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H. MISCAMPBELL

1,877,010

LIME HYDRATOR

Filed Dec. 30, 1929

3 Sheets-Sheet 1

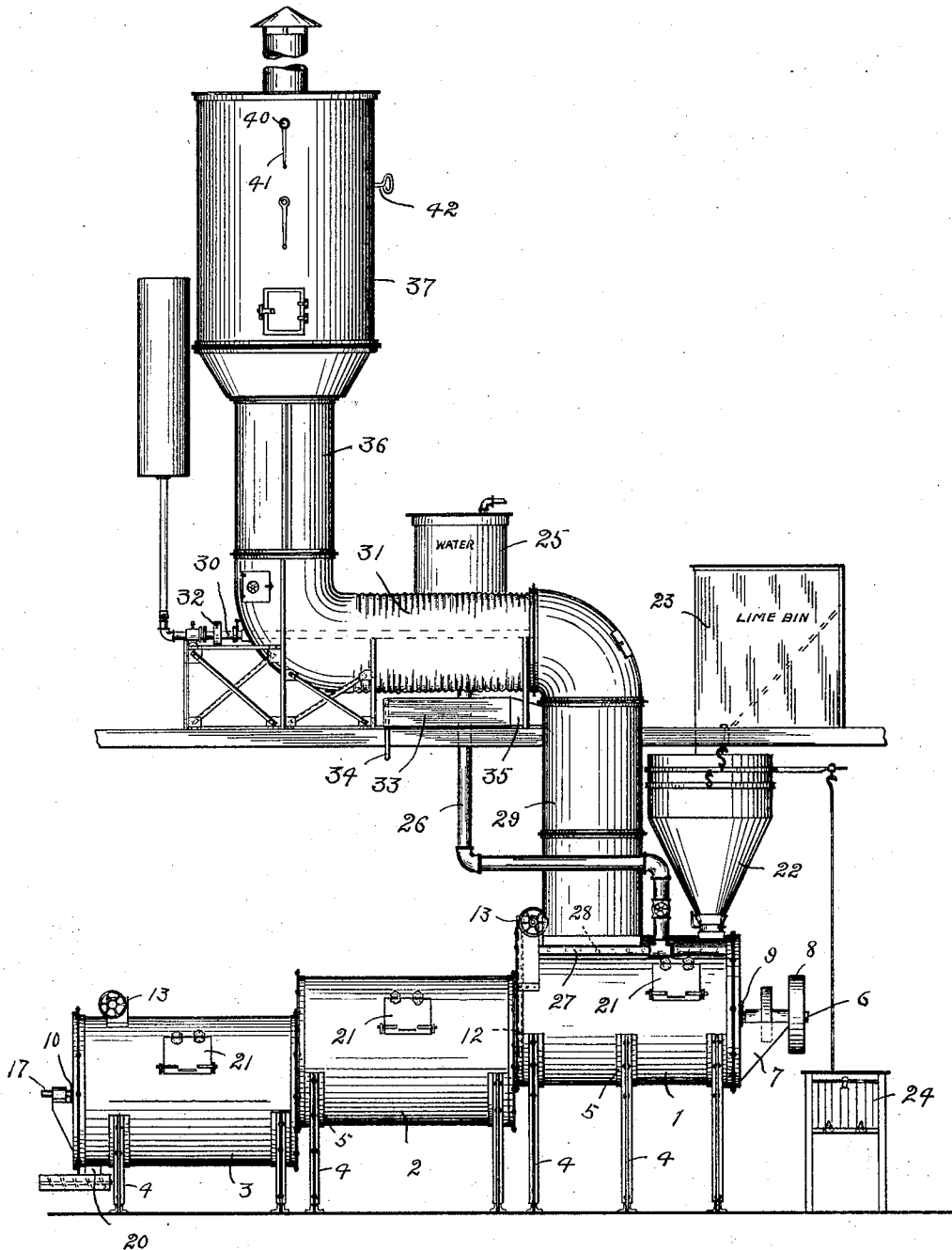


Fig. 1.

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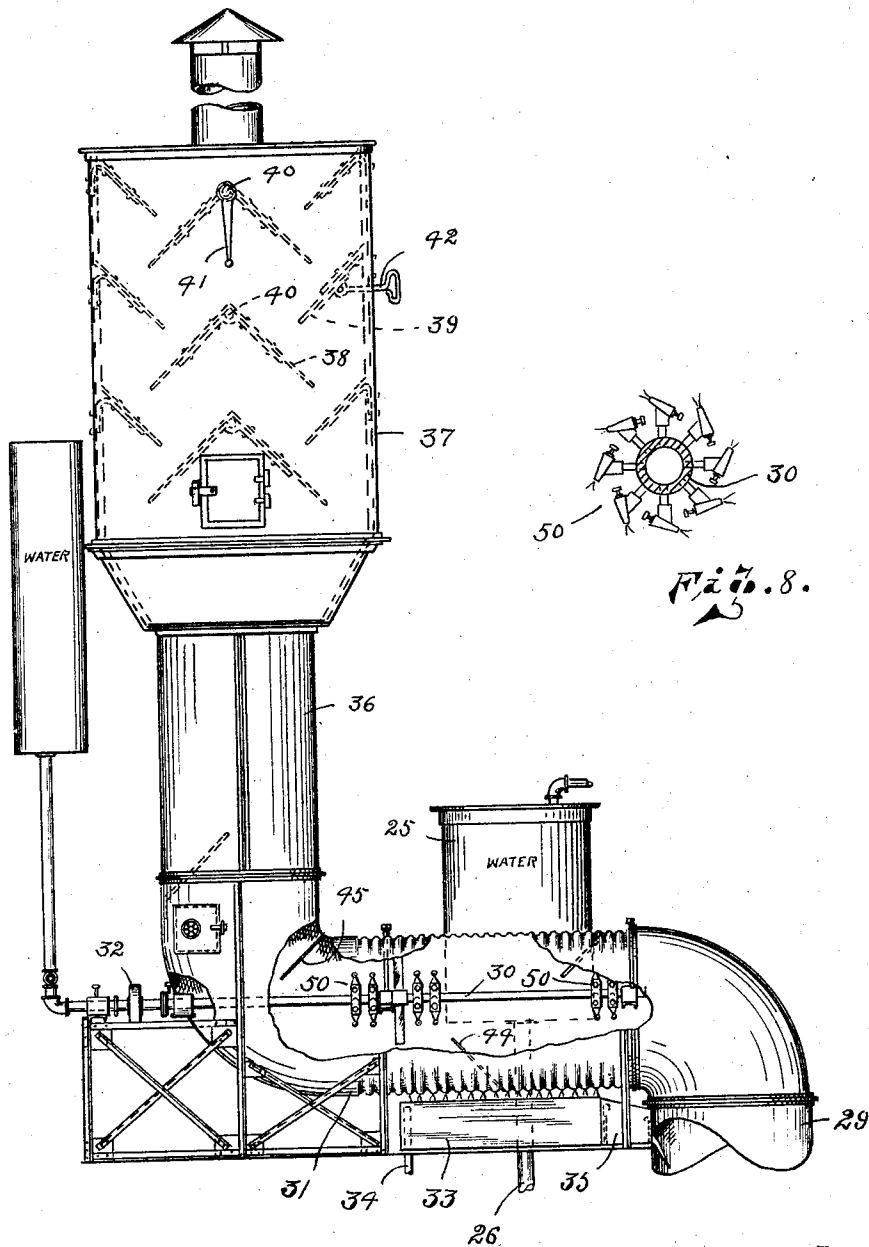
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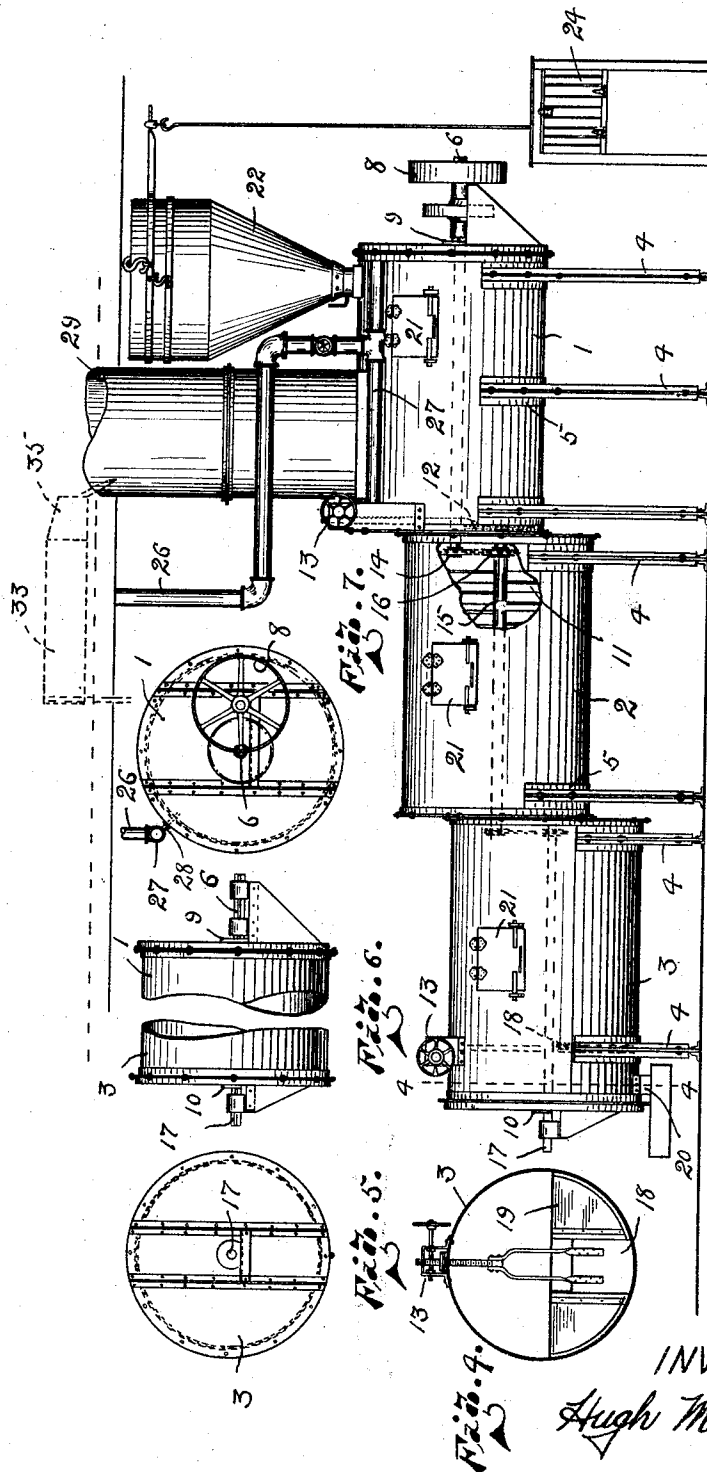


Fig. 3.

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UNITED STATES PATENT OFFICE

HUGH MISCAMPBELL, OF DULUTH, MINNESOTA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO BLAW-KNOX COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF NEW JERSEY

LIME HYDRATOR

Application filed December 30, 1929. Serial No. 417,447.

There are certain advantages in the continuous process of hydrating lime, as hitherto practiced, which are offset by inherent disadvantages. The principal object of the invention is to utilize the advantages commonly present in machines adapted to the continuous process, but by rendering the process a batch process to overcome the inherent disadvantages.

Another object of my present invention is to produce such a hydrator as clean and dust proof as possible.

Applicant's long experience in the hydrating of lime by the batch method would seem to prove conclusively that the process of hydrating a predetermined amount of lime by a given amount of water in thoroughly and completely mixing same, that is to say by the batch method is the only satisfactory way of arriving at a uniformly hydrated product. This is readily substantiated by the obvious fact that in any continuous method of hydration, where water and lime are being continuously mixed, the water will run off or be carried to the place of discharge in advance of the lime, thus rendering uniformity of the product impossible.

In the accompanying drawings forming part of this application, and wherein like reference characters indicate like parts:

Figure 1 is an elevation of one of the improved hydrator units;

Figure 2 is an enlarged side elevation, partly in section, of the upper or dust collecting portion of the unit;

Figure 3 is a somewhat less enlarged view of the lower or hydrating portion of the unit;

Figure 4 is a section through the tail drum of the unit on the line 4-4, Figure 3;

Figure 5 is a rear end elevation of the tail drum of the unit;

Figure 6 is a broken side elevation of the rear end of the tail drum or tank and the front or driving end of the head drum or tank;

Figure 7 is an end elevation of the front or driving end of the head drum; and

Figure 8 is an enlarged elevation of one of the spray nozzles in the dust collector.

The principal hydrating portion of the

unit comprises a plurality of preferably three cooperatively united cylindrical drums or tanks 1, 2 and 3, they being of sheet metal and fixed upon suitable upright fabricated legs or other form of structure such as indicated at 4; each of the legs being provided with a suitable saddle 5 for securely holding the drums in fixed position.

The tail drum 3 is the lowest of such members and the intermediate drum 2 is spaced somewhat above same with its rearmost end incorporated within the front end of the tail drum and the head drum 1 is similarly spaced in relation to the intermediate drum that is above same, with its rear end incorporated within the front end of the intermediate drum and the front end of the head drum is closed as is the rearmost end of the tail drum.

A mixer shaft 6 is installed centrally through the head drum and protrudes beyond the front end of same as for example on the bracket 7 where it is equipped with a pulley 8 or the like for the application of suitable power for rotating same. It might be here stated that the connection through the front end of the head drum is provided with a suitable stuffing box or door 9 to prevent leakage therethrough, and a similar stuffing box or door 10 is provided at the rear end of the tail drum.

Upon the shaft 6 and within the drum 1 are fixed suitable stirring paddles or blades of any desired form, they being indicated at 11, though I prefer that these paddles be biased in their action towards the rearmost end of the drum so that when a batch is completely mixed in this drum and the discharge gate at the rearmost end thereof open, a continuous rotation of the mixing shaft will cause all material in the drum to pass through the gate. The gate 12 is of the lift type, more clearly shown in Figure 4 of the drawings, and is operated by a hand controlled pinion and rack above the drum as shown at 13, so that the same may be intermittently opened and closed. That is to say, after a complete batch has been finished in the head drum, it may be discharged therefrom through the gate

12 into the intermediate drum prior to the recharging of the head drum with a subsequent batch, thus, obviously deriving all the benefits of the batch system, in what amounts
5 virtually to a continuously operating machine. Applicant thereby derives all the advantages of a continuous hydrator at the discharge end thereof, and all the advantages of a batch hydrator at the charging end thereof.

10 The rearmost end of the shaft 6 extends through the drum 1 into the drum 2 and there equipped with preferably a sprocket wheel 14 cooperatively engaged with the
15 shaft 15 within the intermediate drum 2 as by a similar sprocket wheel 16. The latter, however, is preferably twice the diameter of the wheel 14 so that the speed of the shaft 15 is reduced to one-half that of the shaft 6. The shaft 15 is equipped with
20 stirring blades or paddles 11 similar to those previously described.

The shaft 15 extends through the drum 2 and into the tail drum 3 equipped with similar
25 driving mechanism to that just described for the rotation of the shaft 17 in the tail drum. This shaft is also equipped with stirring paddles or blades to provide the final mixing process. It is not considered essential that a gate be provided at the rearmost
30 end of the intermediate drum as the slow motion of the mixing shaft will amply agitate and mix same during the intermediate step in mixing, but such a gate is provided adjacent the rear end of the tail drum, the position of which is shown at 18. In this instance the tail gate 18 is incorporated within
35 a dam 19 or semi-head installed transverse the drum so that when a batch of hydrate is being finished in the tail drum the dam may be kept closed for the purpose of permitting the lighter or fluffier product to pass over the tail gate and thus be saved independently of the coarser or less desirable material; a suitable
40 discharge of course being provided as at 20 intermediate of the tail gate and the rear end of the tail drum. This feature and ultimate handling of the hydrated material is covered in my former U. S. Patent No. 1,662,-
45 932 dated March 20, 1928. Each of the drums are provided with a manhole and cover as illustrated at 21 for convenience of accessibility to the interior of same.

Above the forward end of the head drum
55 is installed the feeding and weighing hopper 22 for the lime, said hopper being supplied with the lime to be hydrated in any desired manner as from the bin 23 directly thereabove. The scales for cooperative engagement with the weighing hopper is illustrated
60 at 24.

A water supply tank is illustrated at 25 and connected with the head drum by means of the pipe 26 leading to the manifold pipe 27
65 disposed horizontally of and above the drum

1 and from which a plurality of small discharge pipes 28 are lead through and into the upper portion of the drum so that through this medium a predetermined amount of
70 water from the tank may be equally distributed upon the contents of the drum.

In this manner it is obvious that elements comprising a batch, that is a predetermined amount of water for a predetermined amount of lime may be conveniently determined and
75 admitted into the drum to be operated upon and the convenience of which is readily appreciated by those versed in the art of lime hydration, as it is well known that lime will vary in calicum content, requiring different
80 proportions of water for best results.

A batch thus supplied to the head drum is thoroughly mixed and treated by the mechanical mechanism within the drum previously
85 described, and which process may be continued to the exact point desired or required for best results before the contents is discharged into the intermediate drum, where it may be further similarly treated as it passes on through to the tail drum.

Now having these three drums in which a batch may be treated will permit of a second batch being added to the head drum while the first batch is passing through the intermediate drum, and still a third batch added to the head drum when the first batch is finally being treated in the tail drum so that in reality a substantially continuous result is accomplished in a batch processed product.

In the matter of making the unit dust proof
100 I have installed in a novel manner therewith substantially the dust collector described in my U. S. Patent Number 1,650,292 of Nov. 22, 1927; the novelty residing in the installation of the stack 29 on top of the head drum 1
105 so as to collect as early in the mixing stage as possible the hot fumes from the hydrator and by which installation fumes from all three of the drums are free to enter the stack, it being understood that portions of the front head of the intermediate and tail drums are open for such communication. The drums being installed one lower than the other provides a natural upwardly inclined passageway for the fumes for the intermediate and
110 tail drums.

The collecting elements of the dust collector comprises the hollow shaft 30 properly
120 journaled within the horizontal portion 31 of the stack and carrying groups of discharge nozzles 50 such as illustrated in Figure 8 of the drawings, said nozzles being so disposed that the discharge therefrom has a tendency to rotate the shaft. In the event of such rotation not being sufficient I have provided that portion of the shaft extending beyond the stack with a pulley 32 for any desired power connection. In the bottom of the horizontal portion 31 of the stack are
125 suitable perforations discharging into a re-

ceiving tank 33 which is provided within the overflow pipe 34 to accommodate the withdrawal of excess water, while beneath same whatever dust or sediment may be collected is discharged through the pipe 35 leading from the bottom of the collector tank back into the stack 29 in which it is returned to the head mixing drum.

It is obvious that the cold water spraying mechanism just described when in operation will produce an exceedingly fine fog or mist like effect in the horizontal portion of the stack, and when met by the ascending dust and steam will cause more or less condensation and precipitation of the dust, though possibly some very fine particles will pass on through this precipitating chamber and through the upright portion 36 of the stack on top of which I have installed more as a precautionary medium a somewhat enlarged rectangularly shaped chamber 37 having a set of spaced inverted V-shaped baffles 38 therein, and intermediate wing like baffles 39 upon the sides thereof, the extreme free end of said baffles overlapping each other vertically. Some or all of these baffles may be made possible of vibratory action in the following manner. The inverted V-shaped baffles each being mounted upon a shaft as indicated at 40 and which may be equipped externally of the enlargement 37 with a manually operated crank as indicated at 41, so that at any time desired they may be shook back and forth, being made to bump the ends of the wing baffles and thereby jar the collected dust thereupon downwardly into the stack. The wing baffles 39 may also be provided with hand shakers as at 42 protruding beyond the sides of the enlarged portion 37. I have also shown inclined baffles as at 43, 44 and 45 to further divert and retard the ascension of dust carried within the gases and fumes from the hydrator; these however being only a matter of detail of construction to improve the efficiency of the device and not entering into the present invention.

Furthermore in this novel form of hydrator it is apparent that in the event of over or under burning of portions of the lime occurring, the same, if time permits, may be left sufficiently long in the collection chamber above the dam in the tail drum to properly hydrate all such portions of lime, and together with the valueless tailings may be removed when desired.

From the foregoing it is evident that I have devised a simple and practical form of hydrator in which the process of hydration may be made continuous but in steps involving batch treatment of the material, and one which may be considerably varied from the embodiment here illustrated without departing from the spirit of the invention as set forth in the appended claims.

Having thus described my invention, what

I claim and desire to secure by Letters Patent, is:

1. A batch hydrating unit of the class described comprising a plurality of vertically stepped mixing drums, said drums being arranged end to end and discharging one into the next adjacent lower one, a mixing shaft within each drum, and a gate in one drum for selectively discharging a batch of material into the next succeeding drum.

2. A hydrating unit of the class described comprising a plurality of hydrating chambers arranged end to end, means including a gate in one chamber for passing a batch of material progressively through said chambers, and means for mixing material simultaneously in all of the chambers.

3. A hydrating unit of the class described comprising a plurality of hydrating chambers arranged end to end, a gate in one chamber for passing a batch of material progressively through said chambers, and means for mixing material simultaneously in all of the chambers, and a dust collector cooperatively connected with all of the chambers.

4. A hydrating unit of the class described comprising a plurality of hydrating chambers arranged end to end, a manually operable gate in one chamber for passing a batch of material progressively through said chambers, means for mixing material simultaneously in all of the chambers, and a dust collector connected with all of the chambers through one of the chambers.

5. A hydrating unit of the class described comprising a plurality of hydrating chambers, means for successively supplying batches of material to be hydrated to one of the chambers, a gate in said chamber for progressively moving batches of said material to the other chambers, and a dust collector mounted upon one of the chambers and communicating with all of them.

6. A lime hydrator comprising three cooperatively connected mixing drums, they being stepped one somewhat higher than the other, means for supplying and hydrating separate batches of material in the uppermost drum, a gate for selectively discharging material from the lowermost drum, and single dust collecting means connected with all of the drums.

7. A combined batch and continuous hydrating unit comprising a plurality of cylindrical mixing chambers, rotatable mixing means within each mixing chamber, batch supply means connected with the initial receiving chamber, means whereby a complete batch may be mixed a predetermined time within said receiving chamber and subsequently discharged into the next succeeding chamber before a subsequent batch is supplied to the initial chamber, and mixing elements within the succeeding chambers whereby continuous action may be applied to mate-

rial passing therethrough during action upon the subsequent batch within the initial receiving chamber.

8. A combined batch and continuous lime hydrator including a plurality of mixing chambers arranged end to end and in stepped relation and in direct communication with each other, mixing elements within each of said chambers, means for supplying a batch of material to one of said chambers, a gate in said latter chamber whereby said batch of material may be mixed a predetermined time and subsequently delivered to the other of said chambers.

9. A lime hydrator of the type described comprising an initial receiving chamber having mixing elements therein, batch supplying means associated with said chamber, an intermediate mixing chamber spaced below said receiving chamber and in end to end relation therewith, a gate intermediate of said chambers whereby a batch of material may be discharged from said receiving chamber into said intermediate chamber, a discharge chamber spaced below said intermediate chamber and in end to end communication therewith and having mixing elements therein, and means whereby a substantially continuous flow of the finished product may be had from the discharge chamber.

In testimony whereof I affix my signature.

HUGH MISCAMPBELL.