G. H. TOMLINSON.

PROCESS OF FEEDING MATERIAL TO DIGESTERS.

APPLICATION FILED NOV. 12, 1910.

1,032,442. Patented July 16, 1912.

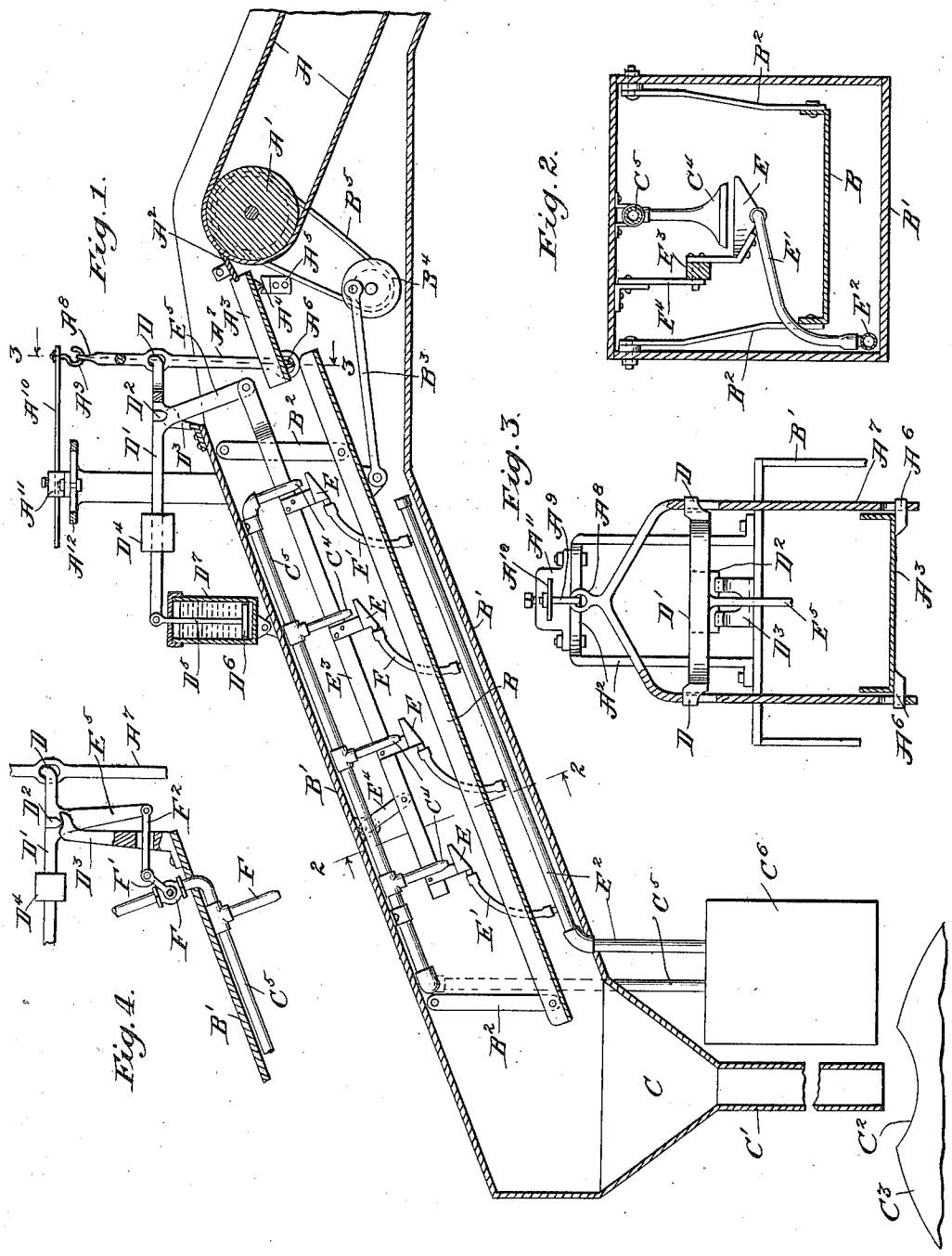

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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PROCESS OF FEEDING MATERIAL TO DIGESTERS.

1,032,442. Specification of Letters Patent. Patented July 16, 1912.

Application filed November 12, 1910. Serial No. 592,023.

To all whom it may concern:

Be it known that I, GEORGE H. TOMLINSON, a subject of the King of England, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in the Process of Feeding Material to Digesters, of which the following is a specification.

My invention relates to the process of producing sugar from comminuted ligno-cellulose by the application of acid thereto. A familiar process is that wherein sawdust is employed and sulfuric acid applied thereto. I do not, however, limit myself to the use of sawdust or to the use of sulfuric acid. Any form of comminuted ligno-cellulose may be suitable for this process, and many kinds of hydrolyzing acids or acid gases may be employed, and they may be used in any convenient degree of density of solution. The best practice is to mix the ligno-cellulose in a relatively large quantity with a comparatively small quantity of acid-carrying fluid, and to effect an intimate mixture, under such circumstances, is one of the objects of my invention.

It will be seen that the problem presents considerable difficulties, and the effort to solve these difficulties has been very expensive and, in many cases, entirely unsuccessful. This is owing to the fact that the sawdust, being relatively dry and tending to pack and delay the flow of fluid therethrough, resists the action, and hence it is necessary, so far as possible, to secure the application of the fluid to a very large number of particles of the ligno-cellulose. In the present invention I accomplish this by causing the ligno-cellulose to move in a widely extended, loose, thin film over a supporting surface, and by spraying the acid-carrying fluid onto and into the surface of such stream. The material is then preferably immediately stirred, so as to complete the process of mixing.

It is, of course, highly important to secure a uniform mixture, for, in the succeeding processes to which the material goes for the purpose of producing sugar, and eventually perhaps alcohol, it is highly desirable that no more acid than is necessary be employed, and that all the ligno-cellulose be equally treated, so that all of the sugar possible may be produced, and no reaction beyond that of the production of sugar be effected. There is, therefore, a certain definite relation between the quantity of ligno-cellulose and the quantity of acid fluid employed, though of course these vary, depending on the nature and condition of the ligno-cellulose and the nature and condition of the acid employed. It is found that sawdust tends to move irregularly, owing frequently to very slight variations in its texture and character and the quantity of moisture present, and even to atmospheric conditions. Moreover, in practice, it is difficult to maintain a perfectly uniform stream of comminuted ligno-cellulose, or sawdust, which is the form commonly treated. It is desirable, therefore, that the flow of fluid be controlled so as to be responsive to variations in the stream of moving sawdust. This principle is equally applicable no matter how the stream is formed or carried on.

The stirring which I have alluded to as desirable after the application of the acid-carrying fluid to the ligno-cellulose, may be effected in any desired manner, by moving the material along, or tossing it about, or stirring it. I use the term "stirring," with this broad general significance. When I speak of a "spray" of acid-carrying fluid, I mean, of course, any desired number of individual jets, as one or more may be used as occasion requires.

The process may be carried into effect by apparatus as diagrammatically illustrated in the accompanying drawings, wherein—

Figure 1 is a longitudinal sectional view of the apparatus; Fig. 2 is a section along the line 2—2 of Fig. 1; Fig. 3 is a section along the line 3—3 of Fig. 1; Fig. 4 is a detail of a modification.

Like parts are indicated by like letters throughout the several figures.

The belt conveyer A rides over the pulley A^1 in opposition to the scraper A^2 which discharges onto the inclined weighing platform A^3 which is supported at the edge near the pulley by the knife-edge A^4 on the bracket A^5 and at the edge farthest removed therefrom by the knife-edge A^6 and connecting link A^7 which terminates at its upper end in the eye A^8 carried by the hook A^9 and supporting spring A^{10} which is carried in the bracket A^{11} adjustable in position on the guide A^{12}.

The weighing platform A^3 discharges onto the oscillating inclined tray B which is

located within and supported from the chute B^1 by means of the links B^2, and which is oscillated by the link B^3 and pulley B^4 driven by the belt B^5 from the pulley A^1. The chute B^1 terminates at its lower extremity in the funnel C and discharge pipe C^1 in opposition to the manhole C^2 in the digester C^3 and contains the spraying nozzles C^4 in communication with the pipe C^5 which is supplied from the reservoir C^6. The link A^7 is carried on the knife-edge D on one end of the scale beam D^1 which is provided with the knife-edge D^2 in opposition to the bracket D^3 on the chute B^1 and has the adjustable counterbalance weight D^4 and is in pivotal engagement at one end with the piston rod D^5, piston D^6 and dashpot D^7. The funnels E which are in opposition to the spray nozzles C^4 and discharge by means of the flexible tubes E^1 to the pipe E^2 and reservoir C^6, are carried on the frame E^3 which is supported at one end by the link E^4 from the chute B^1 and at the other end by the arm E^5 which projects from the fulcrum of the scale beam D^1, and are so located along the frame E^3 that any downward movement of the frame will take them successively out of opposition to the spraying nozzles.

In the modification suggested in Fig. 4, I have shown the supply-pipe C^5 controlled by the valve F which is operated by means of the lever F^1 and link F^2 from the arm E^5.

It will be evident that while I have shown in my drawings an operative device still many changes might be made in the size, shape and arrangement of the parts without departing materially from the spirit of my invention.

The use and operation of my invention are as follows: As the belt conveyer operates, the material carried by it discharges upon the inclined weighing platform, and owing to its inclination passes across it in a continuous sheet being discharged upon the upper end of the oscillating inclined tray down which it travels to the funnel at the end of the chute and thence through the pipe into the digester. Suitable means not shown force a continuous stream of acid or other liquid through the spray nozzles, this stream being discharged into the funnels in the position shown and thence back to the supply reservoir. When the material is passing across the weighing platform its weight depresses the platform and raises the scale beam thus rotating the arm which projects from the beam and thus carrying the funnels back out of register with the spray nozzles so they discharge onto the material passing along the tray below. The arrangement is such that one nozzle after another comes into operation and for a slight quantity of material only a few of the nozzles will operate while for a large quantity which greatly depresses the scale, all of the nozzles will be brought into operation. The relation between the amount of material passing and the amount of acid discharged thereon is controlled by an adjustable spring and a counterbalance on the scale beam, the dashpot being provided to prevent any violent changes in the supply owing to any local disturbance of the amount of cellulose being discharged across the weighing platform.

The apparatus herein described is claimed in my copending application, Ser. No. 598,589, filed December 21, 1910.

I claim—

1. The process of mixing comminuted ligno-cellulose with an acid-carrying fluid, so as to produce an intimate mixture, preparatory to the process of producing sugar, which consists in moving a loose stream of ligno-cellulose, distributing thereon an acid-carrying fluid as it moves, and causing the quantity of fluid distributed to vary, responsive to the variations in the stream of ligno-cellulose.

2. The process of intimately mixing comminuted ligno-cellulose and acid-carrying fluid preparatory to the production of sugar, which consists in moving the comminuted ligno-cellulose in a relatively thin and widely extended layer over a supporting surface, and simultaneously discharging thereinto a spray of acid-carrying fluid.

3. The process of intimately mixing comminuted ligno-cellulose and acid-carrying fluid preparatory to the production of sugar, which consists in moving the comminuted ligno-cellulose in a relatively thin and widely extended layer over a supporting surface, and simultaneously discharging thereinto a spray of acid-carrying fluid,— the quantity of fluid discharged varying, responsive to the variations in the stream of acid-carrying fluid.

4. The process of mixing comminuted ligno-cellulose with an acid-carrying fluid, so as to produce an intimate mixture, preparatory to the process of producing sugar, which consists in moving a loose stream of ligno-cellulose, distributing thereon an acid-carrying fluid as it moves, and causing the quantity of fluid distributed to vary, responsive to the variations in the stream of ligno-cellulose; then stirring the ligno-cellulose so charged with such acid-carrying fluid.

5. The process of intimately mixing comminuted ligno-cellulose and acid-carrying fluid preparatory to the production of sugar, which consists in moving the comminuted ligno-cellulose in a relatively thin and widely extended layer over a supporting surface, and simultaneously discharging thereinto a spray of acid-carrying fluid; then stirring the ligno-cellulose so charged with such acid-carrying fluid.

6. The process of intimately mixing comminuted ligno-cellulose and acid-carrying fluid preparatory to the production of sugar, which consists in moving the comminuted ligno-cellulose in a relatively thin and widely extended layer over a supporting surface, and simultaneously discharging thereinto a spray of acid-carrying fluid,—the quantity of fluid discharged varying, responsive to the variations in the stream of ligno-cellulose; then stirring the ligno-cellulose so charged with such acid-carrying fluid.

7. The process of mixing comminuted ligno-cellulose or other cellulosic raw material with a hydrolyzing fluid for the purpose of producing fermentable sugars, which consists in distributing the fluid upon a moving body of the material to be converted, and then stirring the mass to effect a more intimate admixture.

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