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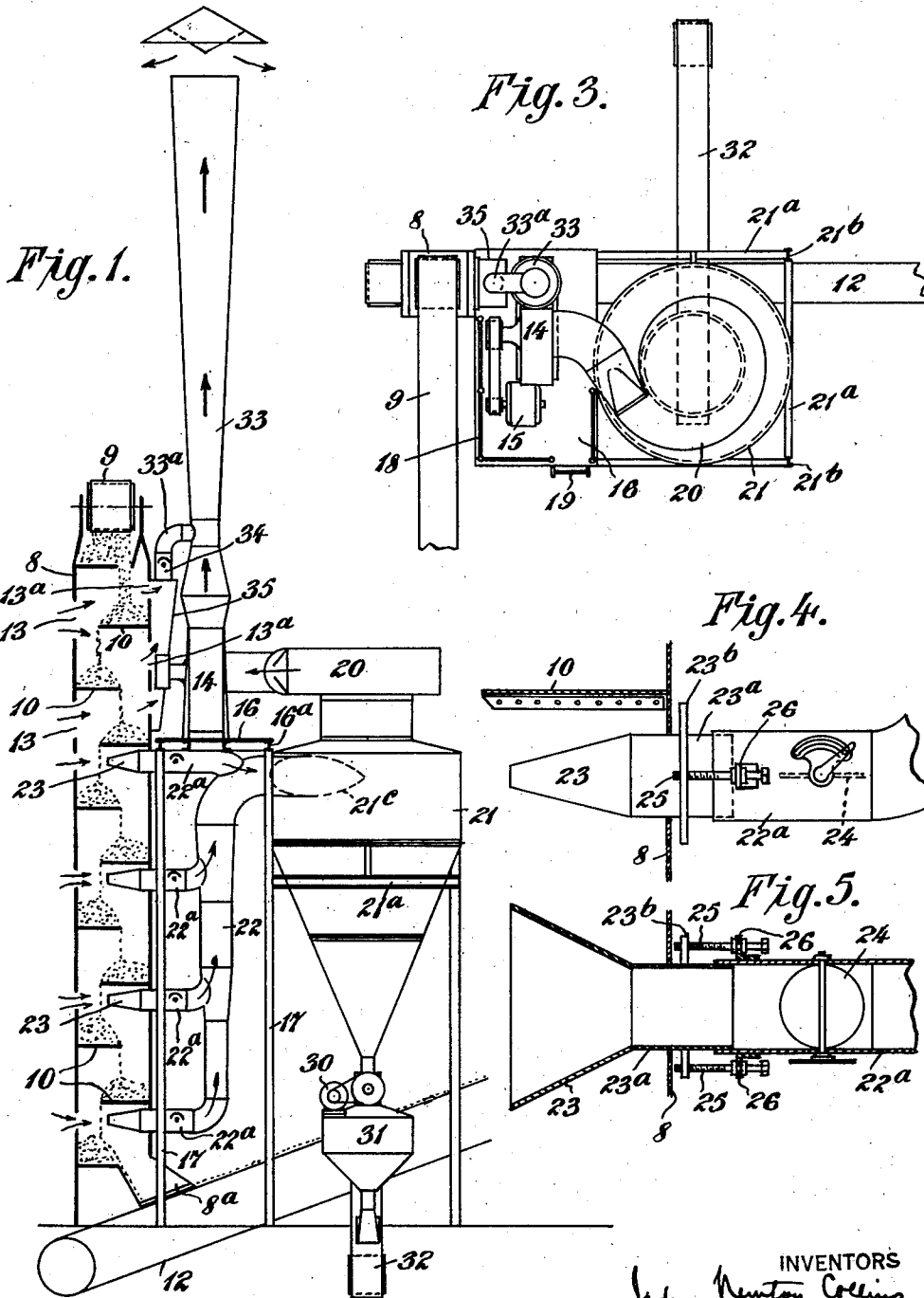
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APPARATUS FOR COOLING, DRYING, AND DESILTING GRANULAR MATERIAL

Filed Aug. 31, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2.

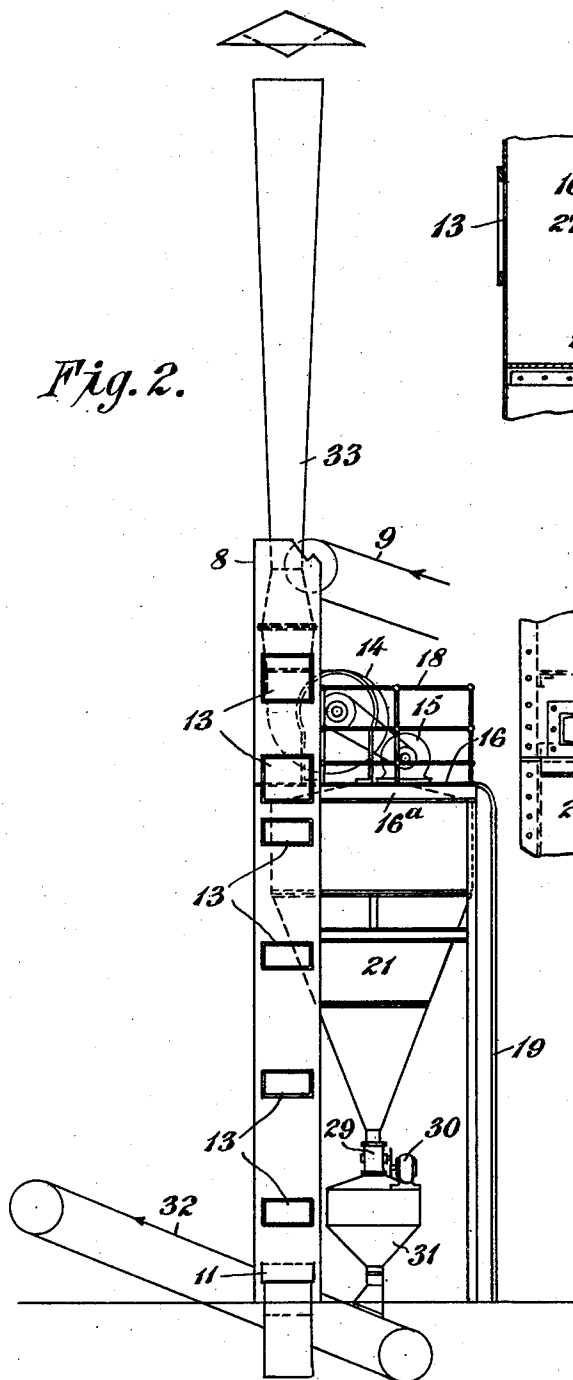


Fig. 6.

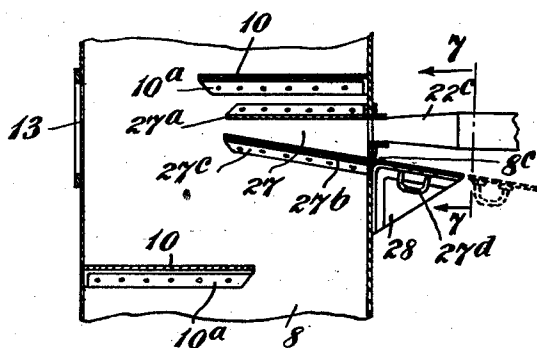
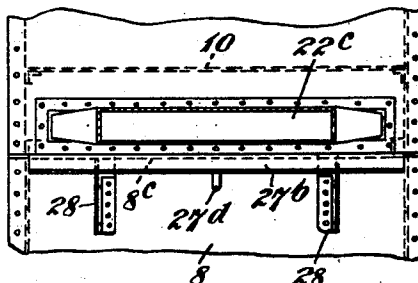


Fig. 7.



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APPARATUS FOR COOLING, DRYING, AND
DESILTING GRANULAR MATERIALJohn Newton Collins, Birmingham, and Clifford
Ashton, Wakefield, EnglandApplication August 31, 1943, Serial No. 500,704
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2 Claims. (Cl. 209-135)

This invention has reference to plant or machinery for effecting cooling and/or drying and desilting operations on granular materials.

Broadly the invention resides in plant or machinery for the purpose aforesaid characterised in that it embodies a tower or chamber into the upper end whereof the granular material to be treated is delivered from a continuous belt conveyor or by other suitable means, the said chamber being furnished interiorly with a series of plates or shelves so disposed relative to each other that the material introduced into the upper end of the chamber is caused to descend therein in the form of a series of vertical curtain-like streams or cascades, the said chamber being provided with air admission apertures so located in one side thereof and relative to the curtain-like streams or cascades of the granular material that air currents induced into the chamber pass through the descending material, the chamber having in combination or association therewith means or mechanism such as is hereinafter described whereby the induction of air into the chamber and through the screens or cascades of material for the purpose of cooling and/or drying the material and desilting, that is to say, removing any undesirably fine particles, dust or other light refuse therefrom, before discharging the material from the lower end of the chamber is very efficiently affected and controlled.

The invention is especially useful for the performance of the cooling, drying and desilting operations involved in the re-conditioning of the sand removed from the moulding boxes employed in casting foundries and will be hereinafter more particularly described in this connection with reference to the accompanying drawings but it is to be understood that it may be employed in the treatment of other granular material involving analogous operations.

Figure 1 of the drawings represents in front elevation partly in section a convenient embodiment of plant or machinery in accordance with the invention for use in the said connection, the parts being shown more or less diagrammatically owing to the small scale to which they are drawn and which is imposed by the size of the sheets.

Figure 2 is a side elevation of the same.

Figure 3 represents the said plant or machinery in plan.

Figures 4 and 5 represent in side elevation and sectional plan respectively a fragmentary portion of the mechanism hereinafter more particularly referred to, drawn to a larger scale than Figures 1, 2 and 3.

Figure 6 illustrates a modified construction of the nozzle devices incorporated in plant or machinery in accordance with the invention, and

Figure 7 shows the said modification in elevation and partly in section on the line 7-7 and looking in the direction of the arrows in Figure 6.

The same numerals of reference indicate the same parts in the several figures of the drawings.

In the embodiment illustrated and designed for the use aforesaid the tower or chamber marked 8 and into the upper end of which the sand to be re-conditioned is delivered, as for example, from a suitably disposed belt conveyor 9, is of a rectangular figure in cross section and the plurality of plates or shelves 10 provided therein for the purpose aforesaid are disposed at suitably spaced apart intervals on two opposite walls of the chamber, the plates or shelves on the one side being staggered or alternating with respect to those on the other side of the chamber after the manner of baffle plates, as is best seen in Figure 1 in which figure the said chamber is shown in vertical section.

The inwardly presented edges of the successive plates on the one side somewhat overhang the corresponding edges of the successive plates or shelves disposed on the opposite side, so that the sand which is delivered from the conveyor 9 on to the uppermost plate of the series on each wall and piles thereon to a certain degree, descends by gravity therefrom on to the succeeding alternating plates in the form of a vertical curtain-like stream or cascade as indicated by the stippling in Figure 1 until it reaches the lowermost plate or shelf in the chamber from which it is passed through a suitably shaped outlet 8^a to a travelling belt or other conveyor 12 whereby it is removed to any desired place for storage or for immediate use.

The air admission apertures denoted by the references 13 which are provided in one side wall of the tower or chamber 8 are located in the parts thereof intermediate the series of plates 10 disposed on the said wall and so that the induced air currents will pass through the curtains of sand formed between the plates on the respective walls.

The air currents which pass through the curtains formed in the upper part or section of the chamber are utilised to effect the cooling and drying of the sand while the currents which pass through the curtains in the remaining or lower part of the chamber continue the cooling process and are also employed to extract any fine par-

articles or dust undesirable in the conditioned sand and which are thus removed before discharge of the sand from the lower end 8^a of the chamber.

The means or mechanism combined or associated with the chamber 8 for effecting the induction of air thereinto and through the curtains or cascades of sand for the purposes specified embodies a centrifugal fan the casing whereof is marked 14 in the drawings, the said fan being power driven as for example by an electromotor 15.

The fan 14 and motor 15 are located in appropriate relationship to the tower or chamber 8 by mounting them on a staging embodying a platform 16 which may be constituted by a metallic grid carried by horizontal members 16^a supported on vertical members or standards 17, the said horizontal and vertical members being conveniently constituted by metallic bars of girder-like formation in cross section. Access is gained to the platform 16, which is preferably furnished with a railing 18, by a ladder 19.

The casing 14 of the centrifugal fan has connection at its intake side with a casing 20 of volute formation provided on the upper end of a centrifugal separator of any appropriate construction adapted for the separation of comminuted matter or particles from air, the casing of which separator is denoted in the drawings by the reference 21 and is conveniently supported in a framing 21^a carried by the vertical standards 21^b.

The upper part of the centrifugal separator 21 is in communication through an aperture 21^c therein with a vertically disposed conduit 22 furnished with a plurality of branch pipes 22^a terminating in nozzles 23 which extend into the lower section of the chamber 8 through the wall thereof opposite to that in which the air induction apertures 13 are provided, the open ends of the nozzles which are preferably of a narrow slot formation being presented to the curtains or cascades of sand in the said lower section of the chamber on the side or face of the curtains opposite to that which is presented to the air induction apertures.

It will be appreciated that when the centrifugal fan is in operation it serves, through the connection of the intake side of its casing 14 with the volute casing 20 on the upper end of the centrifugal separator casing 21, to induce the positive suction of air from the tower or chamber 8 into the nozzles 23 of the branch pipes 22^a of the conduit 22 and the currents of air thus created will pass through the curtains or cascades of sand to which the said nozzles are presented and carry therewith such particles or refuse as it is desired shall be extracted from the sand in its passage through the tower.

The nozzles 23 which operate to extract undesirable fine particles or dust from the lower curtains or cascades of sand are or may be adapted for a slidable adjustment relative to the supporting branch pipes 22^a so as to permit their ends to be set to any desired distance from the streams or cascades of sand to which they are respectively presented and each branch pipe is provided with a damper or valve 24 for regulating the velocity of the air drawn into the nozzles.

The said dampers or valves 24 may be adapted also to control secondary air admission openings in the branch pipes which are opened proportionately to the extent to which the dampers or valves may be adjusted to reduce the velocity of

air passing into the nozzles, thus avoiding undue restriction of the air supply to the centrifugal separator.

In a convenient construction of the adjustable nozzles 23, as illustrated by the enlarged Figures 4 and 5, the flattened end thereof is formed or provided on a cylindrical portion 23^a adapted for a telescopic sliding motion in the branch tube 22^a with which it is associated, the telescopic adjustment being effected through the medium of screwed rods 25 rotatable in bearings furnished in brackets 26 disposed on diametrically opposite sides of the branch tube, the screwed ends of the said rods 25 engaging in tapped holes in a flange 23^b on the part 23^a of the nozzle.

Or in lieu of providing the branch suction tubes 22^a with telescopically adjustable nozzles as described the said branch tubes may, as is illustrated by the fragmentary views Figures 6 and 7, terminate in flattened nozzle-like parts 22^c having a fixed connection with the side wall of the chamber 8 into which they open, each branch tube nozzle-like part 22^c or some only thereof, as for example those of alternate branch tubes, having a virtual extension of its open end into the interior of the chamber, the said extension being constituted by a pocket 27 formed by the plates 27^a and 27^b disposed transversely between the front and rear walls of the chamber.

The upper plate 27^a which preferably lies in a horizontal plane as shown may be fixed to the front and rear walls of the chamber between which it extends by riveting flanges provided on the respective ends of the plate to the said walls, and the plate is of such width that its inner edge lies adjacent to the curtain or cascade of sand to which it is presented.

The lower plate 27^b is disposed in a plane inclined to the upper plate 27^a and is adapted for a sliding motion on inclined angle bars or brackets 27^c provided for its support on the front and rear walls respectively of the chamber.

The said lower plate 27^b which is of greater width than the upper plate extends and works through a slot 8^c in that wall of the chamber to which the nozzle-like parts 22^c are connected, its outwardly extending part being supported on brackets 28 on the outer face of the wall, and the said outwardly extending part is furnished with a handle such as the loop-like grip 27^d or a pair of such grips or other suitable handle for facilitating the sliding of the plate.

It will be appreciated that by suitable adjustment of the slidable plate 27^b relative to the fixed plate 27^a the area of the opening into the pocket 27 and also the proximity of the said opening to the curtain or cascade of sand may be varied as may be required for controlling the air currents induced into the chamber 8 through the apertures 13 and thence through the sand curtains or cascades.

The particles or refuse extracted from the sand curtains or cascades pass from the conduit 22 into the separator 21 and descend to the bottom thereof from which they pass by way of a suitable rotary air-lock valve indicated at 29 and adapted for operation by an electromotor 30 into a reservoir or bin 31 and thence to a travelling belt 32 or other conveyor for final disposal.

The cleaned air is drawn from the separator 21 into the volute casing 20 at its upper end which end as aforesaid is connected to the suction inlet of the casing 14 of the centrifugal fan.

The said fan casing has connection on its dis-

charge side with an outlet or diffuser tube 33 which is of tapering formation, its smaller end being disposed adjacent the fan and designed to act as a venturi for increasing the velocity of the air at this part, and the venturi or throttled section is provided with a lateral branch 33^a with which it co-acts to operate as an ejector, the said branch tube being placed in communication, through a pipe 34 fitted with an air regulating valve, with the top of a casing 35 provided on the upper part of the chamber 8 through which the sand is cascaded, the said casing 35 being disposed on the wall of the chamber 8 opposite to that furnished with the aforesaid air induction apertures 13. The wall whereon the casing 35 is provided has apertures 13^a opening into the said casing and the ejector afforded by the diffuser tube 33 and its lateral branch 33^a operates to effect the induction of currents of air through the upper apertures 13 in the chamber 8 and thence through the curtains or cascades of sand falling in the upper part of the said chamber, and through the apertures 13^a, the sand being thereby cooled and dried prior to its descent into the part of the chamber in which the desilting operation is effected.

The plates or shelves 10 whereon the layers or piles of sand fall in the descent of the sand through the chamber are preferably disposed in horizontal planes and may conveniently be supported by L or angle iron bars or brackets 10^a riveted or otherwise secured in the requisite positions on the walls of the chamber, and as the impact of the curtains or cascades of sand is on the sand which has been already deposited on the respective plates the wear on the plates or shelves is almost negligible.

By the use of plant or machinery in accordance with the invention the separation of fines can be adjusted to give any desired grading of the sand or other granular material passed into the cascade chamber and the fines extracted in

the desilting process do not pass through the fan, thus avoiding wear thereon.

Further, units in accordance with the invention can be designed to deal with any quantity of sand, or other granular material, and as the whole unit operates under partial vacuum conditions no dust can escape to cause an unpleasant working atmosphere in the vicinity of the plant or machinery.

We claim:

1. Apparatus for cooling, drying and desilting granular material comprising a tower having upper and lower sections, means for delivering material to be treated to the upper section of the tower, the tower having apertures therein for induction of air therinto and a series of baffles arranged in staggered relation for causing the material to descend therein in the form of cascades, a centrifugal separator having a volute casing at its upper end and an air-lock discharge valve at its lower end, a conduit connected to the separator and having branch tubes communicating with the lower section of the tower, nozzles for at least some of said branch tubes, said nozzles being presented to the material descending in the tower to effect the induction of air currents therethrough, a centrifugal fan having a casing connected at its intake with the volute casing of the separator, a housing communicating with the upper section of the tower, a diffuser tube connected to the discharge of the centrifugal fan and having a Venturi section therein, and a branch pipe leading from said housing to said Venturi section for the induction of air through the apertures in the upper section of the tower.

2. Apparatus according to claim 1, including a valve in said branch pipe for regulating the induction of air by said Venturi section into the upper section of the tower.

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