(No Model.) 3 Sheets—Sheet 1.

J. O. DONNER.

APPARATUS FOR DECARBONIZING BONE BLACK.

No. 585,658. Patented July 6, 1897.

Fig. 1

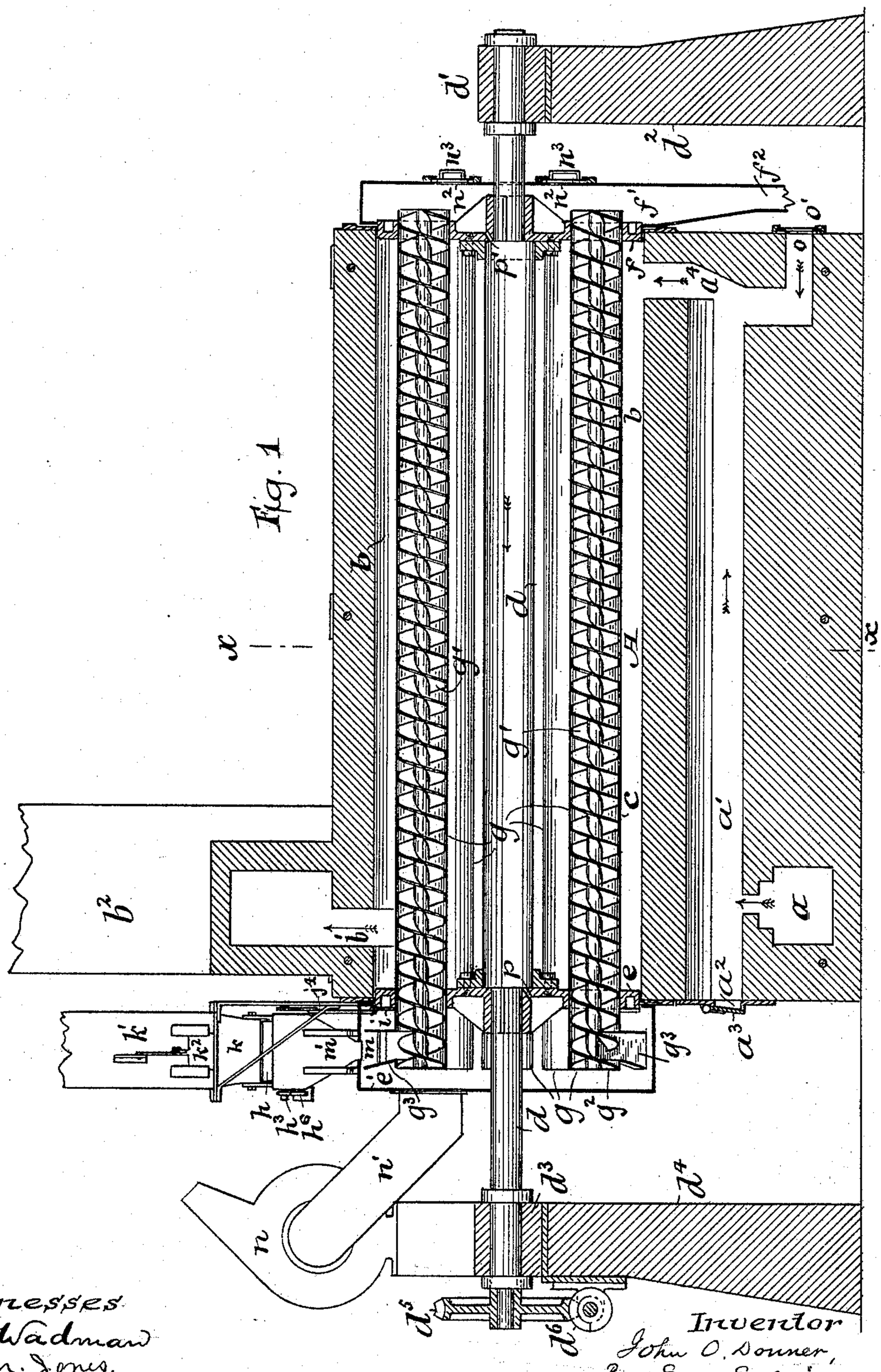

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Fig. 3

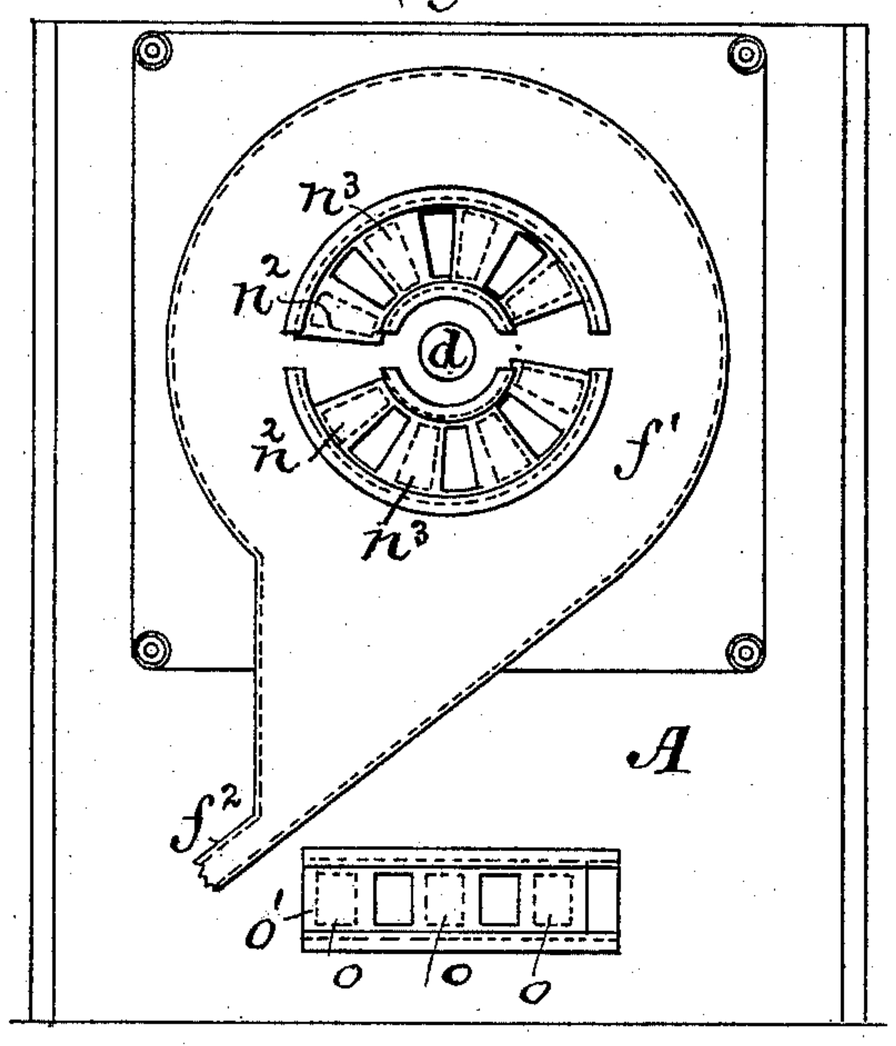


Fig. 4

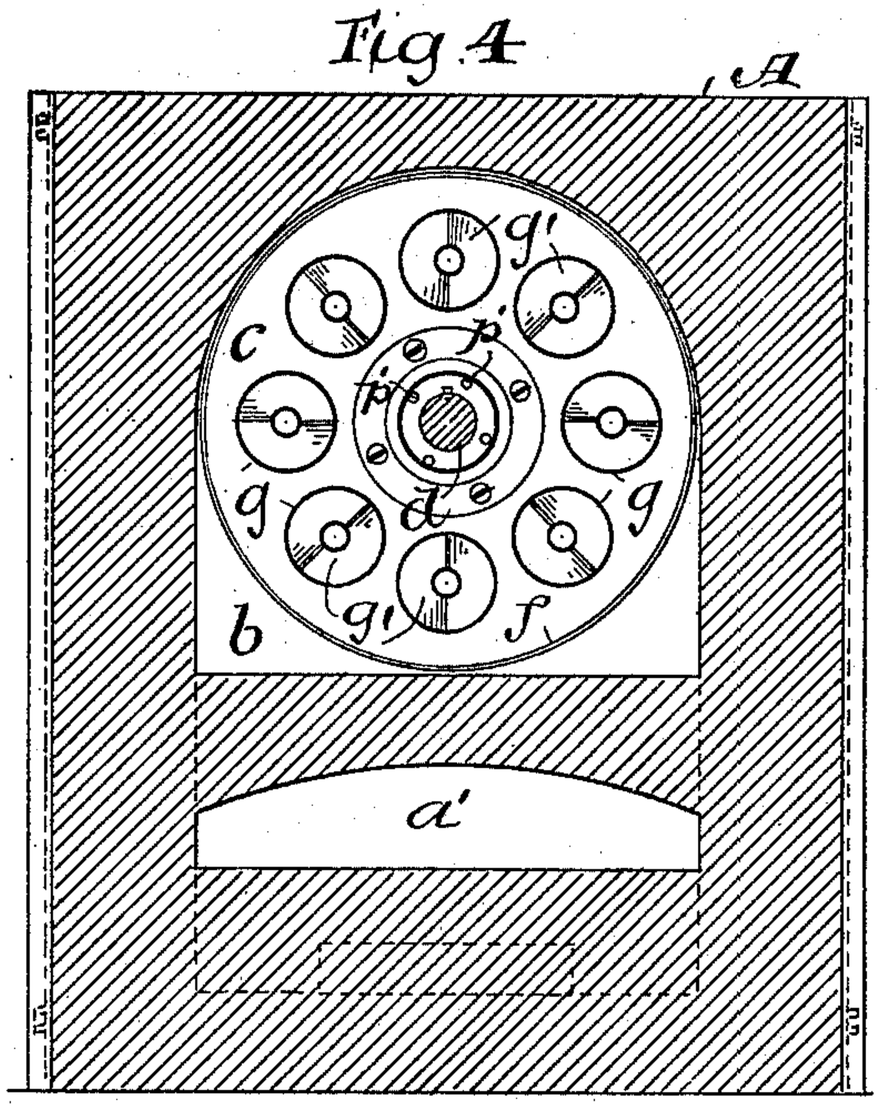
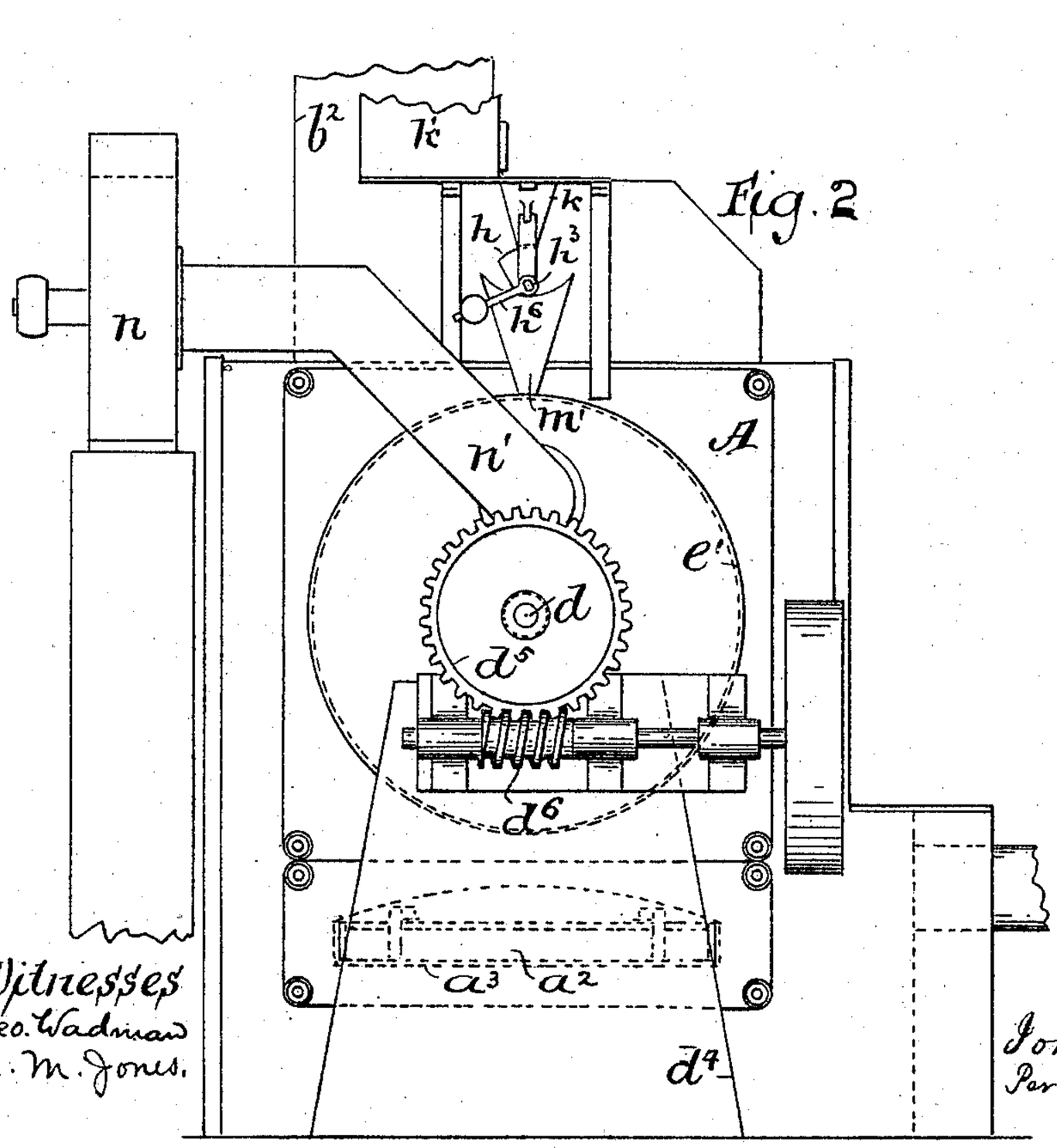


Fig. 2



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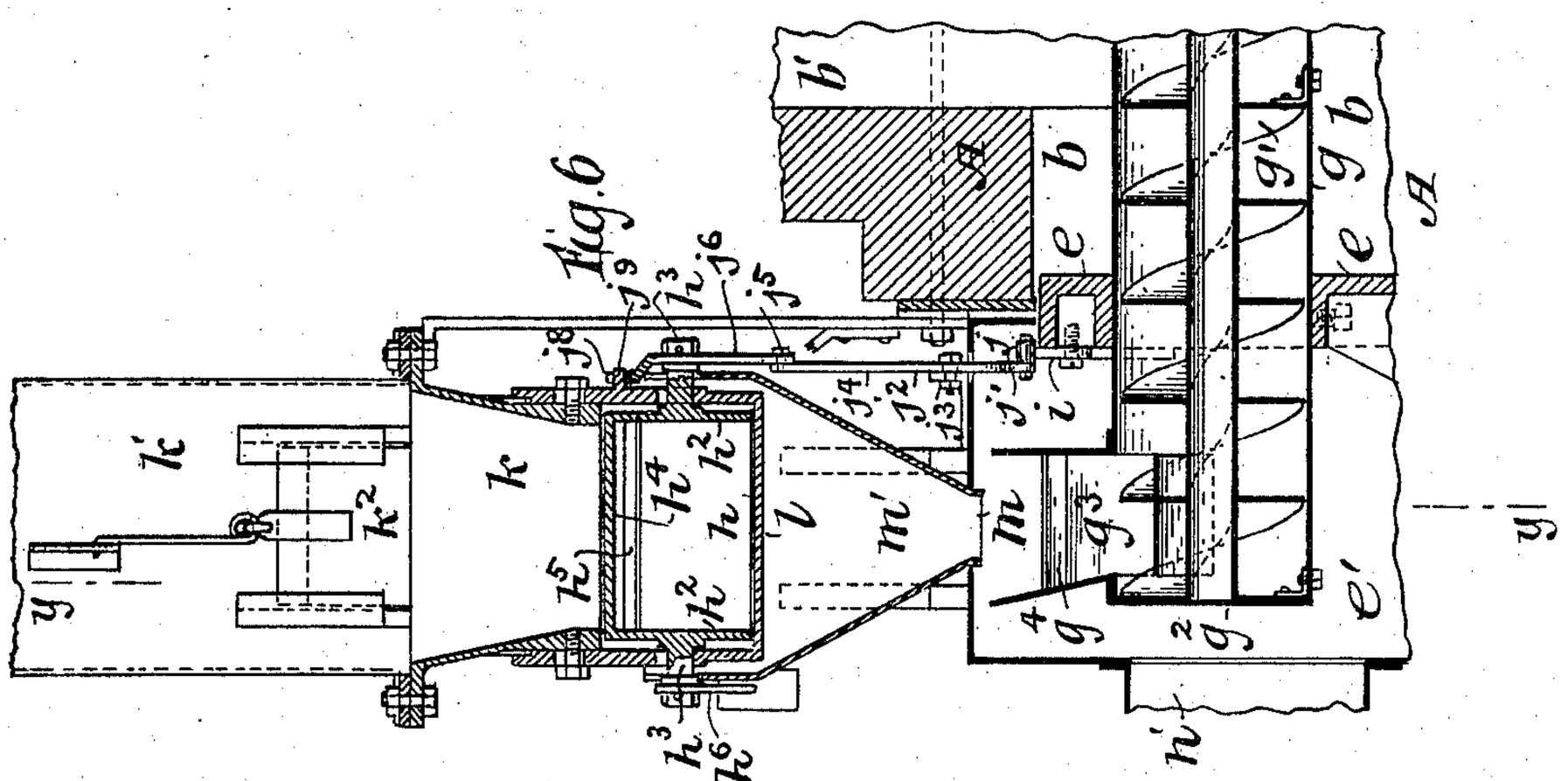

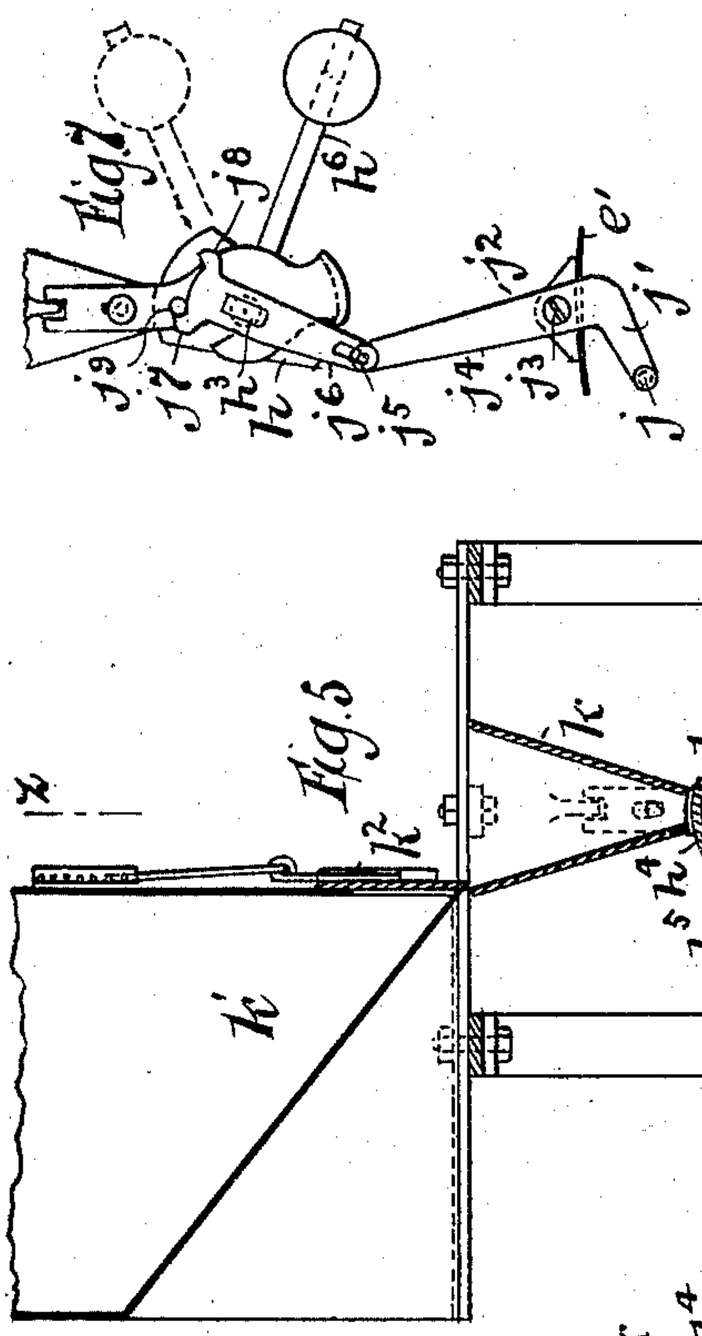

Fig. 7.

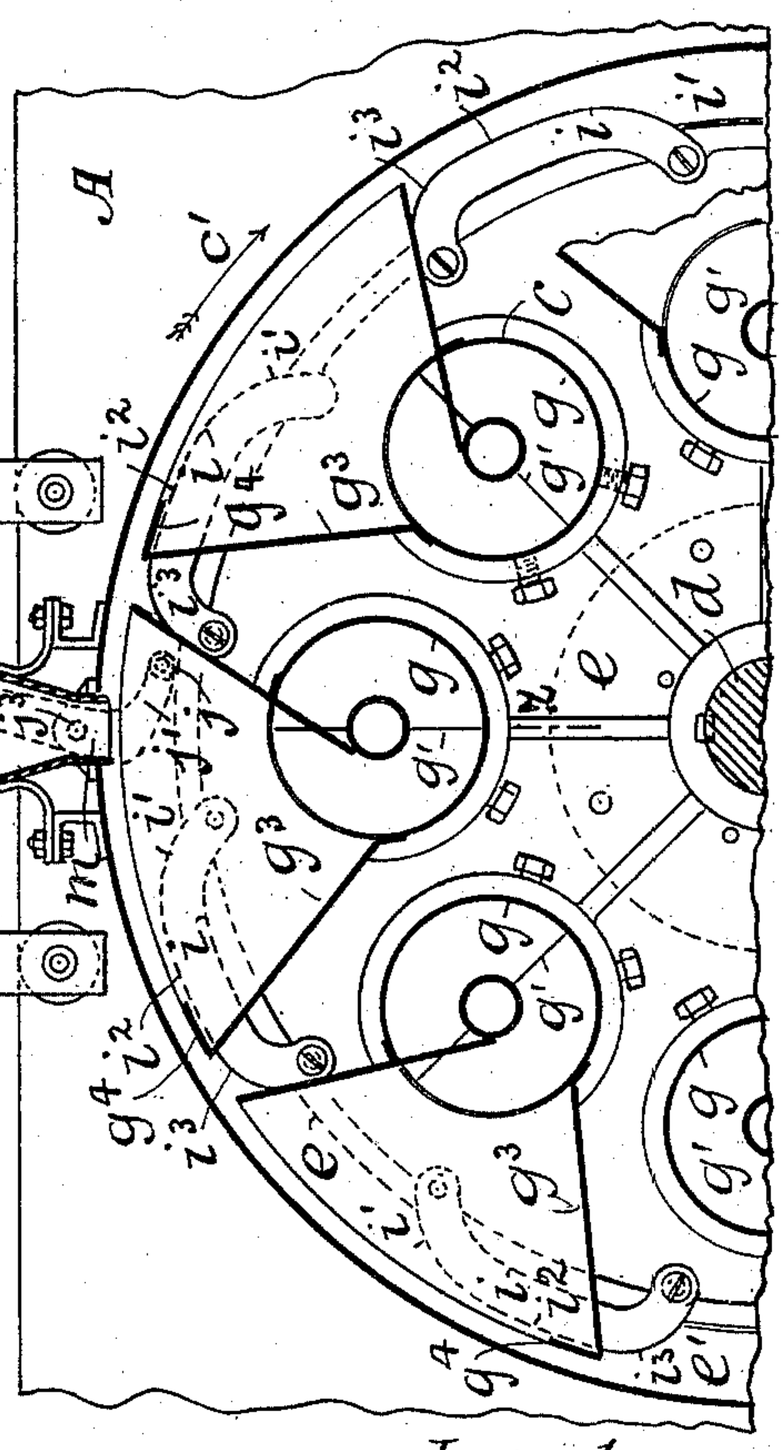

Fig. 5.

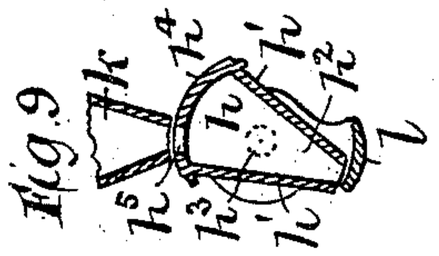

Fig. 9.

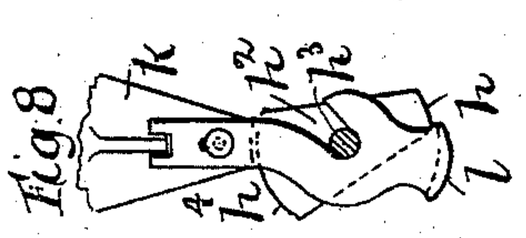

Fig. 8.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DECARBONIZING BONE-BLACK.

SPECIFICATION forming part of Letters Patent No. 585,658, dated July 6, 1897.

Application filed January 14, 1897. Serial No. 619,167. (No model.)

To all whom it may concern:

Be it known that I, JOHN O. DONNER, of Ramsey, New Jersey, have invented certain Improvements in the Art of Decarbonizing Bone-Black, of which the following is a specification.

A certain portion of organic matter taken up by bone-black when employed for filtering sugar liquor is carbonized in the process of revivification and thus charges the particles of reburned black with an excess of carbon.

It is the object of the present invention to secure the systematic removal of this excess of carbon. The method by which the desired result is secured consists in subjecting all the particles of bone-black to uniform conditions of suitably high temperature and environment with a suitable quantity of oxygen. The example of apparatus adapted for this purpose herein shown and described and forming a part of the invention consists of a furnace-chamber heated, preferably, by gas-flames and containing a circularly-arranged group of parallel horizontal tubes inserted at their ends through disks affixed to a central horizontal driving-shaft rotated at prescribed speed from a source of motion outside the furnace. The two disks form parts of the end walls of the furnace-chamber and also corresponding parts of the walls of two air-chambers at the opposite ends of the furnace-chamber, one the feeding-chamber and the other the discharge-chamber. The ends of the tubes projecting into the feeding-chamber are closed, but adjoining its closed ends each tube is provided with an opening in the part of its shell most distant from the driving-shaft, through which opening bone-black is fed into the tube and air is drawn from it. Each tube has interiorly affixed to it a spiral blade or blades having the general characteristics of screw conveyers. By means of suitable devices a prescribed quantity of black which is to be decarbonized is fed into each tube as it passes the vertical plane in traversing the upper part of the feeding-chamber. The spiral blades in the tubes pitch in such directions that the successive charges of black fed into them as they traverse the top of the feeding-chamber tumble along the spiral paths afforded for them as the cage of tubes revolves until they are discharged from the ends of the tubes which project into the delivery-chamber. The heating-chamber is maintained at any desired temperature by appropriately regulating the gas-flames. By means of an exhaust-fan in a flue connected with the feeding-chamber a current of air is drawn into the discharge-chamber, thence through the tubes into and from the feeding-chamber, the quantity of air thus drawn through the tubes being regulated either by varying the speed of rotation of the exhaust-fan or by regulating the area of the port through which air is admitted into the delivery-chamber, or by the employment of both expedients.

The accompanying drawings, illustrating the apparatus, are as follows, namely:

Figure 1 is a central longitudinal vertical section. Fig. 2 is an end elevation showing the feeding-chamber. Fig. 3 is an end elevation showing the discharge-chamber. Fig. 4 is a transverse vertical section taken through the plane indicated by the dotted line $x\ x$ on Fig. 1. Fig. 5 is a transverse vertical section taken through the plane indicated by the dotted line $y\ y$ on Fig. 6. Fig. 6 is a vertical section taken through the plane indicated by the dotted line $z\ z$ on Fig. 5. Figs. 7, 8, and 9 represent details of the vibrating charger and its appurtenances.

The apparatus embraces a furnace A, preferably heated by gas. The gas-supply chamber a is situated beneath one end of the combustion-chamber a'. Air is introduced through the inlet-port a^2, provided with the damper a^3, in part for the support of combustion and in part for mixture with the products of combustion. From the combustion-chamber the products of combustion and any air mixed therewith flow through the passage a^4 into the heating-chamber b, from which they are ultimately discharged into the flue b' of the chimney b^2.

Within the heating-chamber b is the rotating system c of parallel decarbonizing-tubes, arranged equidistantly from each other at like radial distances from the shaft d. A

disk *e*, affixed to the shaft *d*, constitutes a portion of what may for present convenience be called the "front" end of the heating-chamber *b*, and a similar disk *f*, likewise affixed to the shaft *d*, constitutes a portion of the opposite or rear end of the heating-chamber *b*. The disk *e* is a part of the partition separating the heating-chamber *b* from the feeding-chamber *e'*, while the disk *f* separates the heating-chamber *b* from the discharge-chamber *f'*.

The shaft *d* extends through the chambers *b*, *e'*, and *f'*, and has its rear end bearing in the box d', erected upon the top of the pier d^2, and its front end bearing in the box d^3, erected upon the top of the pier d^4. Affixed to the shaft *d* is the worm-wheel d^5, meshing with the rotating worm d^6, by means of which the shaft *d* with the disks *e* and *f* are rotated at a prescribed rate.

The decarbonizing-tubes are alike in construction. Each consists of a hollow cylindrical shell *g*, extending through the heating-chamber *b*, and extending through and affixed to the disks *e* and *f*.

Within the shell *g* and affixed thereto is a screw conveyer *g'*. The front end of the tube, which projects into the feeding-chamber *e'*, is closed by the head g^2, adjoining which is an opening in the shell provided with the flaring hopper g^3, which extends from the tube in a direction radially outward from the shaft *d*. The rotation of the shaft *d* imparts to each tube an orbital motion in the direction indicated by the curved arrow *c'*, and hence during each rotation of the shaft *d* each tube makes one revolution upon its own geometrical axis. While each hopper g^3 is traversing the upper part of the feeding-chamber *e'* there is fed into it from the vibrating charger *h* a prescribed quantity of bone-black which falls to the bottom of the space between the adjacent convolutions of the screw conveyer, from which the charger is transferred into the next adjoining space between the convolutions of the screw by the time the shaft *d* has completed a revolution, and thus again caused the hopper g^3 to traverse the upper part of the feeding-chamber *e'*. By the continued revolutions of the shaft *d* successive charges of bone-black are introduced through the hopper g^3 and are progressively transferred from the front end of the tube to the rear end, from which they fall into the discharge-chamber *f'* and are delivered therefrom through the discharge-spout f^2. The charger *h* is constructed with downwardly-converging side walls *h' h'* and with end walls h^2 h^2, which at the top and bottom are curved concentrically with the axis of vibration afforded the charger by its trunnions h^3 h^3. The concentrically-curved cover h^4 at the top of the charger is provided with the feed-slot h^5. A weighted arm h^6, attached to one of the trunnions h^3, tends to rock the charger into the position in which it is represented in Figs. 5, 7, and 8, in which position the contents of the charger fall through its open lower end into that one of the hoppers g^3 which is at the time traversing the upper part of the feeding-chamber *e'*.

A number of suitably-curved cam-bars *i*, equaling the number of tubes are equidistantly affixed to the disk *e*. After each hopper has moved far enough along the upper part of the feeding-chamber *e'* to have received the contents of the charger the riser *i'* on the adjacent cam-bar engages and rocks upward the crank-pin *j* on the laterally-extending arm *j'* of the bell-crank lever j^2, pivotally supported by the bolt j^3, secured to a standard erected upon the top of the feeding-chamber *e'*. The upwardly-extending arm j^4 is thereby made to sway laterally. A pin j^5, near the extremity of the arm j^4, engages a slot in the lever j^6, which is affixed to one of the trunnions of the vibrating charger. By the motion thus communicated the charger is made to vibrate from the position in which it is represented in Fig. 5 to the position in which it is represented in Fig. 9, in which, as will be seen, the feed-slot h^5 is brought into vertical alinement with the mouth of the spout *k*, while the lower open end of the charger is swung over the stationary shield *l*. The upper end of the lever j^6 is bifurcated and its motion in either direction is arrested by the collision of its prongs j^7 or j^8, as the case may be, with the stop-pin j^9. During the described motion imparted by the cam-bar *i* the weighted arm is swung upward from the position in which it is represented in solid lines in Fig. 7 to the position in which it is represented in dotted lines in the said figure.

The charger is retained in the position in which it is represented in Fig. 9 so long as the pin *j* remains in engagement with the concentric portion i^2 of the cam-bar, which is at the time in operation. As the disk *e* continues its rotating motion the pin *j* is at the appropriate time permitted to ride down the incline i^3 of the cam-bar *i* under the influence of the weighted arm h^6, by the fall of which the charger *h* is swung into its discharging position, which is represented in Figs. 5, 7, and 8.

Bone-black is supplied from the bin *k'* to the spout *k* at an appropriate rate by suitably elevating the gate k^2. It will thus be perceived that the operation of successively feeding prescribed charges of bone-black to the decarbonizing-tubes is performed automatically.

The feeding-chamber *e'* is cylindrical in form and is erected upon the end wall of the furnace outside the disk *e*. At the top the periphery of the feeding-chamber is perforated to admit the mouth *m* of the funnel *m'*, into which the bone-black is delivered from the charger *h* and by which the black is conducted to that one of the hoppers g^3 which is at the time traversing the upper part of the feeding-chamber *e'*. Any bone-black which may drop to the bottom of the feeding-chamber *e'* will be scooped up by the hoppers g^3

while they are traversing the lower part of the feeding-chamber. To enable the hoppers to perform this function, they are each provided with the inwardly-turned flange g^4, as shown.

An air-exhaust fan n is connected by the pipe n' with the feeding-chamber e' and is rotated at such speed as may be required for the purpose of drawing air through the decarbonizing-tubes into and from the feeding-chamber e'.

For the purpose of regulating the quantity of air which may be drawn through the decarbonizing-tubes the end wall of the discharge-chamber f' is provided with apertures n^2, adapted to be wholly or partially closed by the adjustable dampers n^3 n^3.

A pyrometer of any suitable kind is placed within the heating-chamber at any convenient point for the purpose of indicating the temperature of the heating-chamber. In case the temperature in the heating-chamber rises too high more or less cool air is admitted through the inlets o in the rear end wall of the furnace provided with the adjustable dampers o'. The portion of the shaft d which is within the heating-chamber is preferably made hollow and communicates by the apertures p with the feeding-chamber e' and by the apertures p' with the discharge-chamber f'. Hence when the exhaust-fan n is in operation a current of cool air is drawn through the hollow portion of the shaft d, which has the tendency to prevent that portion of the shaft from becoming overheated.

It will be seen that in operation the temperature of the heating-chamber may be varied as required by appropriately altering the supply of gas into the gas-chamber a, the quantity of air admitted through the inlet a^2 for the support of combustion in the combustion-chamber a', and, if necessary, by admitting cold air through the inlet-passages o in the rear end wall of the furnace.

It follows that the two necessary factors in effecting a prescribed partial decarbonization of the bone-black under treatment—to wit, first, the temperature to which the bone-black is subjected, and, secondly, the quantity of oxygen with which the bone-black is environed while under treatment—are perfectly under control.

What is claimed as the invention is—

1. An apparatus for partially decarbonizing bone-black, comprising a heating-chamber; means for heating and controlling the temperature in said chamber; a rotating system of decarbonizing-tubes arranged around and at like radial distances from a rotating shaft which constitutes their common axis of orbital revolution within said chamber; screw conveyers fixed within said tubes; means for successively introducing into each of said tubes prescribed charges of the material to be treated therein; and means for establishing and controlling currents of air through said tubes, whereby during the orbital revolution of each of said tubes the said material will be made to progressively tumble along the convolutions of the screw conveyer from the part of the tube into which said material is fed to the part of the tube from which said material is discharged after having been subjected to prescribed conditions of temperature and environment with the oxygen of the air.

2. In apparatus for partially decarbonizing bone-black comprising a heating-chamber together with a feeding-chamber and a discharge-chamber arranged at opposite ends of the said heating-chamber; means for heating and controlling the temperature in said heating-chamber; a rotating shaft extending through said chambers, and means for rotating said shaft; disks affixed to said shaft and forming portions of the end walls of said heating-chamber; a system of decarbonizing-tubes, provided with interiorly-fixed screw conveyers, and grouped around said shaft and having their opposite ends affixed to and projecting through said disks into said feeding-chamber and into said discharge-chamber respectively; each of said tubes provided at one end with a feed-opening adapting it to receive a prescribed charge of material to be treated at a prescribed stage in each of its successive traverses of the upper part of said feeding-chamber and adapted at its opposite end to progressively discharge its contents into said discharge-chamber; an exhaust-fan suitably connected with said feeding-chamber, and air-inlets provided with dampers for admitting air into said discharge-chamber, substantially as and for the purposes set forth.

3. In an organized apparatus for partially decarbonizing bone-black containing a rotating system of decarbonizing-tubes arranged within a heating-chamber and projecting therefrom into a feeding-chamber; hoppers affixed to the parts of said tubes projecting into said feeding-chamber, each of which hoppers is provided upon one of its edges with an inwardly-turned flange for the purpose of enabling the hopper to act as a scoop during its traverse of the lower part of said feeding-chamber.

4. In an organized apparatus for partially decarbonizing bone-black containing a rotating system of decarbonizing-tubes arranged within a heating-chamber and projecting therefrom into a feeding-chamber, and provided with suitable hoppers, the combination, as herein set forth, of a system of cams rotating with the said system of tubes; a vibrating charger, provided at the top with a feed-opening adapting it, when occupying one of its extreme positions to receive a charge of bone-black from a suitably-arranged spout; a system of levers adapted to be actuated by said cams successively for the purpose of moving said vibrating charger into position to receive its charge; a stationary shield for closing the mouth of the charger at the time when it is receiving its charge; a weighted arm for vibrating the charger to its opposite position

when the lever system is released from the action of the cams, whereby the contents of the charger will be discharged into that one of the tubes which is at that time traversing the upper part of said feed-chamber.

5. The combination, as herein set forth, of the described rotating system of decarbonizing-tubes provided with hoppers arranged within a feeding-chamber; a system of cams rotating with said tubes; a vibrating charger adapted to contain a prescribed charge of bone-black; a weighted arm for rocking said charger in one direction; connections between said charger and the path of movement of said cams, whereby said charger will be alternately rocked in one direction to receive a prescribed charge of bone-black from a suitably-arranged spout and in the opposite direction to deliver its charge of bone-black into that one of the said hoppers which is at the time traversing the upper part of said feeding-chamber.

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