2 Sheets—Sheet 1.

G. MILBANK.

Middlings Purifying and Separating Machine.

No. 198,775. **Patented Jan. 1, 1878.**

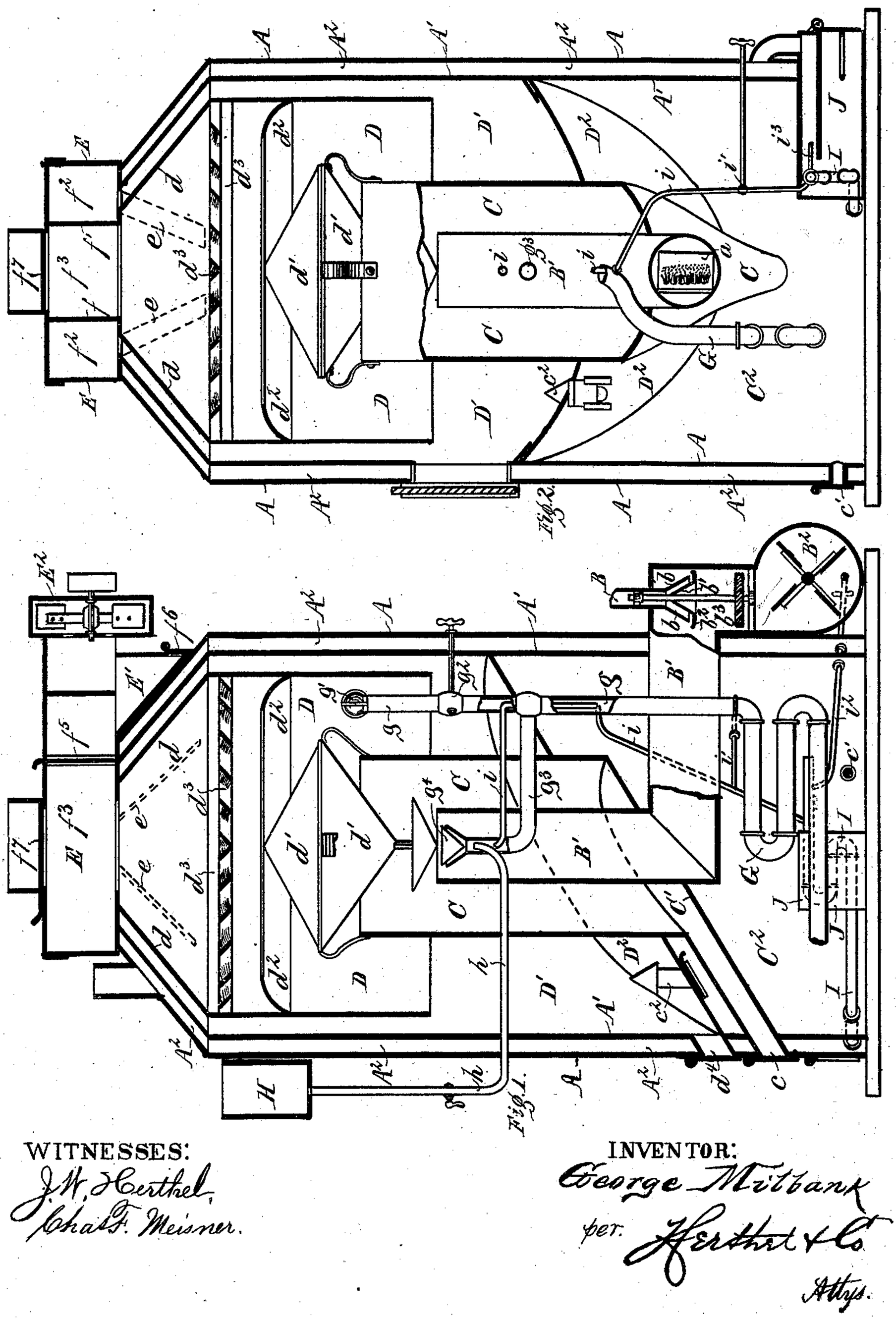

Fig. 2.

Fig. 1.

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Attys.

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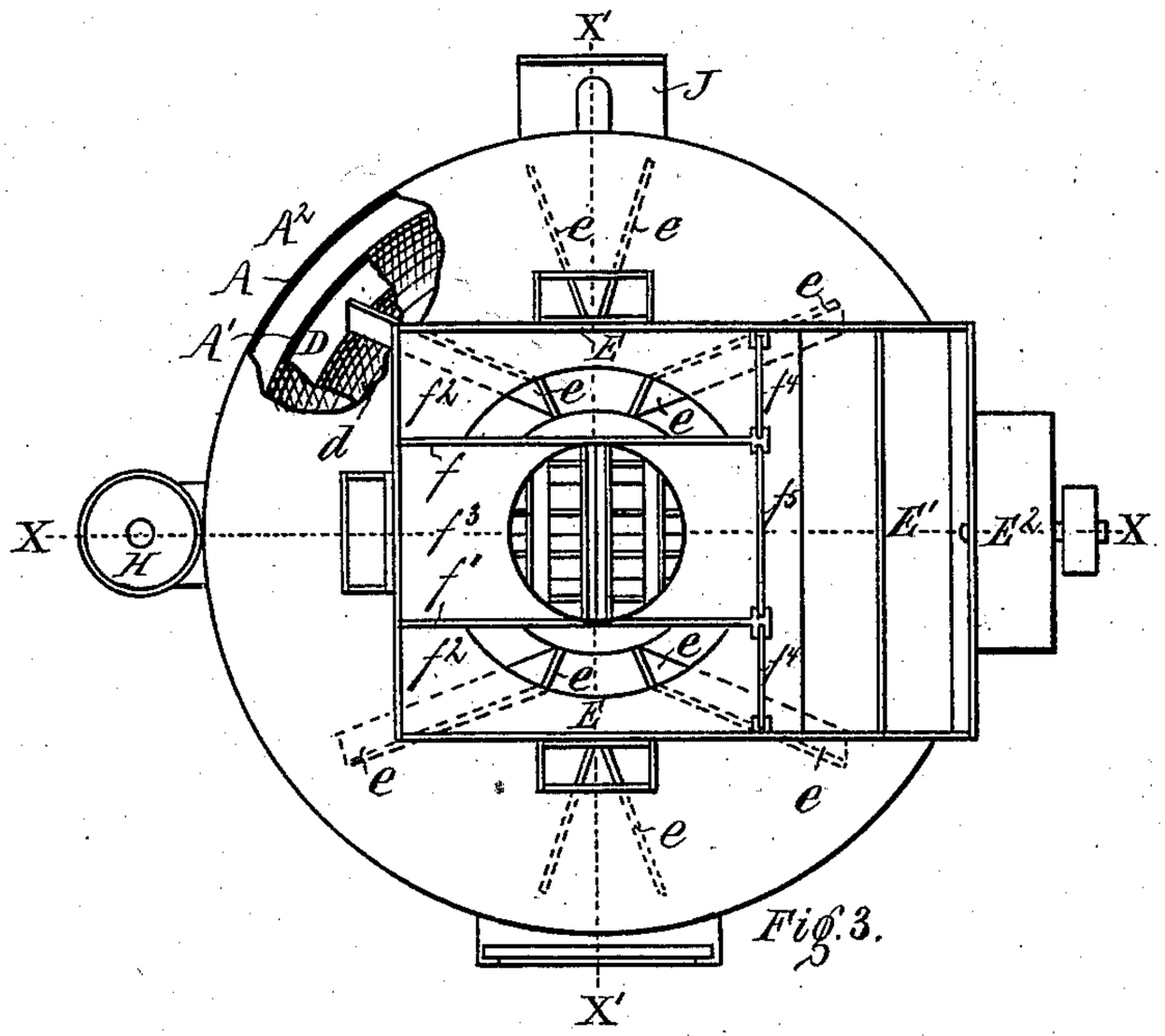

Fig. 3.

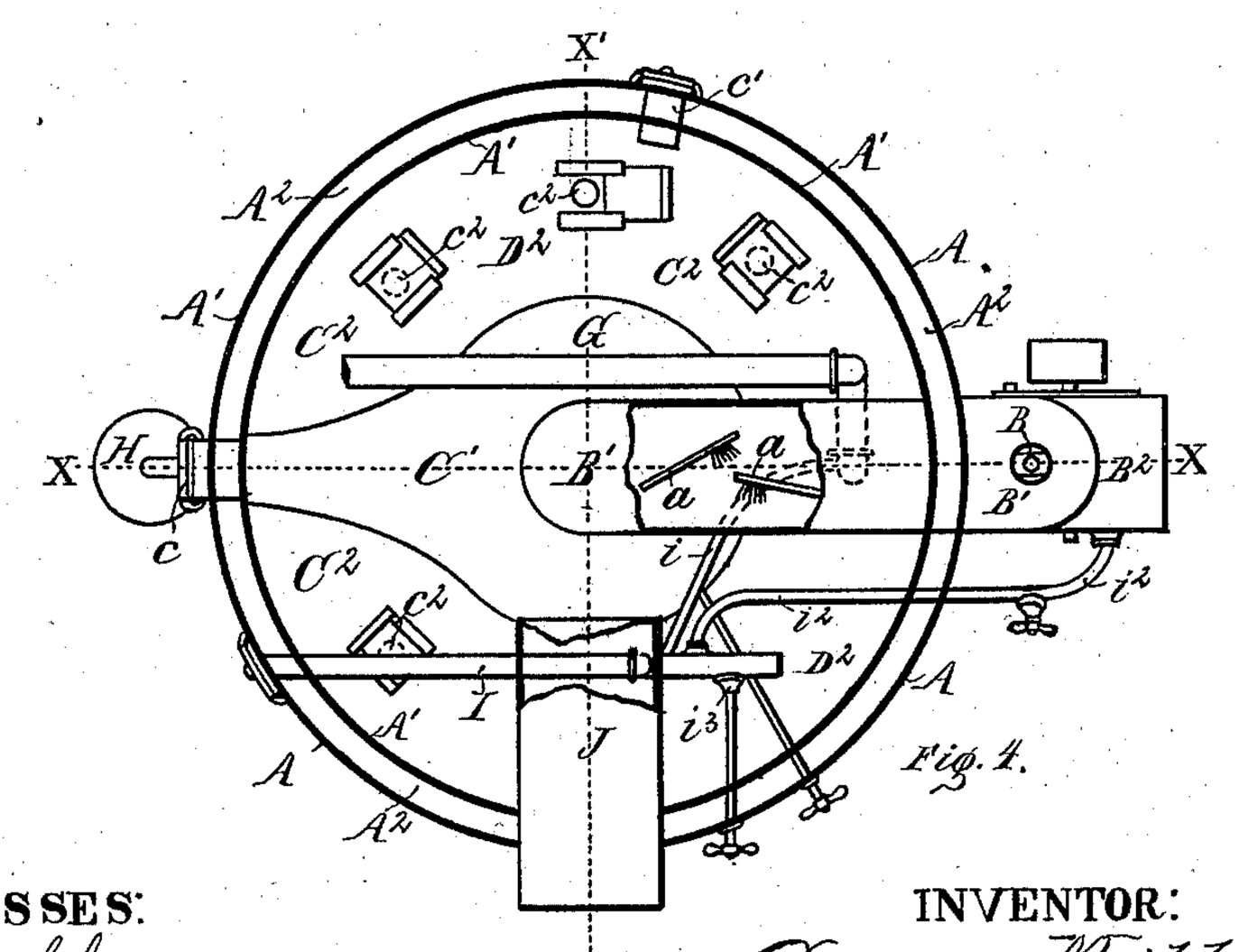

Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE MILBANK, OF CHILLICOTHE, MISSOURI.

IMPROVEMENT IN MIDDLINGS PURIFYING AND SEPARATING MACHINES.

Specification forming part of Letters Patent No. **198,775,** dated January 1, 1878; application filed April 3, 1876.

To all whom it may concern:

Be it known that I, GEORGE MILBANK, of Chillicothe, Lvingston county, and State of Missouri, have invented an Improved Apparatus for Purifying Middlings, Flour, Meal, &c., of which the following is a specification:

This invention relates to a machine or apparatus adapted for the purpose of purifying middlings, flour, meal, &c., by separating the heavier impurities and the lighter impurities, also must, weedy, earthy, old, strong, or other impure smell or taste from said middlings, flour, meal, &c. Besides suction and blast, singly or combined, in my invention, steam or hot air, water, or other purifying fluid or vapor is used, to suit the particular requirements of the particles to be purified.

The nature of my invention relates, therefore, to an improved construction of parts, their combination, and the agencies or means employed for dampening or drying the particles, all of which will now more fully appear.

In the drawings, Figure 1 is a sectional elevation on line X X of Figs. 3, 4. Fig. 2 is a sectional elevation on line X′ X′ of Figs. 3 and 4. Fig. 3 is a top plan with cover of fan-chamber removed. Fig. 4 is a bottom plan, showing interior parts.

A represents an exterior casing. A^1 is a similar casing, arranged so as to create the annular chamber A^2. The chamber A^2 serves as a smoke stack or conductor, and protects the parts within from outside atmospheric influences, and still further increases the heat within the apparatus. Hence the top of A^2 is closed and provided with chimneys.

The middlings, flour, meal, and the like particles to be cleaned or treated are, by blast or suction, or both combined, carried upward, in order to be subjected to the required process of separation and purification. B represents the feed-spout. It enters a main feed-spout, B^1, which leads to the chambers within the apparatus. This main feed-spout also serves as a blast and suction spout.

B^2 is the blast-fan attachment to the main spout. The suction-fan attachment is at top, as will hereinafter appear. As the feed is entered into the feed-spout B, it is subjected to the action of certain operating parts that I arrange within the main feed-spout. These parts are as follows: The middlings, flour, or meal entered in feed-spout B fall out of its funnel-shaped mouth *b* (see Fig. 1) upon a centrifugal feeder situated in the main feed-spout B^1, and revolved by a vane-wheel, said centrifugal feeder consisting of a cone, b^1, situated on a saucer-shaped plate, b^2, on the shaft which carries the vane-wheel b^3. (See Fig. 1.) The particles falling upon the cones are spread upon a saucer-shaped plate, which, with its upturned edge and revolving motions, throws the particles outward and upward, and by that means gravitation is arrested, and the currents assisted in starting the particles through main feed-spout. If, however, a portion of the particles should fall below plate onto vane-wheel, it, with its inclined wings, again throws said particles upward, and the current is assisted, as before, in starting the particles through feed-spout B^1.

The main feed-spout B^1 I arrange to pass through both casings A A^1 up along the center to the height indicated in Figs. 1 and 2. As shown at *a*, Figs. 2 and 4, within the main spout I place inclined pieces or brushes, in such manner that the particles passing glide upon them, and by that means are scoured or brushed.

As shown in Figs. 1 and 2, I arrange, surrounding the feed-spout B^1, the chamber C, its bottom resting upon a discharge-hopper, C^1, while its open top partly extends within a top chamber, D. From main feed-spout B^1 the middlings, flour, meal, &c., enter the chamber C, which I call "center expansion-chamber." It being larger than the feed-spout B^1, the air is expanded, and by that means its power is reduced, it being now sufficient to carry the purer particles and lighter impurities only out at the top of said expansion-chamber C. The heavier impurities, such as germs, specks, dirt, &c., whose specific gravity is greater than the purer particles, gravitate below, falling upon the hopper-shaped and inclined bottom C^1, (see Figs. 1 and 2,) and passing out the outlet *c*, Figs. 1 and 4. The outlet *c* is controlled by a flap-valve, which closes by force of suction, or opens by weight of particles on the inside, allowing the same to pass out. A distinct separation and purification have by these means taken place—viz., the germ, specks, dirt, &c., that are

heavier than the pure middlings, flour, meal, or the like, are thus first separated and discharged—an improvement and advantage and result not heretofore accomplished. The remaining particles are, by the further means now to be described, passed through a further process of separation.

The center expansion-chamber C now acts as feed-spout to a top chamber, D. This chamber D, by its cone-shaped outlet *d*, Figs. 1 and 2, communicates with the top fan-chamber E. The bottom of the chamber D is open, so that particles in the same can drop out below. Further, this top chamber D has current-regulating, scouring, and brushing devices, consisting of a double cone, d^1, placed over the center of the main feed-spout B^1, an inner projecting flange, d^2, and inclined pieces d^3, placed crosswise, one above the other, all shown in Fig. 1.

I call the chamber D a "top expansion-chamber," for the air in the same is more rarefied than in C. Such particles as drop out below D enter the outer chamber D^1, formed by the interior casing A^1. This chamber D^1 I call "outer expansion-chamber," the air in same being still further rarefied. At D^2, Figs. 1 and 2, I provide the outer chamber D^1 with a hopper similar to that of chamber C, so arranged that the droppings on the same will be discharged out of the outlet d^4, Fig. 1, which also has a flap-valve for the discharge-opening. The top of the outer expansion-chamber is cone-shaped, connecting also with the fan-chamber E at top.

The space between the cones at the top I provide with partitions *e*, (see Figs. 1, 2, 3,) which serve to divide the currents, giving equal upward current all around outside of chamber D.

The impurities, offal, and light stuff from each of the expansion-chambers C D D^1 enter the fan-chamber E at top by way of separate compartments. Thus I provide the fan-chamber with the partitions f f^1, (see Figs. 2 and 3,) which divide the outlets of each expansion-chamber, the light stuff entering the side chambers f^2 from the outer expansion-chamber D^1, and the lighter particles and impurities from the top expansion-chamber entering the outer chamber f^3. (See Figs. 2 and 3.) The chambers f^2 f^3 are controlled by slides f^4 f^5, (see Fig. 3,) which pass down through proper slots in the closed top of the fan-chamber, and so that said slides will open or close the outlets of the respective chambers f^2 f^3, with a discharge-chute, E^1, forming part of the bottom of fan-chamber, and having discharge-outlet controlled by a flap-valve at f^6, Figs. 1 and 3. The power of the air in the expansion-chamber D is therefore only sufficient to carry the lighter particles and impurities out of the top of said chamber in case the top of fan-chamber is closed by the slide f^7 at top, while the slide f^5 is open, and the lighter particles and impurities will thus enter said fan-chamber. The purer and heavier particles, however, gravitate below, and fall upon the hopper or inclined bottom D^2, passing out at outlet d^4. In the fan-chamber the lighter particles and impurities are again divided by expansion and varying directions of the current, the heavier particles falling and passing out at the opening at f^6, and said discharged particles can then be repassed to feed-spout, to be again operated upon, the final exit and discharge of the lighter impurities being, however, into and out of the suction-fan E^2.

For the better purification of the purest particles gravitating to bottom D^2 of outer expansion-chamber D^1, I can open a valve, c^1, (see Figs. 1 and 2,) when using suction-fan. By this means outside air is allowed to enter the bottom chamber C^2, and from said chamber the air passes upward through one or more flues, c^2, (see Figs. 1, 2, and 4,) in the bottom D^2 of expansion-chamber D^1, and thus creates an upward draft, which carries upward and out the lighter impurities that may have escaped from the top expansion-chamber D. A cone over the flue c^2 prevents the pure particles from dropping through said flue or flues into the chamber C^2.

That the ascending impurities may avoid coming in contact with the gravitating particles from the top expansion-chamber D, I open the slides f^4, which causes the draft to pass upward outside of the top expansion-chamber D. By varying the quantity of air passing in at the valve c^1, I can also regulate the force of the current in each chamber C and D in proportion to each other—that is, if the force of the current is too great in expansion-chamber C, and right in expansion-chamber D, I can open valve c^1 and allow the suction-fan to get part of its supply of air from that source, and thus less will pass up the feed-spout B^1 into the expansion-chamber C, and hence the power of air in same will be reduced, while the force of the current in expansion-chamber D will remain the same. If, however, by closing valve c^1 I do not have enough draft upward in outer expansion-chamber D^1, (below bottom chamber D,) I can open the slides f^4 f^4, which enables me to open said valve c^1, and yet not interfere with drafts in expansion-chambers C D, as the air passes into the suction-fan without going through the expansion-chamber D. By closing the slides f^4 f^4 the draft below chamber D is reduced or turned up through said chamber. I can use the blast-fan alone, by closing the slides in fan-chamber and opening the top slide f^7. The middlings, flour, meal, &c., will then be blown up out of main feed-spout B^1 into expansion-chamber C, thence to D, and out of same at top, each of the expansion-chambers dropping the heavier particles, and the lighter particles passing out at top. In case I need more power than one fan can give, I use both suction and blast fans together.

The means thus far described are for purifying and separating middlings, flour, meal, &c., that are free from dampness, or musty, weedy, earthy, old, strong, or other impure smells or tastes. To treat particles so affected, I get heat into the outer expansion-chamber

D¹, through its bottom and its short spouts, from the lower chamber C², which, for this purpose, I call a "reservoir for heat." The heat I create by the employment and use of steam-coil, hot-air coil, furnace, or other like means. Hence, within the apparatus G (see Figs. 1, 2, and 4) is a coil of steam-pipes, one end thereof connecting to an exterior boiler. The top end *g* of steam-coil extends upward, (see Fig. 1,) and is provided with a ball-valve, g^1, which rises by pressure of steam, and spreads the same; but when no steam is issuing the valve drops to its seat, and keeps the dust out, the amount of steam to escape out of pipe *g* being regulated and controlled by a globe-valve at g^2. As, therefore, the particles falling from the expansion-chamber D have a suitable distance to pass through, and that through a suitable temperature, in order to reach the hopper of the chamber D¹, said particles have their dampness removed, and those that are purified pass out, as before described. If, however, the middlings, flour, meal, &c., contain must or other impure smell, before mentioned, more than the dampness they contain could carry off, to further dampen, all that is required is to allow steam to issue at *g*. Again, I can apply the steam in feed-spout B¹ by a branch pipe, g^3, (see Fig. 1,) controlled by a suitable valve. At the outlet g^3 I have a funnel-shaped mouth, with an inverted cone, g^4, in the opening, for spreading the steam and keeping out the dust when not in use. The rush of steam, displacing air above, causes a suction in lower part of main feed-spout B¹, and a blast above it, and, to the amount of its power, either wholly or in part makes the use of either suction or blast fans, or both, unnecessary under some circumstances.

To further dampen and purify, if necessary, I can use water or other purifying fluids obtained from a tank, H, conducted by pipe *h*, having proper stop-cock. The fluid thus conducted enters the steam-pipe g^3, when, by the action of the steam, the water is atomized, and passed out and applied with the steam.

In case the steam contains less heat than required, I obtain more heat by means of a hot-air pipe, *i*, connected with a hot-air coil, I, (see Figs. 1 and 2,) the quantity of this being regulated by valve at *i'*. The hot-air pipe *i* passes up the interior of the steam-pipe *g;* thence out of same along the top of the branch pipe g^3, and finally enters same near its discharge, (see Fig. 1,) and thus the heat is passed out of said branch along with the steam. One end of the hot-air coil connects outside the casing A, so as to derive the outside air for the purpose of being heated. After being suitably dampened, the particles fall from the chamber D to bottom of D¹ through the heated air, and thus said particles are again dried, the impure smell, taste, &c., being carried off with the dampness, and the purified particles passing out at outlet d^4, as before described.

To further purify, however, by separating the lighter impurities from the dampened and dried particles, I open slides f^4 f^4, which give the lighter impurities the means of exit, which otherwise they would not have, for as the lighter particles, (impurities,) by absorbing dampness in expansion-chamber D, would become too heavy, they gravitate below, where they would again become light by drying, and, passing up again, absorb dampness, and in this way continue to vibrate from one chamber to the other. This is prevented, as just above mentioned.

By opening the top slide f^7 and closing f^5 the steam or dampness has a direct means of exit from the chamber D. As the impure or damp particles will contain the greatest amount of dampness in the upper part of chamber D¹, the higher temperature can be used, and is needed, for the prevention of condensation.

The hot-air pipe can be used for conducting heat with or without steam into the chamber D, in order to still further increase the temperature in said chamber. Also, I can obtain heat from hot-air coil by connecting a pipe, i^2, with the blast-fan, controlled by a suitable cock. (See Figs. 1 and 2.) Thus from the blast-fan the heat is forced into top chamber D, and said hot air in feed-spout B¹ also dries pure as well as impure particles.

J represents a suitable furnace.

To regulate the temperature in the outer chamber D¹, I open the valve c^1, letting in cold air, or reduce the fire or pressure of the steam, or open the furnace-door. For a higher temperature I can open a valve at i^3, (see Figs. 2 and 4,) letting in hot air, or I can increase the steam-pressure or fire.

What I claim is—

1. In a middlings-separator, the combination, with blast-fan B² and feeding-passage B¹, of the feed-spout B, having funnel-mouth C, and centrifugal feeder, consisting of cone b^1, saucer b^2, and vane-wheel b^3, substantially as shown and described, for the purpose specified.

2. In a middlings-separator, the combination, with blast-fan B² and upward open-top feeding-passage B¹, of open-top settling-chamber C, open-bottom expansion-chamber D, outer settling-chamber D¹, and suction-fan E², communicating with chambers D D¹, said feeding-passage and chambers being arranged one within another, substantially as and for the purpose set forth.

3. In a middlings-separator, the combination, with blast-fan B² and upward open-top feeding-passage B¹, of open-top settling-chamber C, open-bottom expansion-chamber D, outer settling-chamber D¹, suction-fan E², and discharge-bottoms D² C¹, all constructed and arranged substantially as shown and described, for the purpose specified.

4. In a middlings-separator, the combination, with open-top feeding-passage B¹ and open-top settling-chamber C, of double cone d^1 and open-bottom expansion-chamber D,

provided with internal flange d^2 and fixed beaters d^3, substantially as shown and described, for the purpose specified.

5. In a middlings-separator, the combination, with suction-fan E^2, of the fixed air-current deflectors and beaters e, arranged in the annular cone-space forming the upper part d of settling-chamber D, substantially as and for the purpose specified.

6. In a middlings-separator, the combination, with settling-chamber D^1 and expansion-chamber D, of suction-fan E^2 and chamber E, divided into compartments f^2 f^3, communicating with the fan through independent adjustable openings f^4 f^5, whereby the upward currents in the chambers D D^1 may be regulated independently of each other, substantially as and for the purpose specified.

7. In a middlings-separator, the combination, with suction-fan f^2, expansion-chamber D, and settling-chamber D^1, having bottom D^2, with elevated flue c^2 therein, of adjustable valve c in the outer wall of lower chamber C^2, substantially as shown and described, for the purpose specified.

8. In a middlings-separator, the combination, with suction-fan E^2, central open-top settling-chamber C, expansion-chamber D, and settling-chamber D^1, having bottom D^2, with elevated flue c^2 therein, of adjustable valve c^1 in the outer wall of lower chamber C^2, substantially as and for the purpose specified.

9. The process of purifying middlings, flour, meal, &c., by subjecting the particles to the action of steam or water, or both water and steam combined, for dampening the said particles in the manner described, and further subjecting said dampened particles to a drying action by the use of hot air, as herein described, in order thereby to remove from said particles must, bad odor, and other injurious qualities.

10. In a middlings-separator, the combination, with the expansion-chamber D and feeding-passage B^1, of the steam-coil G and branch thereof projecting into said chamber, and provided with a self-closing valve, g^1, substantially as and for the purpose specified.

11. In a middlings-separator, the combination, with feed-spout B^1 and expansion-chamber D, of the steam-coil G, and branch pipe g^3, with steam-spreading devices, constructed and arranged substantially as shown and described, for the purpose specified.

12. In a middlings-separator, the water-tank H, having pipe h, in combination with steam-pipe g^3, steam-coil G, feeding-passage B^1, and expanding-chamber, into which the middlings are fed, substantially as shown and described.

13. In a middlings-separator, the hot-air coil I, provided with branch i, in combination with feed-passage B and expanding-chamber, into which the middlings are fed, substantially as and for the purpose set forth.

14. In a middlings-separator, the combination, with feeding-passage B^1, chambers D^1 and C^2, communicating therewith by adjustable opening c^2, of a steam-coil, G, communicating with the feeding passage or chambers for dampening and drying middlings, substantially in the manner and for the purpose set forth.

In testimony of said invention I have hereunto set my hand.

GEORGE MILBANK.

Witnesses:

WILLIAM M. HERTHEL,

CHAS. F. MEISNER.