

No. 840,883.

PATENTED JAN. 8, 1907.

E. VIAL.
DRYING DRUM.

APPLICATION FILED MAR. 17, 1906.

Fig. 1.

2 SHEETS—SHEET 1.

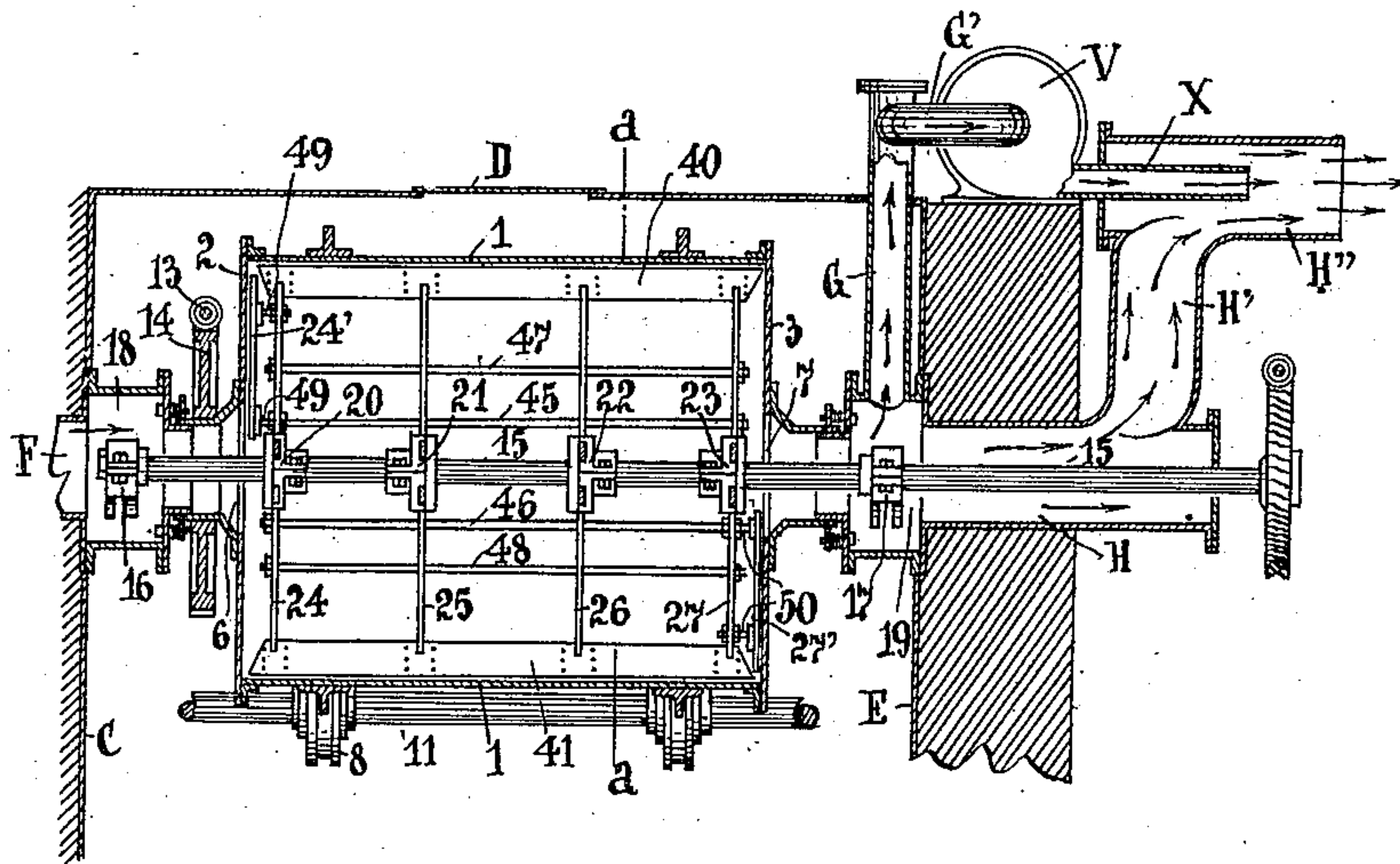
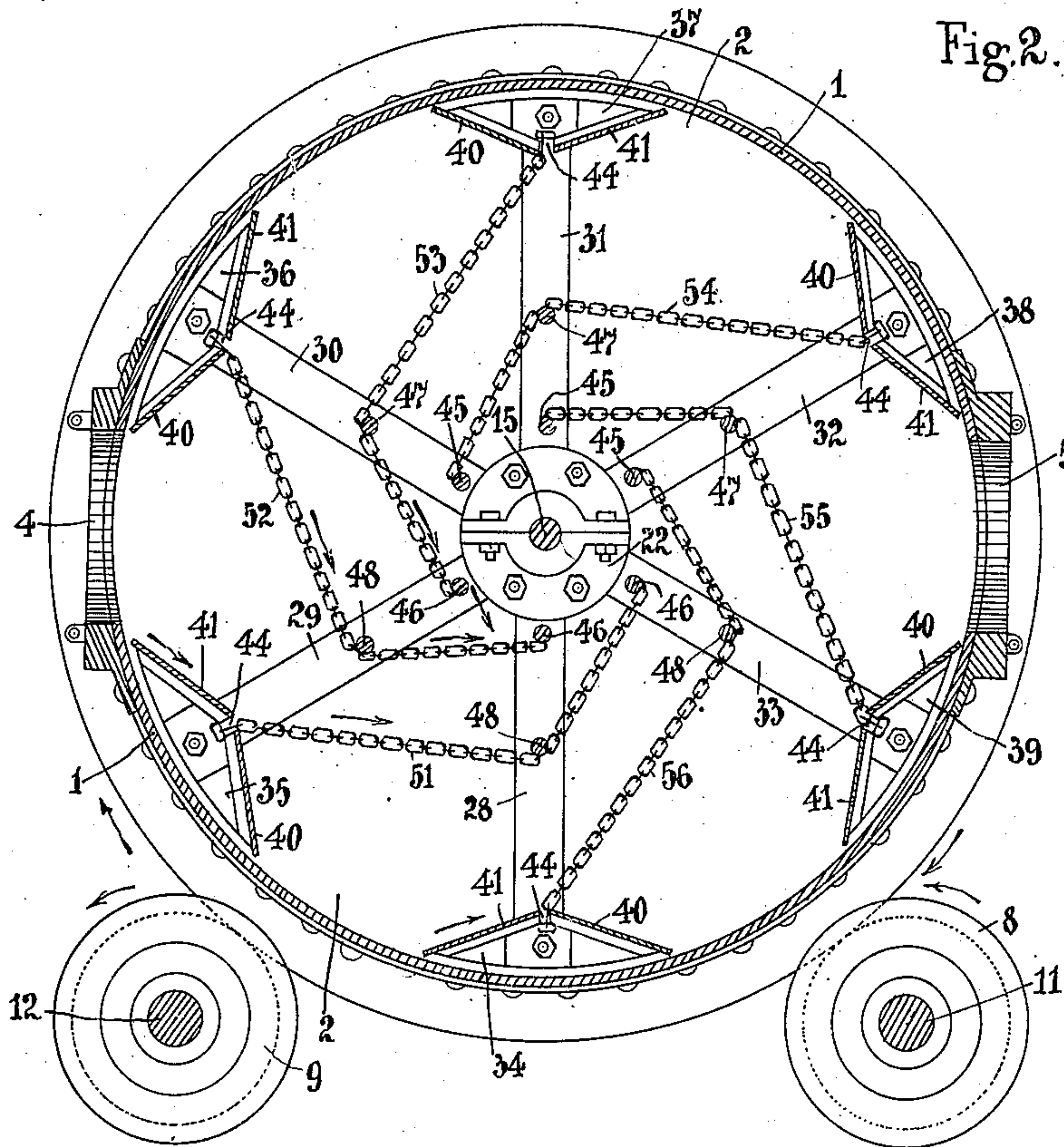


Fig. 2.



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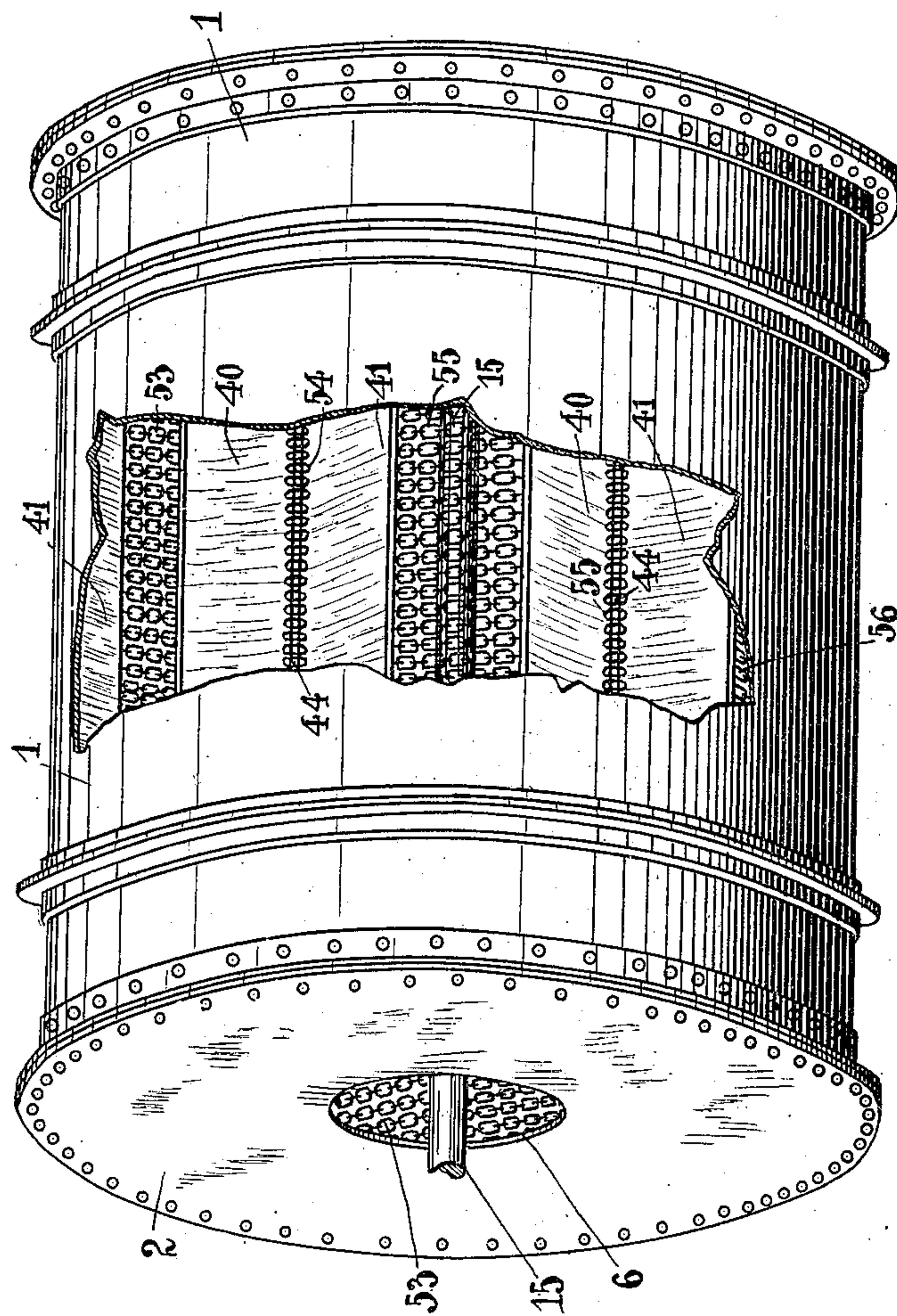
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2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

EMILE VIAL, OF BRUSSELS, BELGIUM.

DRYING-DRUM.

No. 840,883.

Specification of Letters Patent.

Patented Jan. 8, 1907.

Application filed March 17, 1906. Serial No. 306,513.

To all whom it may concern:

Be it known that I, EMILE VIAL, engineer, a citizen of the French Republic, residing at Rue Belliard 142, Brussels, Belgium, have
5 invented new and useful Improvements in Drying-Drums; and I do hereby declare the following to be a full, clear, and exact description of the same.

My present invention relates to drying-
10 drums, the object being to provide an apparatus of this kind wherein the materials to be dried are heated by means of fire-gases pressed through the drum in a continuous way, said materials being continuously agi-
15 tated within the drum by means of special agitating devices rotated independently within the drum, as more fully described and claimed hereinafter, reference being had to the accompanying drawings, wherein—

20 Figure 1 is a longitudinal section of the drying-drum and appliances, and Fig. 2 is a vertical cross-section on line *a a* of Fig. 1. Fig. 3 is a perspective view of the device, partly broken away.

25 The drying-drum is formed of a cylindrical metal container 1, the ends of which are closed by means of plates 2 3. Said container is provided with four openings, two manholes 4 5, Fig. 2, for the charging of the
30 drum, and two opposite passages 6 7 for the circulation of the heating-gases and the outlet of steam generated during the drying operation. The drum is preferably arranged within a heat-insulating chamber, (shown
35 diagrammatically in Fig. 1 and indicated by the references C D E,) and within said chamber the drum is supported on two pairs of loose rollers 8 9, arranged on two horizontal shafts 11 12 and rotated by the frictional en-
40 gagement of the drum, which is actuated at a relatively slow rate of speed by means of a worm 13, meshing with a worm-wheel 14, secured to one end of the drum.

The inner surfaces of the drum 1 are plain,
45 as shown, and through the drum extends a longitudinal independent shaft 15, journaled in bearings 16 17, arranged in the gas conduits or passages 18 19, said shaft being actuated from the outside by any suitable
50 transmission—i. e., a worm and worm-wheel, as shown in Fig. 1. Within the drum 1 the shaft 15 carries four or more hubs 20 21 22 23, provided with four or more series 24 25 26 27
55 of six flat iron spokes 28 29 30 31 32 33, Fig. 2, carrying at their free ends rigid shoes 34 35 36 37 38 39. These shoes serve to sup-

port and rotate circularly at a very small distance from the drum-walls six pairs of horizontal sheet-iron plates or bars 40 41, extending along the entire length of the drum 60 and inclined oppositely in each pair, a small free space 44 being left between the adjacent ends of each pair of plates 40 41.

All the spokes arranged to register with one another in the several series are con- 65 nected symmetrically by means of longitudinal rods 45 46 47 48, and the end series 24 and 27 are furthermore provided with flat iron plates 24' 27', respectively, supported by the ends of the rods 49 50 and serving to 70 clean by their rotation the vertical side walls of the drum 1.

The most essential feature of my improved arrangement consists in the provision, in the space comprised between the two end series 75 of spokes 24 27, of a particular structure formed of chains 51 52 53 54 55 56, made of equal length and secured at one end to the horizontal connecting-rods in close proximity to the shaft 15, and at the other end en- 80 gaging the free space 44 left between the opposite end of the rakes 40 41, wherein the chains are securely held in place. These parallel and somewhat stretched chains are arranged sufficiently close to each other be- 85 tween each series of spokes to form six series of special platforms, as shown in Fig. 2.

The operation of the improved drying-drum is as follows: The arrangement of double rakes 40 41 has for its object to pro- 90 duce a useful effect in both directions when it is desired. However, in practice the shaft 15 is normally rotated in the direction of the rotation imparted to the drum 1, but at a higher rate of speed than the latter. So long 95 as the materials to be dried are in a more or less liquid state the rakes 40 41 and chains 51 56 serve to increase considerably the heating and vaporizing surfaces in the current of heating-gases; but when the materials begin 100 to be thickened and aggregated the rakes 40 41, rotating at a higher rate of speed than the drum, successively raise the materials and bring them upon the respective platforms, as shown by arrows in Fig. 2. The materials 105 thus fractioned and projected toward the central current of gases are therefore constantly rolled and sieved by the action of the rotating platforms, whereby increased surfaces thereof are brought into contact with 110 the heating-gases. It will be easily understood that in these conditions the most gluey

materials must be granulated, pulverized, and completely dried in a very short time. The circulation of the hot gases entering the drum at F and the discharge of the steam
 5 are obtained, on the one hand, through the pipe G, connected by pipes G' outside of the insulating-chamber C D E to the suction-openings of an exhauster V, and, on the other hand, through the pipes H H' H'', the
 10 latter, H'', surrounding the discharge-nozzle X of said exhauster. The effect of this arrangement of pipes H, H', H'', and X is to discharge through the pipe H by the discharge of the exhauster into the pipe H'' a larger
 15 quantity of gas and steam than that discharged by suction through the pipes G G', whereby the motive power necessary for producing the suction is considerably reduced.

Heretofore horizontal drying - drums of
 20 well-known construction could not be successfully used for drying gluey sediments by means of hot gases passing through the drums for the following reasons: In these
 25 prior constructions the walls of the drums are provided with yielding dividing devices, which are not capable of raising the materials, and the latter remain, therefore, on the bottom part of the drum and are not sub-
 30 mitted to the drying action of the hot gases. In other constructions the drums are provided with rigid dividing devices which are adapted to raise the materials to be dried, but permit the same to drop in blocks upon
 35 the bottom of the drum, so that the useful contact-surfaces are not appreciably increased. Furthermore, these rigid devices are soon covered with a hard layer of dry material, so that the operation thereof is hin-
 40 dered, no practical means for cleaning the same during the operation having been devised heretofore.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

45 1. In a drying apparatus of the class described, the combination with a horizontal rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall thereof, circular openings in the
 50 vertical side walls of the drum and means for rotating the latter at a relatively low rate of speed: of a horizontal independently-rotatable shaft, extending longitudinally and centrally through the drum, a plurality of
 55 suitable platforms carried by said shaft, means for raising the materials to be dried from the bottom of the drum upon said platforms, means for independently rotating said shaft at a higher rate of speed, and
 60 means for energically causing the circulation of hot gases through the drum and discharging the steam generated from the same, substantially as set forth.

2. In a drying apparatus of the class de-
 65 scribed, the combination with a horizontal

rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall thereof, circular openings in the vertical side walls of the drum and means for rotating the latter at a relatively low rate of
 70 speed: of a horizontal independently-rotatable shaft, extending longitudinally and centrally through the drum, a plurality of hubs secured to said shaft at suitable distances from each other, a series of radial arms on
 75 each hub, suitable raising devices carried on the free ends of said arms and arranged in close proximity to the cylindrical wall of the drum, a plurality of suitable platforms supported by the several series of arms and
 80 adapted to receive the materials raised by said devices means for independently rotating said shaft at a higher rate of speed, and means requiring a relatively weak motive power for energically causing the circula-
 85 tion of hot gases through the drum and the discharge of steam from the latter, substantially as set forth.

3. In a drying apparatus of the class described, the combination with a horizontal
 90 rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall of the drum, circular passages in the vertical side walls thereof, suitable circular rails, secured to the outside of the cylindrical wall, pairs of loose grooved rollers engaged by said rails, horizontal shafts arranged longitudinally below the drum and
 95 carrying said loose rollers, means for rotating the drum on the latter at a relatively low rate of speed, and a suitable heat-insulating casing around the drum and its appliances: of a horizontal independently - rotatable shaft extending longitudinally and centrally
 100 through the drum, a plurality of suitable platforms carried by said shaft, means for raising the materials to be dried from the bottom of the drum upon said platforms, means for independently rotating said shaft at a
 105 higher rate of speed, and means for energically causing the circulation of hot gases through the drum and discharging the steam generated from the same, substantially as set forth.

4. In a drying apparatus of the class described, the combination with a horizontal
 115 rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall of the drum, circular passages in the vertical side walls thereof, suitable circular rails, secured to the outside of the cylindrical wall, pairs of loose grooved rollers engaged by said rails, horizontal shafts arranged longitudinally below the drum and carrying said
 120 loose rollers, means for rotating the drum on the latter at a relatively low rate of speed, and a suitable heat-insulating casing around the drum and its appliances, of a horizontal independently - rotatable shaft, extending
 125 longitudinally and centrally through the cir-
 130

cular passages in the vertical side walls of the drum, a plurality of hubs secured to said shaft at suitable distances from each other: a series of radial arms on each hub, suitable raising devices arranged on the free ends of said arms and in close proximity of the cylindrical wall of the drum, a plurality of suitable platforms supported by the several series of arms and adapted to receive the materials raised by said devices means for independently rotating said central shaft at a higher rate of speed, and means for energetically causing the circulation of hot gases through the drum and the discharge of steam therefrom, substantially as set forth.

5. In a drying apparatus of the class described, the combination with a horizontal rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall of the drum, circular passages in the vertical side walls thereof, suitable circular rails, secured to the outside of the cylindrical wall, pairs of loose grooved rollers engaged by said rails, horizontal shafts arranged longitudinally below the drum and carrying said loose rollers, means for rotating the drum on the latter at a relatively low rate of speed, and a suitable heat-insulating casing around the drum and its appliances, of a horizontal independently-rotatable shaft extending longitudinally and centrally through the circular passages in the vertical side walls of the drum, a plurality of hubs secured to said shaft at suitable distances from each other, a series of radial arms on each hub, a substantially triangular rigid shoe secured to the free end of each radial arm, longitudinally-extending oppositely-inclined rakes secured to the shoes of the several arms, suitable platforms carried by the latter to receive the materials raised by said rakes, means for rotating said central shaft independently and means for energetically causing the circulation of hot gases through the drum and the discharge of steam therefrom, substantially as set forth.

6. In a drying apparatus of the class described, the combination with a horizontal rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall of the drum, circular passages in the vertical side walls thereof, suitable circular rails, secured to the outside of the cylindrical wall, pairs of loose grooved rollers engaged by said rails, horizontal shafts arranged longitudinally below the drum and carrying said loose rollers, means for rotating the drum on the latter at a relatively low rate of speed, and a suitable heat-insulating casing around the drum and its appliances, of a horizontal independently-rotatable shaft extending longitudinally and centrally through the circular passages in the vertical side walls of the drum, a plurality of hubs secured to said shaft at suitable distances from each

other, a series of radial arms on each hub, a substantially triangular rigid shoe secured to the free end of each radial arm, longitudinally-extending oppositely-inclined rakes secured to the shoes of the several arms and extending over the entire length of the drum, longitudinal rods connecting the radial arms of the several hubs, parallel chains extending from each pair of rakes over the connecting-rods to the corresponding hubs to form a sort of platform, means for rotating said central shaft independently and means for energetically causing the circulation of hot gases through the drum and the discharge of steam therefrom, substantially as set forth.

7. In a drying apparatus of the class described, the combination with a horizontal rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall of the drum, circular passages in the vertical side walls thereof, suitable circular rails, secured to the outside of the cylindrical wall, pairs of loose grooved rollers engaged by said rails, horizontal shafts arranged longitudinally below the drum and carrying said loose rollers, means for rotating the drum on the latter at a relatively low rate of speed, and a suitable heat-insulating casing around the drum and its appliances: of a horizontal independently-rotatable shaft extending longitudinally and centrally through the drum, a plurality of suitable platforms carried by said shaft, means for raising the materials to be dried from the bottom of the drum upon said platforms, means for independently rotating said shaft at a higher rate of speed, a suitable exhauster outside of the drum, a pipe connection between the steam-discharge passage of the latter and the inlet of the exhauster, and a pipe connection between said discharge-passage and the outlet or discharge of the exhauster, substantially as set forth.

8. In a drying apparatus of the class described, the combination with a horizontal rotatable drum made with plain walls, charging and discharging openings in the cylindrical wall of the drum, circular passages in the vertical side walls thereof, suitable circular rails, secured to the outside of the cylindrical wall, pairs of loose grooved rollers engaged by said rails, horizontal shafts arranged longitudinally below the drum and carrying said loose rollers, means for rotating the drum on the latter at a relatively low rate of speed, and a suitable heat-insulating casing around the drum and its appliances, of a horizontal independently-rotatable shaft extending longitudinally and centrally through the circular passages in the vertical side walls of the drum, a plurality of hubs secured to said shaft at suitable distances from each other, a series of radial arms on each hub, a substantially triangular rigid shoe secured to the free end of each radial arm, longitudi-

nally-extending oppositely-inclined rakes secured to the shoes of the several arms and extending over the entire length of the drum, longitudinal rods connecting the radial arms of the several hubs, parallel chains extending from each pair of rakes over the connecting-rods to the corresponding hubs to form a sort of platform, suitable scrapers, carried by the end series of radial arms and adapted to scrape the vertical side walls of the drum, means for rotating the central shaft independently, a suitable exhauster outside of the drum, a pipe connection between the steam-

discharge passage of the latter and the inlet of the exhauster, and a pipe connection between said discharge-passage and the outlet or discharge of the exhauster, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE VIAL.

Witnesses:

CHARLES HONOLD,
GREGORY PHELAN.