March 17, 1925. 1,530,193

H. S. MONTGOMERY

SCREENING MACHINE

Filed March 15, 1923 3 Sheets-Sheet 1

Fig. 2.

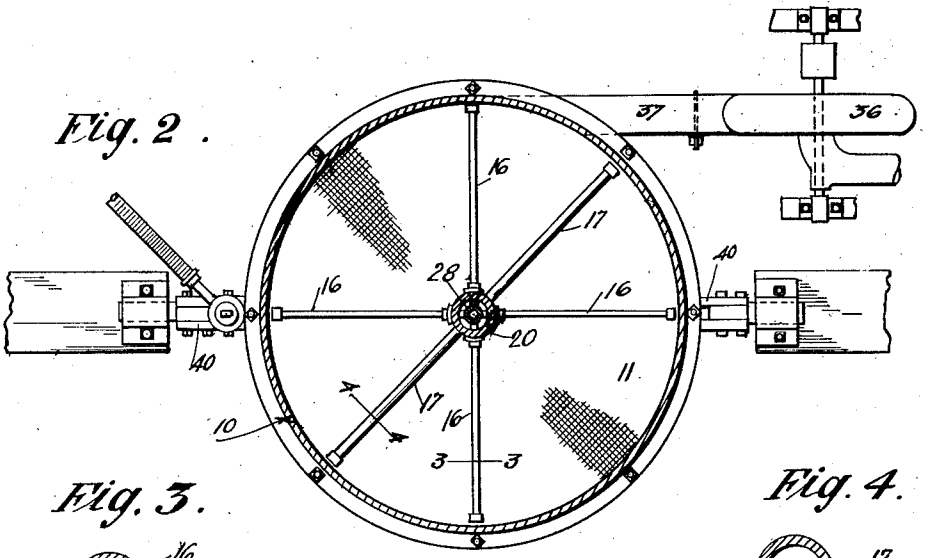



Fig. 3.

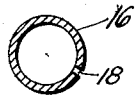



Fig. 4.

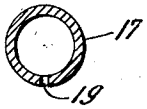



Fig. 1.




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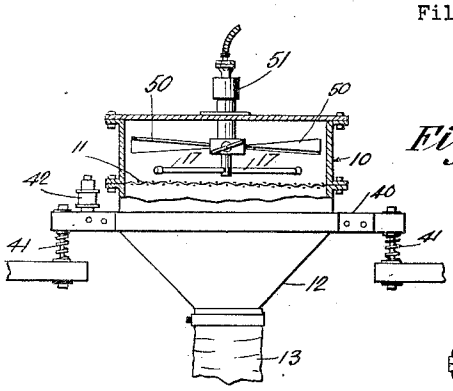


Fig. 6.

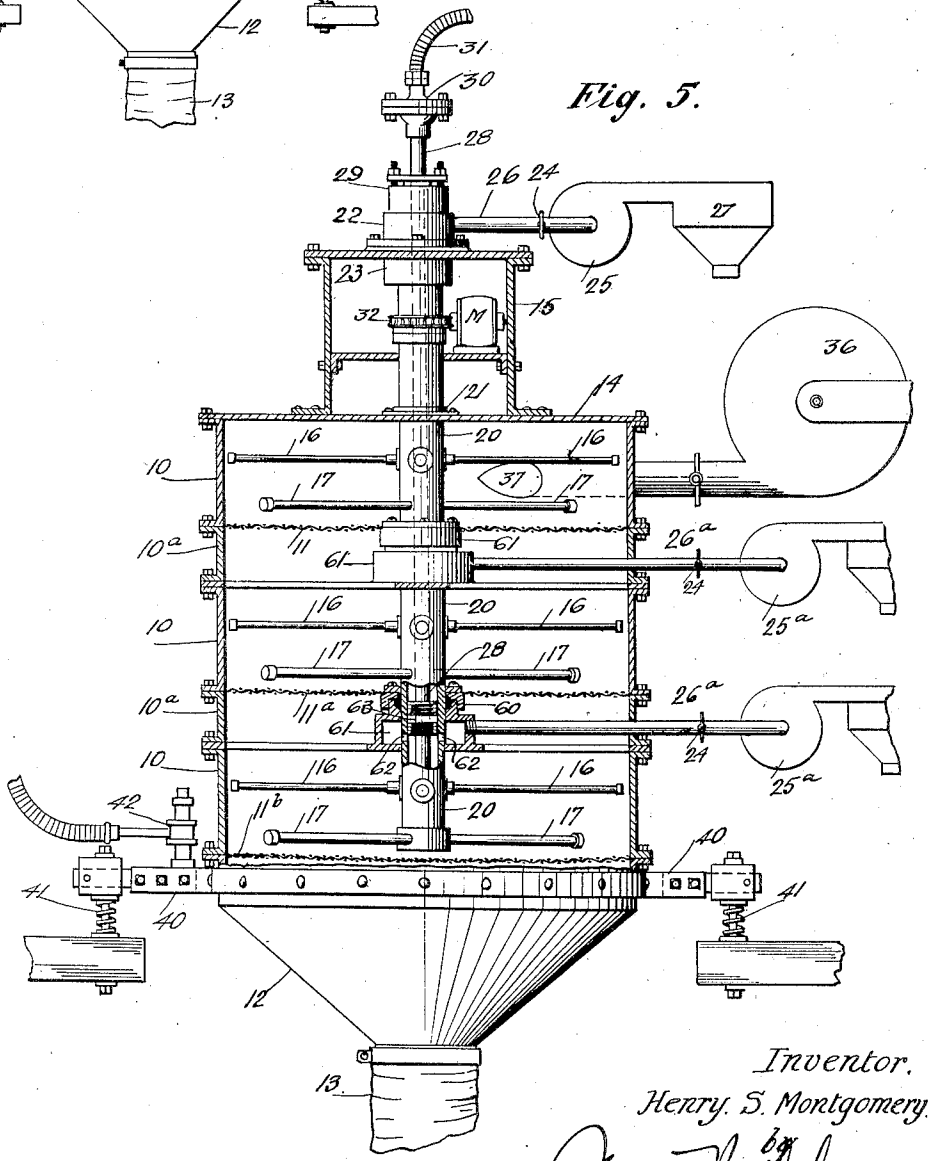


Fig. 5.

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SCREENING MACHINE

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Fig. 7.

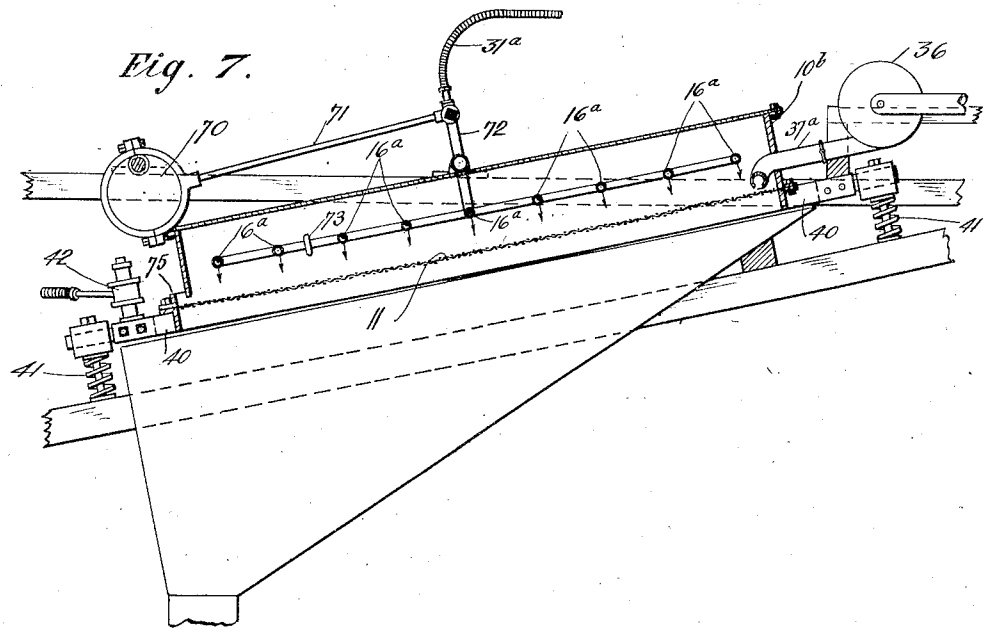
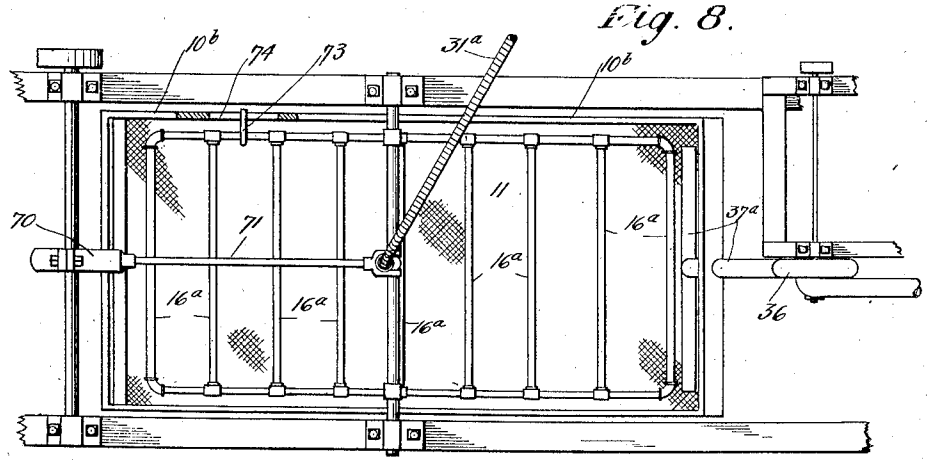



Fig. 8.




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Patented Mar. 17, 1925. 1,530,193

# UNITED STATES PATENT OFFICE.

HENRY S. MONTGOMERY, OF RIVERSIDE, CALIFORNIA.

## SCREENING MACHINE.

Application filed March 15, 1923. Serial No. 625,223.

*To all whom it may concern:*

Be it known that I, HENRY S. MONTGOMERY, a citizen of the United States, residing in Riverside, county of Riverside, State of California, have invented new and useful Improvements in Screening Machines, of which the following is a specification.

This invention has to do with screens for screening and sizing materials in general; and although the invention has been particularly developed with reference to the screening of fine materials that are of a light and fluffy nature and therefore difficult to screen by ordinary methods and some of the most advantageous features of the invention are obtained when screening such materials, it will be understood that the invention is not at all necessarily limited to use with such materials but may be applied advantageously to the screening of any substance.

In the screening and sizing of such materials as diatomaceous or infusorial earths great difficulties have been encountered where it is desired to screen to small size. The screens become quickly clogged, even when mechanically vibrated; and the material has a tendency to gather in balls that stand on the surface of the screen and effectually prevent screening action. I have found that the application of air pressure to the materials, in conjunction with mechanical screen vibration assists greatly in screening of such materials; and I have also found that if the materials, at the same time they are held down on the screen by air pressure, are moved over the surface of the screen, effective screening can be accomplished. In my prior and co-pending application entitled "Method and apparatus for screening materials" filed Sept. 21, 1922, Serial No. 589,518, I have set out a screening apparatus which embodies these general principles; and the present invention presents improvements in such an apparatus as set out in said prior application. The present application deals with various features of improvement that will be fully understood from the following specification, said improvements having mainly to do with the method of introducing air for the purpose of creating the desired pressures and movements of the material, and with means for removing the over size from the screen from time to time. The improvements also include certain mechanical refinements, and also mechanical arrangements for putting several such screens into combination with each other for the purpose of subjecting material to several successive screenings. All of these things and various other objects and features of accomplishment of the invention, will be best understood from the following detailed description of preferred and specific forms of devices illustrative of the invention, reference for such purpose being had to the accompanying drawings in which—

Fig. 1 is a vertical central section showing a single unit mechanism in accordance with my invention;

Fig. 2 is a plan section of the same on line 2—2 of Fig. 1;

Fig. 3 is an enlarged detail section on line 3—3 of Fig. 2,

Fig. 4 is an enlarged detail section on line 4—4 of Fig. 2;

Fig. 5 is a vertical central section showing a mechanism including several screening units;

Fig. 6 is a central vertical section of a single unit mechanism showing a modified arrangement;

Fig. 7 is a vertical longitudinal section showing another modification; and Fig. 8 is a plan of the same with cover removed.

In Figs. 1 to 6 I show my invention as applied to a circular screen, and I show the various parts that move over the screen surface as having circular motions, this being a convenient and simple arrangement. It will be understood however, from what I say hereinafter with regard to its operation that the essential characteristic of these relative motions is that the material be kept moving over the surface of the screen; and although this motion over the surface of the screen may be preferably circular, it is not necessarily so.

I illustrate at 10 a circular screen casing with a screen 11 in its bottom, a delivery casing 12 extending below the screen cas-

ing to connect with a collector 13 which may be in the form of a collector bag or any other of the various collector arrangements that are well known in the art. The upper end of screen casing 10 is closed by a cover plate 14 and on this cover plate a frame or other support 15 may be mounted to support the bearings and stuffing boxes, etc., for the mechanism that I am about to describe.

Within the screen casing there are two sets of radial tubes 16 and 17. Tubes 16 are those through which air under pressure is admitted to the screen while tubes 17 are those through which, by the application of suction, the oversize is removed from the screen. The air discharge from tube 16 is through lines of perforations 18 that point diagonally downwardly, so that the air discharge will force the material down onto the screen and also move it around (over the surface of) the screen. I show several tubes 16; and, even if those tubes are stationary the air jets issuing from them will keep the material traveling over the screen. But I prefer to rotate the tubes 16, so as to make uniform their action over the whole surface of the screen. And when the tubes are rotated, the jet perforations may be pointed more nearly downwardly or exactly downwardly, as the rotation may furnish the movement over the screen. Or I may prefer in any case to point some perforations directly downwardly and some diagonally downwardly. Likewise, I prefer to rotate the suction tubes 17 in order to make their action uniform over the whole screen surface. Accordingly, I mount the vacuum tubes 17, which have a slot or a line of perforations as shown at 19 along their lower sides, on and in communication with a vertical rotating tube 20 which extends up through cover plate 14. through some suitable packing means as indicated at 21. The upper end of this tube 20 discharges into a chamber 22 stationarily mounted on framing 15, a stuffing box being provided at 23 to make a sufficiently tight joint between the revolving tube and the chamber. A suction pipe 26 connects chamber 22 with a suction fan 25, under control of valve 24; and the fan may discharge into a collector 27 of any suitable type.

Inside the tube 20 and rotating with it is an air pipe 28; and air jet tubes 16, extending through the wall of tube 20, connect with air pipe 28. This air pipe extends up through tube 20 and chamber 22 and through a stuffing box 29, out of the chamber, and then has a swivel connection 30 of some suitable kind with an air pressure line 31.

The rotating system that I have described may be rotated by the air reaction of jets 18; but I may prefer also to give this rotating system a positive drive, as by motor M operating on worm gear 32 on rotating tube 20. If a motor is used, the parts may be rotated in either direction, either with or against the direction in which they would be rotated by air reaction.

The material to be screened may be fed into the device in different manners, for instance, it may be fed by the screw feed means indicated 35 in Fig. 1; or it may be fed in by an air blower 36 that will blow the material through tube 37 tangentially into the screen casing. This tangential introduction of the material, along with the air in which it is blown, will of course set up a circular or cyclonic motion of the material over the screen. But, regardless of the manner in which the material is introduced, movement of the material over the screen, in this case, a circular or cylonic movement, will be set up and maintained by the action of the air jets. At the same time, the air introduced by the air jets, and that introduced with the material, if the air form of feed is used, will set up in the screen casing above the screen a certain air pressure above the air pressure that is maintained below the screen. This air pressure tends to hold the material down on the screen; and at the same time the air movement moves the material over the surface of the screen. The air pressure, in addition to the downward action of the air jets tends to keep the fines moving through the screen and keep the screen clean, while the movement of the particles tends to break up any collections of particles so that the particles themselves may pass through the screen. I may also apply a suction to discharge 13 to aid in taking the fines away from the screen.

The whole screen is mounted on a vibratory mounting. For instance, it may be mounted on a frame 40 supported on springs 41; and any suitable means may be used to vibrate frame 40 and the screen. For instance, a small air hammer, indicated at 42, may act to vibrate the system. It is not necessary to have a violent vibration: it is only desired to have sufficient vibration to help materials pass through the screen and to help dislodge any oversize particles that might otherwise be stuck in the screen.

When the device is in operation the material is fed in to the vibrating screen at a suitable rate, and air pressure is admitted to air jet tubes 16 and those tubes may be revolved. The material is held down on the screen by the air pressure and is thrown against the screen and along its surface by the direct action of the air jets 18, so that the material is kept in constant motion over the surface of the screen and is brought into more or less forcible contact with the

screen. The fines pass through the screen and go to the collector; and when the oversize has accumulated on the screen the suction is turned on to tubes 17 and they act to pick up the oversize and thus clean the screen. Ordinarily, the application of the suction action through the period of one revolution of tubes 17 is sufficient to clean the screen. It is not necessary to shut off the feed of material or to shut off the air feed to tubes 16 during this suction cleaning action, although that may be done if desired; but in any case only a small amount of fines is carried out with the oversize. This oversize may, after passing through collector 27, be passed back to the crusher or grinder, or it may be put into storage bins.

To operate the suction periodically I may provide a simple automatic means to open valve 24 periodically; as a cam 60 operated by worm gear 61 from revolving tube 28.

In Fig. 6 I show a modification in which a propeller fan 50 may be used to provide the air motion for carrying and pressing the material against screen 11 and for moving it over the surface of the screen. This fan 50, driven by any suitable means as by pulley 51, creates an air motion downwardly and circularly around over the screen; with the same general effect and result as hereinbefore stated. It will be understood that in any case the air movement around (parallel with the surface of) the screen is slow enough that the material is not blown over the screen surface so fast that it has no chance to go through the screen.

In Fig. 5 I show an arrangement of the type of device of Fig. 1 to make a mechanism including a number of screen units. Here I provide a composite screen casing made up of sections 10 and $10^a$ with superposed screens 11, $11^a$, and $11^b$ which may be of increasing fineness. Here the rotating tube 20 extends on down through the uppermost screen 11, where it passes through a stuffing box 60 and then through a suction chamber 61. Then the tube 20 extends on down to and through the screen $11^a$ where the same construction is repeated. This arrangement may be repeated as many times as there are screens in the multiple unit mechanism. At each chamber 61 the tube 20 has openings 62 through its wall, and there is an internal plug 63 in tube 20 just above these openings. From each suction chamber 61 a suction pipe $26^a$ extends to a suction fan $25^a$. By reason of the construction herein described it will be seen that the uppermost suction fan 25 will draw only on the uppermost suction tubes 17; the next suction fan $25^a$ will draw only on the next suction tubes 17; while the lowermost suction fan $25^a$ will draw only on the lowermost suction tubes 17. All the tubes 16 are connected to the common air pressure pipe 28 which extends the whole length of composite tube 20. Thus, while the various air jet tubes 16 are fed from a common air supply, the several suction tubes 17 connect with individual suction apparatus, and the oversize removed from the several screens is consequently kept separate. If the screens are progressively finer, the oversize from all the screens, excepting possibly the uppermost one, will be definitely sized, and so these oversizes may be passed to storage.

In Figs. 7 and 8 I show a different structure. Here the air jet pipes $16^a$ are arranged in grid formation and are fed with air from a pressure connection $31^a$. The jets may point perpendicularly toward the screen 11 as indicated. The jet pipes are moved back and forth in their plane (parallel to the screen) by an eccentric 70 and connecting rod 71 attached to pivoted arm 72 connected to the grid of pipes; a guide pin 73 in slot 74 of the screen housing $10^b$ guiding the grid of pipes in its movement. As the pipes are reciprocated parallel to the screen this movement furnishes the movement of the air jets parallel to the screen to move the material over the screen. It will be understood that here, or in the other form if jet openings pointing straight at the screen are used, the resultant of the air jet movement per se and the movement of the pipes over the screen is to give an air jet that has a resultant movement diagonally onto the screen; and that where in the following claims I speak of means to deliver a diagonal air jet I mean to include either arrangement for getting such a diagonal movement of air.

The screen is mounted on a spring supported vibrated frame as before described; and stands at a slight angle so that the oversize works toward the lower end where it passes off over a ledge 75. The material may be fed in with an air current by blower 36 through tube $37^a$, which thus also supplies an air current to move the material along the screen.

Having described a preferred form of my invention, I claim:—

1. In combination, a screen, and means to feed material onto it, and a plurality of means to direct air jets diagonally downwardly onto and along the screen at spaced points over its surface, with the result of blowing the material along the screen and through it.

2. In combination, a screen, and means to feed material onto it, and a plurality of means to direct air jets diagonally downwardly onto and along the screen at spaced points over its surface, said means being movable along the screen so that the points of application of the air jets are moved

over the screen, with the result of blowing the material along the screen and through it.

3. In combination, a screen, and means to feed material onto it, and a plurality of means to direct air jets diagonally downwardly onto and along the screen at spaced points over its surface, said means being rotatable in a plane parallel to the screen, with the result of blowing the material along the screen and through it.

4. In combination, a screen, and means to feed material onto it, and a plurality of means to direct air jets diagonally downwardly onto and along the screen at spaced points over its surface, said means embodying a plurality of radial perforated tubes rotating about a common center, and means to feed air pressure to the tubes, with the result of blowing the material along the screen and through it.

5. In combination, a screen and means to feed material onto it, and suction means operative over the screen to remove oversize material, embodying a suction tube movable over the screen surface with a suction opening at its under side, and means to apply suction intermittently to the tube.

6. In combination, a screen and means to feed material onto it, a revolving tube on an axis substantially perpendicular to the screen, a perforated suction tube mounted on and communicating with the revolving tube and extending radially therefrom at a point near the screen, means to apply suction to the revolving tube, an air pressure pipe inside the revolving tube, and an air jet pipe mounted on the revolving tube and connecting with the pipe.

7. In combination, a screen and means to feed material onto it, a revolving tube on an axis substantially perpendicular to the screen, a perforated suction tube mounted on and communicating with the revolving tube and extending radially therefrom at a point near the screen, means to apply suction to the revolving tube, an air pressure pipe inside the revolving tube, and an air jet pipe mounted on the revolving tube and connecting with the pipe, said air jet pipe having jet perforations that point diagonally downwardly to deliver air jets down onto and along the screen.

8. In combination, a screen and means to feed material onto it, a revolving tube on an axis substantially perpendicular to the screen, a perforated suction tube mounted on and communicating with the revolving tube and extending radially therefrom at a point near the screen, means to apply suction to the revolving tube, an air pressure pipe inside the revolving tube, and a plurality of radial air jet pipes mounted on the revolving tube and connecting with the pipe, each air jet pipe having jet perforations that point diagonally downwardly to deliver air jets down onto and along the screen.

9. In combination, a screen and means to feed material onto it, a revolving tube on an axis substantially perpendicular to the screen, a perforated suction tube mounted on and communicating with the revolving tube and extending radially therefrom at a point near the screen, means to apply suction to the revolving tube, an air pressure pipe inside the revolving tube, and an air jet pipe mounted on the revolving tube and connecting with the pipe; and means positively to rotate the revolving tube.

10. In combination, a screen and means to feed material onto it, a revolving tube on an axis substantially perpendicular to the screen, a perforated suction tube mounted on and communicating with the revolving tube and extending radially therefrom at a point near the screen, means to apply suction to the revolving tube, an air pressure pipe inside the revolving tube, and a plurality of radial air jet pipes mounted on the revolving tube and connecting with the pipe, each air jet pipe having jet perforations that point diagonally downwardly to deliver air jets down onto and along the screen; and means positively to rotate the revolving tube.

11. In combination, a screen and means to feed material onto it, means to vibrate the screen, means to create an air current over and along the screen, and means to apply suction over the screen to remove oversize material.

12. In combination, a screen and means to feed material onto it, means to vibrate the screen, means to create a circular air current over the screen, and revolving means to apply suction over the screen to remove the oversize material.

13. In combination, a screen and means to feed material onto it, means to vibrate the screen, means to create a circular air current over the screen, and revolving means to apply suction over the screen to remove the oversize material, the means for feeding material onto the screen involving an air current feed tangential of the screen.

14. In combination, a screen and means to feed material onto it, suction means operative over the screen to remove oversize material, and means to apply suction intermittently to said suction means.

15. In combination, a screen and means to feed material onto it, a revolving tube on an axis substantially perpendicular to the screen, another tube within the revolving tube, radially extending tubes over the screen and connected with the inner and outer perpendicular tubes, respectively, one of said radial tubes being perforated for application of suction action to the screen and

the other having jet openings directed at the screen, and means to apply suction and air pressure, respectively, to the two perpendicular tubes.

16. In combination, a screen and means to feed material onto it, and means, independent of the material feeding means to direct an air jet diagonally downwardly onto and along the surface of the screen, with the result of blowing the material along the screen and through it.

In witness that I claim the foregoing I have hereunto subscribed my name this 7th day of March, 1923.

HENRY S. MONTGOMERY.