

No. 634,200.

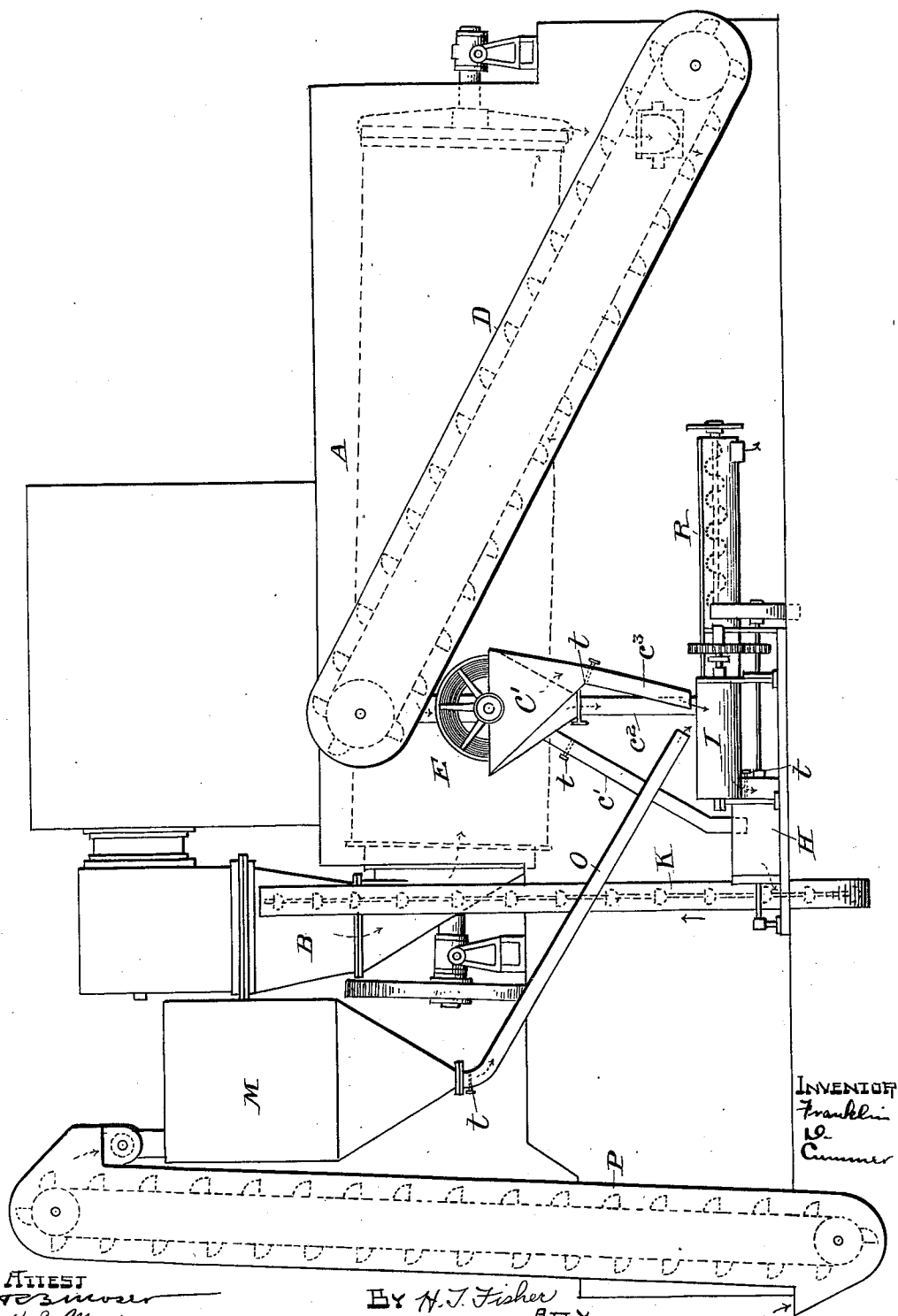
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F. D. CUMMER.

PROCESS OR METHOD OF DRYING VARIOUS MATERIALS.

(Application filed Mar. 25, 1898. Renewed Aug. 26, 1899.)

(No Model.)



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ATTEST
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ATTY

Witnessed Jan 21 1899

UNITED STATES PATENT OFFICE.

FRANKLIN DAVID CUMMER, OF CLEVELAND, OHIO; WILLIAM M. CUMMER, ADMINISTRATOR OF SAID FRANKLIN DAVID CUMMER, DECEASED, ASSIGNOR TO THE F. D. CUMMER & SON COMPANY, OF SAME PLACE.

PROCESS OR METHOD OF DRYING VARIOUS MATERIALS.

SPECIFICATION forming part of Letters Patent No. 634,200, dated October 3, 1899.

Application filed March 26, 1898. Renewed August 26, 1899. Serial No. 728,635. (No specimens.)

To all whom it may concern:

Be it known that I, FRANKLIN DAVID CUMMER, a citizen of the United States; residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Processes or Methods of Drying Various Materials; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a process or method of drying various materials, as hereinafter enumerated and fully described; and the object of the invention is to so improve and develop the drying process or method I have hitherto practiced and is now well known that I can successfully handle a number of materials which have hitherto been regarded as practically beyond the reach of such processes, and especially on any such scale as would render their treatment profitable and practicable for large undertakings.

As an example of the kind of material to which my present improved process of drying is especially applicable, I mention city sewage, a character of material which, so far as I am aware, has never before yielded to a drying process approaching to my invention, because of certain apparently insuperable difficulties not heretofore overcome. Some of these difficulties have arisen in my own experience under the application of my own original processes and may be enumerated as follows:

First. It was found to be impossible with the old method to dry the material so that in its dried condition it would carry less than fifteen per cent. of moisture without danger from repeated explosions of the material in the presence of high temperatures, and as the dried material carrying fifteen per cent. of moisture would mold and decay after being placed in piles this result was entirely unsatisfactory.

Second. With the old process I confidently relied on evaporating nine hundred pounds of moisture per hour; but I found that if I generated heat enough to evaporate more than five hundred pounds and if I dried the ma-

terial below fifteen per cent. of moisture I was liable to have repeated and dangerous explosions, as already explained.

Third. Again, it was very difficult to so manage the fire in the feeding and operating of the drier as to deliver the dried material at temperatures below 200° Fahrenheit, or sufficiently low to avoid volatilizing the fertilizing properties of the sewage.

Fourth. Again, there came from the drier frequently very uncomfortable and objectionable odors. This occurred always when material inside of the drier became overheated or heated above a moderate temperature, as was liable at any time to occur.

Fifth. The drier also delivered into the atmosphere a very large amount of fine dust, which was carried by the wind and air into the houses of residents who lived near the works, and which of course was a very great objection to the operation of the drier and clearly demonstrated that the method of handling the material was as yet imperfect and incomplete and that the whole process must be materially improved in order to make it efficient and effective for handling sewage.

My invention therefore consists in the improved process or method of drying materials hereinafter described whereby each and all of the several obstacles and objections hereinbefore enumerated and sundry others not particularized are wholly overcome and the practicability of my improved process is demonstrated and established to the entire satisfaction of all who have given it a trial.

The differences and advantages of the improved method over the old may be summarized here for contrast and a better understanding of the invention.

First. After making and testing my improvements I found that I could deliver the dried material carrying as low as two per cent. of moisture just as easily and reliably and continuously as if I were delivering the dried material carrying a high percentage of moisture.

Second. The same drier in this process has evaporated during a trial test of twenty-four hours, very accurately conducted, seventeen

hundred and fifty pounds of moisture per hour on an average, and I am sure that during the latter part of the run we were evaporating more than two thousand pounds of moisture per hour, or four times as much as could be safely evaporated until my improvement had been made.

Third. During a run of over four weeks night and day there has not occurred any fire or explosion whatever, and it is found that the dried material shows no retrogression and that it has in its driest condition every valuable chemical property which it possessed before its delivery to the drier. I have found also that by reason of this improvement in the process I am enabled now to dry blood, tankage, garbage, superphosphates, and all of this line and class of materials, which are very difficult indeed to dry without deterioration or losses of valuable properties whatsoever, so I have as the result of the improvement the double advantage of not only being able to dry the material with much greater economy and without injuring it in the slightest degree, but also of doing at least twice as much work in a given time with a plant of a given size and of handling materials which by the old process were very difficult to handle at best and with meager results as compared with the present.

Fourth. There are now no odors of any kind whatever delivered into the atmosphere from the drier, and during the closely-observed test of twenty-four hours to which I have alluded the dried material left the drier at a uniform temperature of about 125° Fahrenheit, although in the final stages of the drying process the mingled material (the dried and partially-dried materials, as will herein-after appear) passed through at a final temperature of 650° to 700° Fahrenheit. The moisture in the wet material was mingled with the dry product, so that the high temperature was not able to affect or overheat the dried material, although the dried material (the finest particles of it) carried only about two per cent. of moisture. The moisture on the moist material protected the dry.

Fifth. The dust trouble was wholly overcome and so completely that after work had gone on night and day for four weeks an inspection of the roof of the large works wherein the apparatus was located was made by several of the men, and it was found that even in the gutters, where it was expected that some dust would be discovered, they were not able to find any, the fact being that no dust whatever does escape under the present improved operations.

In order to carry out the invention and obtain the foregoing results, it is only necessary that a suitable drying system of some kind be had wherein the material can be exposed to the requisite temperature and conditions for drying the same in the presence of the drying agent and avoiding explosions and loss of dried material, as well as handling the ma-

terial with reference to other results, as indicated in the foregoing description. Any suitably-constructed drier will serve this purpose.

One form of apparatus by which this process may be performed is illustrated in the accompanying drawing, which is a side elevation thereof.

Referring to the drawing, A is the main cylinder, into which the raw material is introduced by hopper B and in which the material is partially dried. D is a conveyer for carrying the material thus dried or partly dried to a rotary separating-screen E. The conveyer D is outside of cylinder A, and the material falls out from one end of the cylinder onto the conveyer, as indicated by arrows. Beneath this screen is a hopper C, from which lead three several spouts c' c^2 c^3 . The spout c' leads the material partly dried from the screen to a tank H, and the spouts c^2 c^3 lead still drier grades of material into the cylinder I. The dried materials in I may also be led into the tank H to again mix with the moist but partially-dried material. From the tank H the more or less dried material may be conveyed by elevator K up to hopper B and there mixed with the raw material and reintroduced into the first drying-cylinder. If the material in I is too dry, dusty, or gaseous, raw material can be introduced therein from hopper M through spout O, the raw material having been raised to hopper M by elevator P. The separate spouts and cylinders may be provided with cut-offs t . After the material is thus carried through and dried the second time in cylinder A and separated by screen E the process may be stopped at the cylinder I and the resultant product drawn off by conveyer R.

Now, having such a drier or apparatus, I come to the same with my new step in the process, and instead of feeding into the apparatus only a supply of raw or fresh material, as always heretofore, I add thereto directly at the mouth of the apparatus a separate volume or stream of partly-dried material of the same kind, or after mixing the raw with material more or less dried carry the mixture into the apparatus, and I keep on mixing with the raw or fresh material a quantity of the material that has been subjected to the drying process. The quantity and the condition of the material so added may vary, so that there may be more or less as to quantity and more or less perfectly dry material, or there may be perfectly dry mixed with imperfectly-dried material added to the raw at any desired point in the feeding process, and any suitable way of mixing the materials, either before reaching the drier or at the drier, may be adopted, the invention not being in the means or apparatus that may be employed in carrying out the process or method, but in the method of drying sundry materials carrying high percentages of moisture and consisting in returning a quantity of the material, largely in a moist condition, which has

gone through the process one or more times to be passed through again with a quantity of the fresh or raw material, thus adding largely to the quantity of material handled and producing conditions and obtaining results whereby not only much larger quantities of many materials may be dried in a given time by a given amount of heat, but other advantages are obtained and dangers are avoided not hitherto known or possible in this art. Now in order that we may further see the advantage of this new method of handling material I again refer to the trial test hereinbefore mentioned and in which the superiority of this method was so successfully demonstrated.

When I first visited the works, they were evaporating only five hundred pounds of moisture per hour and the breeching of the drier was so hot that it radiated an uncomfortable heat quite a distance away. Indeed, in some places the temperature was so high that the breeching approached to redness in color; but when I introduced the return-stream of partially-dried material to these otherwise unfavorable conditions the temperature in the breeching decreased according as the quantity of return material was increased, for the reason that in proportion as I returned more and more of the partially-dried material I had more material in my drier, so that I was presenting twice to three times as much moist surface to the drying action of the hot gases as I was able to do before creating and maintaining this return-stream. The invariable result was that in proportion as I increased the surface of moist material exposed to the hot gases or heating agent by increasing the return-stream or by feeding faster, or both, the temperature at the breeching was decreased, while the percentage of moisture in the outgoing gases increased until the temperature of the said gases was about 110° Fahrenheit and the humidity of the gases about the dew or precipitating point, and the discharging temperature was also lowered. It follows that when the gases carrying this moisture at the dew-point were delivered into the dust-room or expansion-chamber on their way out of the apparatus, owing to the further expansion of the gases and the cooling effect, the dust became instantaneously heavy, and every particle of it was precipitated in said room and nothing but the clear gases and mingled air passed away from the dust-room into the outside atmosphere.

The wet sewage when delivered to the drier carried an average of sixty-five per cent. of moisture. So in order to dry materials carrying such high percentages of moisture it is necessary that they should be exposed to very high temperatures in order to drive off such a large amount of moisture in the short space of time the material takes to travel through the drier, and therefore, although the material is very moist, the result is (owing to the fact that a comparatively small stream of the

material can be fed into the drier in its very wet condition and be dried in one passage) that this small stream of material under the conditions described did not and cannot present enough absorbing-surface to the hot gases to take up the amount of heat that is necessarily created to dry such material in the short exposure it receives. For this reason large quantities of practically-wasted heat passed off into the air, and there was no way in the old system of helping these conditions. Then, also, a high temperature was maintained in the dust-room, with a small percentage of moisture, both of which conditions were exactly the opposite of what were desired and were necessary to settle the dust in the dust-room, as the invention contemplated; but as soon as a return-stream of partially-dried material was established I was enabled to dry from two to four times as much material as before in a given time, with much less coal in proportion to the work accomplished, and many very material advantages resulted directly from this improvement, as has already been shown, without creating a single disadvantage so far as I am aware.

My practice is to separate the dry from the partly dry by some suitable means, and it will depend on this separation as to how much is separated out as a commercial product and how much goes back to be dried over. Sometimes the same material may go through the process three or more times, and so it occurs that sometimes three or four times as much material is returning to be fed into the drier as is being separated out in the sifting or screening of the material as it comes from the drier. It also follows that sometimes there are three or four or even five times as much material in transit through the drier in different stages of dryness as there would be if the return-stream of partially-dried material mixed with more or less of the perfectly-dried were omitted.

In dealing with many materials—such as lignite, gypsum, refuse feed-cakes from starch and glucose works, garbage, fish-scrap, &c.—it is desirable and often necessary to pass the returned moist partially-dried material through some suitable disintegrating or crushing process, so that as it is returned to the drier it will be finally dried and reduced and not require putting through again. Other materials are sufficiently disintegrated by the handling they receive in the process of drying.

Let it also be noted that the return of moist or partially-dried material with more or less perfectly dried to the drier enables me to deliver the dried material at very low temperatures regardless of the percentage of moisture which the dried material may carry or the temperature to which it may have been exposed. Indeed, the material will be nearly as cool if carrying only two per cent. of moisture as if it carried ten to fifteen per cent.

In case this process be employed for drying

lignite, pressed cake, and similar materials I first disintegrate the raw wet material, so that it will be of convenient size to feed to the drier. Then further treatment takes place, as hereinbefore described.

It has been found very difficult, indeed, to separate all iron and resistive materials from dried garbage, so that in pulverizing dried garbage, owing to its very explosive nature, many disastrous explosions and fires have occurred through sparks created in the pulverizer by having the disintegrating parts of the pulverizer strike fire against the hard substances which are contained in the dried garbage. With my system all such materials and others as well may be pulverized or disintegrated as they are returned in a partially-dried condition to the drier, and thus all danger from explosion can be avoided.

It must be understood and appreciated that by having the drier discharge constantly fully-dried material mixed with material not fully dried, but instead carrying different percentages of moisture, or the commercial or desired percentage, the moisture carried by the wet material, which is mixed with the dry and drier material, protects the drier and dry material during the whole of the drying process, including the final stage, so that

during the entire drying process the more dry material is protected by the moisture carried by the more moist material.

What I claim as new, and desire to secure by Letters Patent, is—

1. The process of treating moist materials like garbage, consisting in drying the material in part completely, then separating out the sufficiently dried from the insufficiently dried and passing the latter with more or less of the dry material through the drying process again in conjunction with the wet or raw material, substantially as described.

2. The process of drying garbage and other materials, consisting in drying the raw or fresh material along with a quantity of the same material which has been partially dried, and in controlling the condition of the said mixed material as it passes through the drying process and of the resulting product by adding more or less of the material that has been through the process as may be needed from time to time, substantially as described.

Witness my hand to the foregoing specification this 10th day of March, 1898.

FRANKLIN DAVID CUMMER.

Witnesses:

H. T. FISHER,

H. E. MUDRA.