in said undulation chamber, means for producing undulation of the stock in said undulation chamber to keep said screen clean and to prevent accumulation of thick stock in said undulation chamber, and a freeness detection chamber positioned to receive the liquid discharging through said

screen, said freeness detection chamber being provided with an outlet through which the liquid continuously discharges therefrom, the liquid level in said freeness detection chamber being indicative of the freeness of the stock.

9. A freeness detector comprising three chambers in nested relation, one of said chambers being a sample-receiving chamber, another a detecting chamber, and the third a detected stock-receiving chamber into which said sample-receiving chamber continuously discharges, means for continuously conducting a stock sample to said sample-receiving chamber, a screen through which liquid from the stock sample may continuously flow from said sample-receiving chamber to said detecting chamber, said screen forming part of the dividing wall between these two chambers, means for continuously conducting the liquid from said detecting chamber, and means for continuously conducting detected stock from said detected stock-receiving chamber, the liquid level in said detecting chamber being indicative of the freeness of the stock.

10. A structure as specified in claim 9; said screen being vertical, and means for producing undulation of the stock sample in said sample-receiving chamber to keep said screen clean and to prevent accumulation of thick stock in said sample-receiving chamber.

11. A freeness detector comprising a stock-receiving chamber to which a stock sample is continuously supplied, a detecting chamber within said receiving chamber and having a screen through which liquid is continuously admitted to said detecting chamber from said receiving chamber, and an outlet through which the stock continuously discharges from said detecting chamber, the level of the stock in said detecting chamber being indicative of the freeness of the stock.

HAROLD DONALD WELLS.