A. G. J. RAPP.

PROCESS OF TREATING GRANULAR MATERIAL.

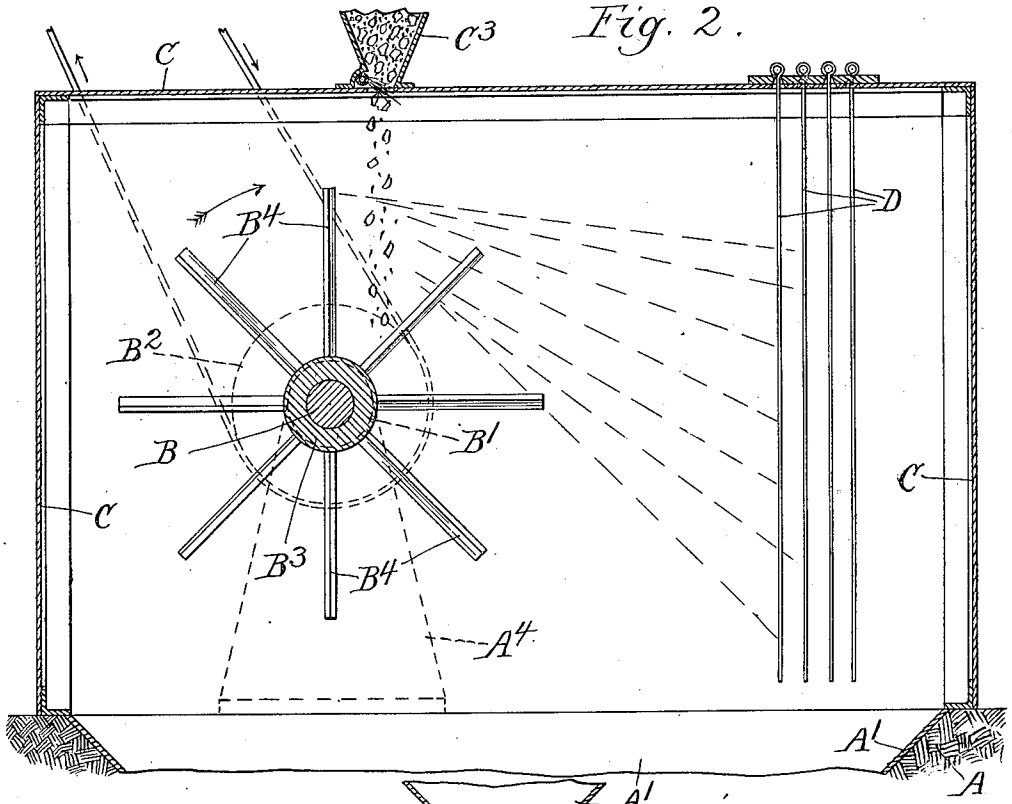
APPLICATION FILED DEC. 28, 1916.

1,289,542.

Patented Dec. 31, 1918.

2 SHEETS—SHEET 1.

Fig. 2.



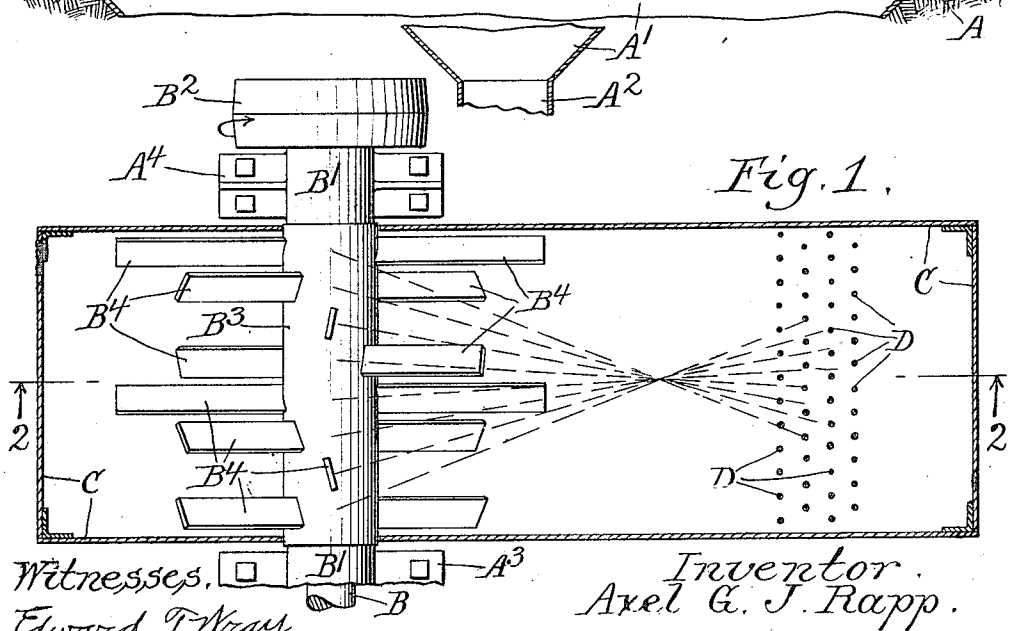


Fig. 1.

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2 SHEETS—SHEET 2.

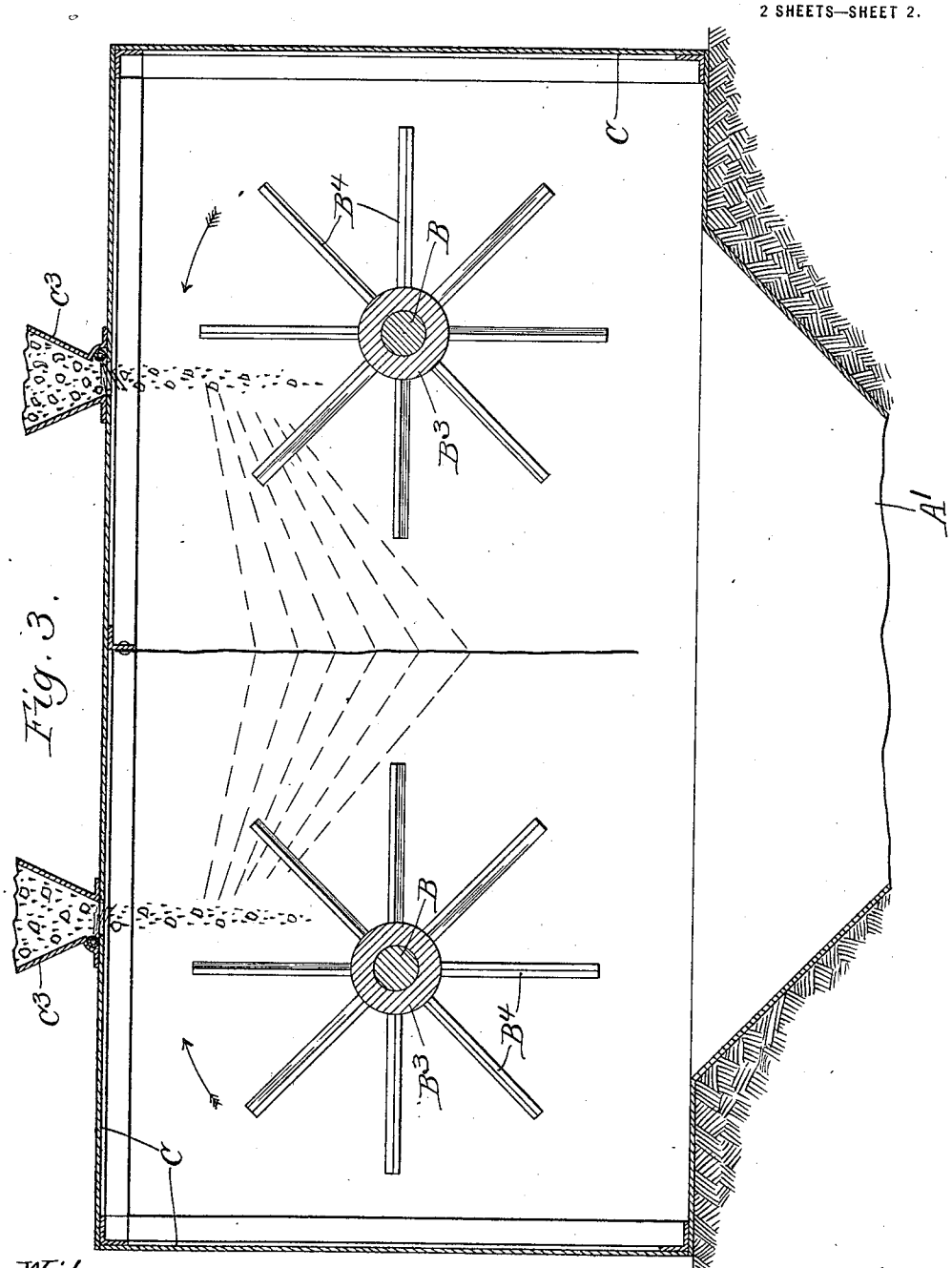


Fig. 3.

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UNITED STATES PATENT OFFICE.

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PROCESS OF TREATING GRANULAR MATERIAL.

1,289,542. Specification of Letters Patent. Patented Dec. 31, 1918.

Application filed December 28, 1916. Serial No. 139,237.

To all whom it may concern:

Be it known that I, AXEL G. J. RAPP, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes of Treating Granular Material, of which the following is a specification.

My invention relates to improvements in the process of treating granular material and is directed toward means for drying, mixing or breaking up as the case may be, fragmentary or granular material.

In connection with molders' sand my process is suitable for cooling and tempering molders' sand. It is understood, of course, that this sand comes from molds in a clotted, heated, lumpy condition. Where the foundry is working under a high pressure the sand is used over and over again, it frequently happens that the temperature gets so high that it is almost impossible to keep the sand moist enough after it has been packed into the mold. My process cools and moistens or tempers the sand and breaks up any sintered or otherwise conglomerated masses of sand.

My process is equally well adapted to use in connection with sand or dust which is to be dried because in this case it also breaks up and reduces the agglomerated fragments. Other purposes of my invention will be obvious as they develop from time to time in the specification.

I have illustrated my invention as applied to a number of different types of machines or devices for carrying it out though it will be obvious the invention might be carried out by a very large number of different types of mechanisms.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a plan view;

Fig. 2 is a section along the line 2—2 of Fig. 1;

Fig. 3 is a detail showing the arrangement of the beating arm.

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

I will now describe the preferred form of machine or apparatus for carrying out my invention.

A is a foundation wall containing a hopper A^1. A^2 is a discharge chute leading therefrom. A^3, A^4 are parallel upwardly extending supporting frames, projecting upwardly from the foundation wall A.

B is a drive shaft rotatably mounted in the bearings B^1 in the frames A^3, A^4. It carries at one end a pulley B^2 whereby the shaft may be rotated by any suitable source of power not here shown. B^3 is a beater hub mounted on the shaft. Projecting outwardly from this beater hub are a series of beater arms B^4. These beater arms are arranged in two groups, the group on one side inclined with respect to the group on the other side, and both groups being so arranged that material being struck by these beater arms when they are in a substantially vertical position and above the hub will be concentrated toward the center of the housing. That is to say, as the shaft rotates in a clockwise direction the front faces of the arms are inclined inwardly and rearwardly.

C is a housing adapted to inclose the beating device. C^3 is a hopper for feeding material into the housing in the path of the beating vanes or paddles, the housing being adapted to discharge into the hopper A^1.

Rods D depend downwardly from the top of the housing in front of the shaft. The rods are arranged in tiers or banks as indicated and swing freely. They extend down so far that all the material which is hit by the beater arms and projected forward strikes against them or passes through them so that they serve as a flexible curtain or interruption to arrest and deflect the material and to prevent too great a discharge of material against the end of the housing.

The curtain of rods through which way little of the material will pass, serves, of course, to break up and mix the material, but it also serves to interrupt and prevent any currents which might prevent satisfactory mixing.

In the modified form material is projected in two streams which intersect, thus the particles in one stream impinge upon the particles in another, the only difference here being that two beaters are used. The process in each case is exactly the same because it consists in projecting this material in such wise that the particles converge at the focal point and impinge one upon another. In this modified form the two sep-

arate streams are fed to beating fans rotating about a horizontal axis and these fans strike the material projecting tangentially toward the focal point in exactly the same way as do the fans in the preferred form. I also show a flexible curtain made of a thin flexible diaphragm instead of rods. Obviously in this case the material will be struck more suddenly than by the rods but even so no material can pack on or adhere to the thin flexible rapidly vibrating diaphragm.

The use and operation of my device are as follows:

Materials such as sand, dust, coal or the like which is to be broken up or mixed, is fed into the hopper at the top while the shaft is rotating rapidly. All the material as it comes in is struck by the beaters or paddles and projected forwardly against the curtain of bars. As soon as it strikes this curtain it drops down. Possibly other material may pass through the curtain and be projected against the side of the housing or against the back of the housing. Most of it, however, is stopped completely and drops through to the open bottom of the housing.

The inclination of the front of the working surface of the beater arms results in throwing the material from one side of the beater toward the opposite side of the housing. The result is that the different groups of material are thrown against the moving screen along converging lines, thus assisting in the intermixing and intermingling of the separate particles of material.

It will be noted that in the preferred form the material is fed in a general mass downwardly into the housing in such wise that as it falls freely under the influence of gravity it comes in contact with the beater vanes. These beater vanes are inclined some of them more than others, the inclination increasing outwardly toward the ends of the vanes. Material is fed so that some of it comes in contact with all the vanes and when these vanes strike it they project each and every particle violently forward along a tangential line substantially at right angles to the direction of the fall. The tangential path followed by these different particles is peculiar in that the varying inclination of the vanes tends to cause all the particles to converge toward the central part removed from the beater. These converging particles will at that central focal point be congested or concentrated together and will strike one upon another thus both by the impact of the vanes and by the impact of one particle upon another the concentraterd fragments of material will largely be broken up and the different particles will be mixed about so that there will be an effective mixing and distribution of the particles; for instance if a relatively heavy and relatively light particle come together they will glance off at an angle in another part of the apparatus and since this process is constantly going on a thorough mixing will take place.

If it is desired to increase the mixing and breaking effect or if it is desired to have the process carried out in an apparatus of relatively small size a flexible curtain of rods is used. This curtain has a two-fold function. It stops the movement of the material and concentrates it in a centrally located discharge area. It is placed so near to the beating member that even the lightest particles reach it and all the particles are stopped by it and allowed to drop freely down the discharge. If this curtain is dispensed with the particles will continue their movement until air friction arrests them, the heavier particles going farther than the lighter ones.

This, of course, will result in a sorting or dividing of the product up into masses of different sizes and if this is not objectionable and if ample space is available, there might be no need for the curtain and the curtain might be dispensed with.

It will be understood that the rods making up this curtain are comparatively thin and light. They then give very freely to the impact of the blow and do not arrest the material with absolute suddenness and because they give and bend and vibrate there is no tendency for the material to pack on the rod. Of course, the flexible curtain might be made of other materials than the rods as indicated but I find these rods lend themselves peculiarly well to this operation because by their separate vibrations they tend to clean one another and each to clean itself because their very shape tends to prevent the material from adhering. In general terms what happens to any one particle is that it strikes the side of one rod, glances off and strikes the side of another. It may strike three or four rods each time loosing a part of its velocity before it finally drops down into the discharge.

In another form where two separate streams are fed into two separate beaters the process is exactly the same. These streams converge the material, the particles impinge one upon another and are mixed and separated.

One important feature of my process is that when this work is done in a closed chamber the beating vanes agitate the air and the particles are blown about by a hurricane of an air blast which blast is distributed and broken up by the curtain and by the impingement against the side of the chamber. Thus the material is constantly subject to an air blast which arrests it. The result is that when molding sand is being treated, peculiarly light and fluffy sand, which experience shows is exceedingly valuable in the foundry, is obtained.

In cooling and treating molding sand the sand would first be moistened and it might be desirable to introduce moisture into the chamber with the sand by separate means as suggested. This moisture tends to settle on individual grains. Thus the fact that each individual grain of sand is thrown about in the air and that the air has free access to it increases the speed of this vibration, tends thereby to cool the sand, thus the sand after being passed through from the machine may be instantly used and by keeping the molder sand going through the machine the molders may be in operation day and night if necessary, with a minimum of sand in use.

In the preferred form where the material is fed under the influence of gravity and falls freely in the path of the beating vanes, it will be observed that the shape of the hopper and discharge throat is such that the material is fed in a more or less thin sheet and since the beating vanes are set in shafts at different inclinations, there will never be the tendency for all the material when struck by the vanes to concentrate in a single focal area. This insures, of course, a very fine and effective division and mixing of the material and it prevents the possibility of that part of the material which may happen to be discharged in front of the outer vanes from not being mixed with the remaining mass. Since the major part of mixing takes place in the air it will be very thorough because there is no impediment to the different particles changing place throughout the entire zone and because there is little, if any, possibility of packing of the material. You cannot pack material unless you have some rigid surface against which it is packed and one of the great difficulties in mixing finely divided material is that it is likely to cake or pack. This finely divided material in this case being mixed in the air, cannot of course, have any packing tendency whatsoever. In the modified form the same result is obtained though here the streams come from various sources but they all concentrate upon a focus and the particles impinge one upon another and are mixed and comingle.

I claim:

1. The process of finely dividing and mixing material which consists in dropping the same in a relatively thin sheet into a beating zone, discharging it from said beating zone laterally by violent blows and causing the particles to travel laterally in converging and intersecting streams through the air, then arresting the flight of such material and causing it to drop as finely divided and mixed material out of the zone of treatment.

2. The process of finely dividing and mixing material which consists in dropping the same in a relatively thin sheet into a horizontally disposed beating zone along the axis of said zone, discharging it from said beating zone laterally by violent blows and causing the particles to travel laterally in converging and intersecting streams through the air, then arresting the flight of such material and causing it to drop as finely divided and mixed material out of the zone of treatment.

In testimony whereof, I affix my signature in the presence of two witnesses this 21st day of December, 1916.

AXEL G. J. RAPP.

Witnesses:
MARION L. INGRAHAM,
LYDIA M. SYLVANUS.