(No Model.) 2 Sheets—Sheet 1.

J. HIGGINBOTTOM.

SIEVING, SEPARATING, AND PURIFYING APPARATUS.

No. 556,148. Patented Mar. 10, 1896.

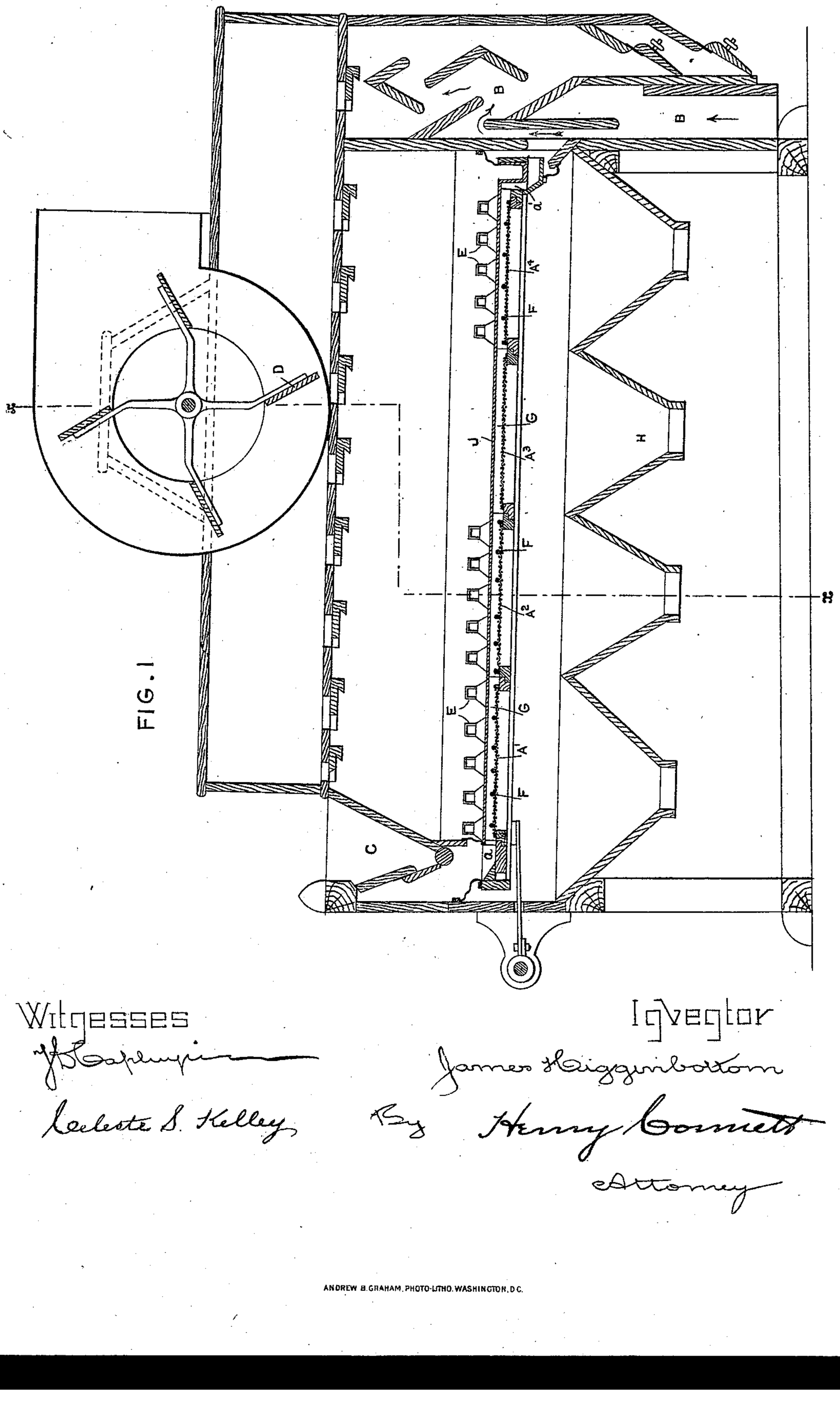

FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2.

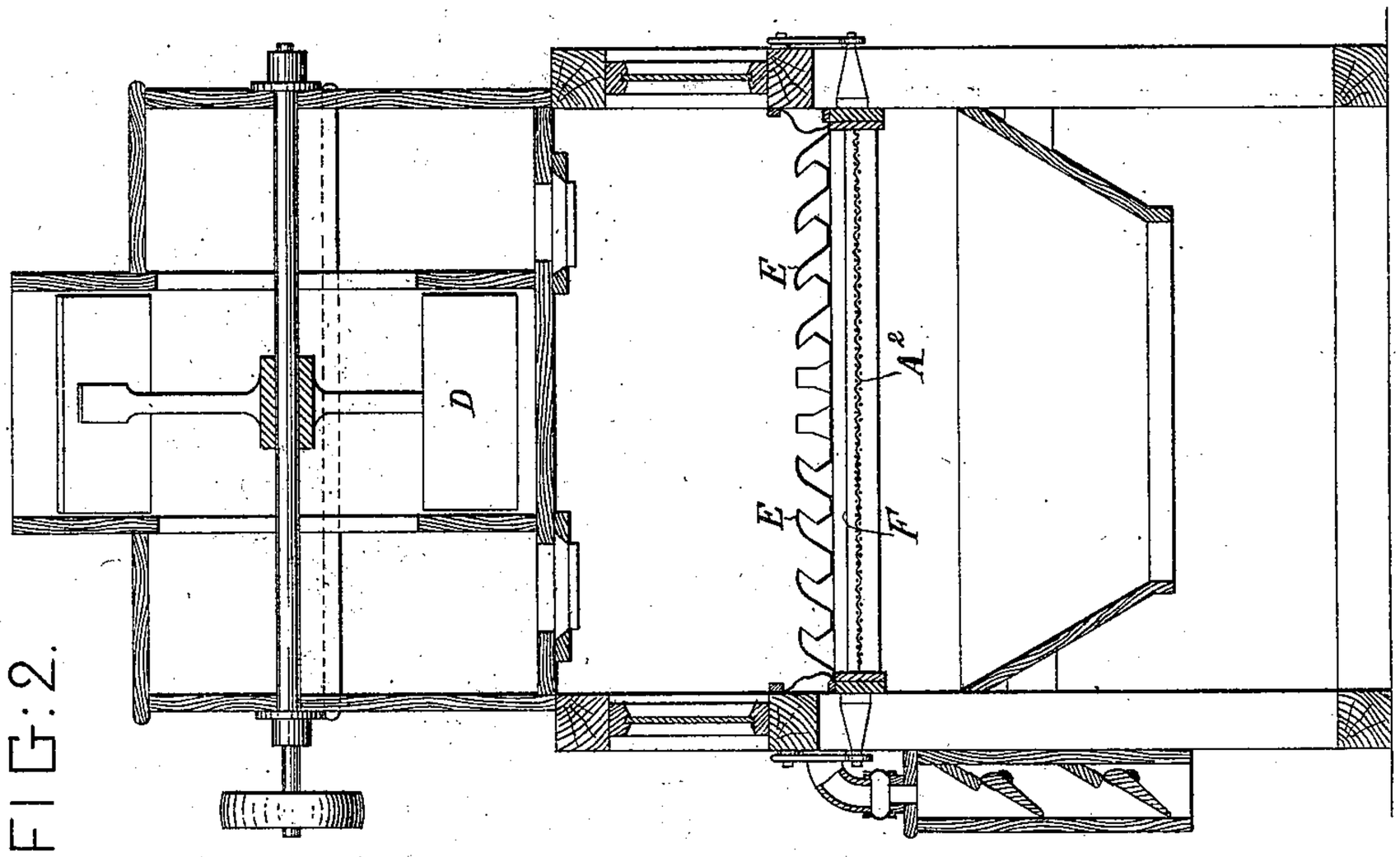


FIG. 3.

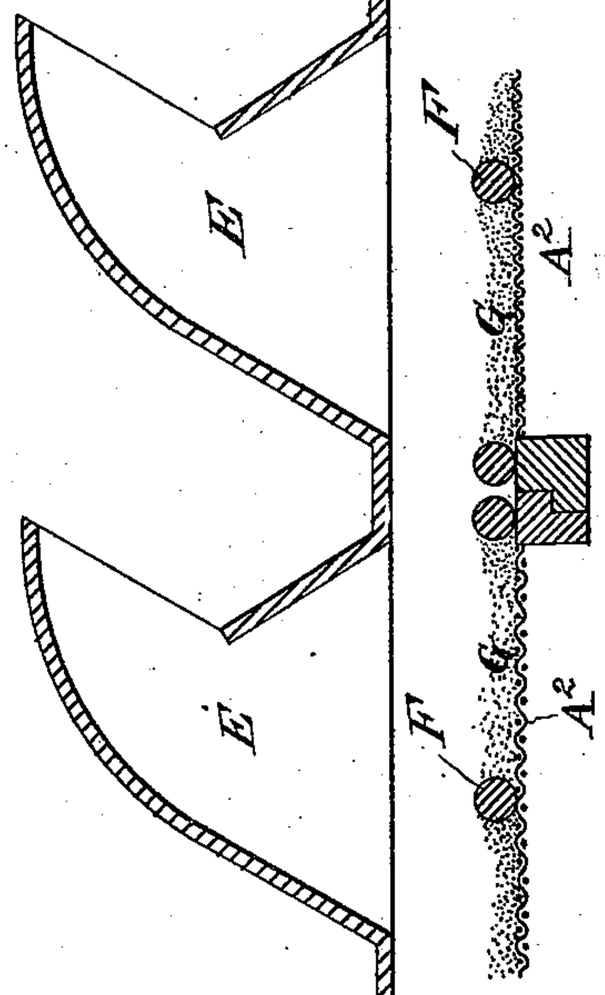
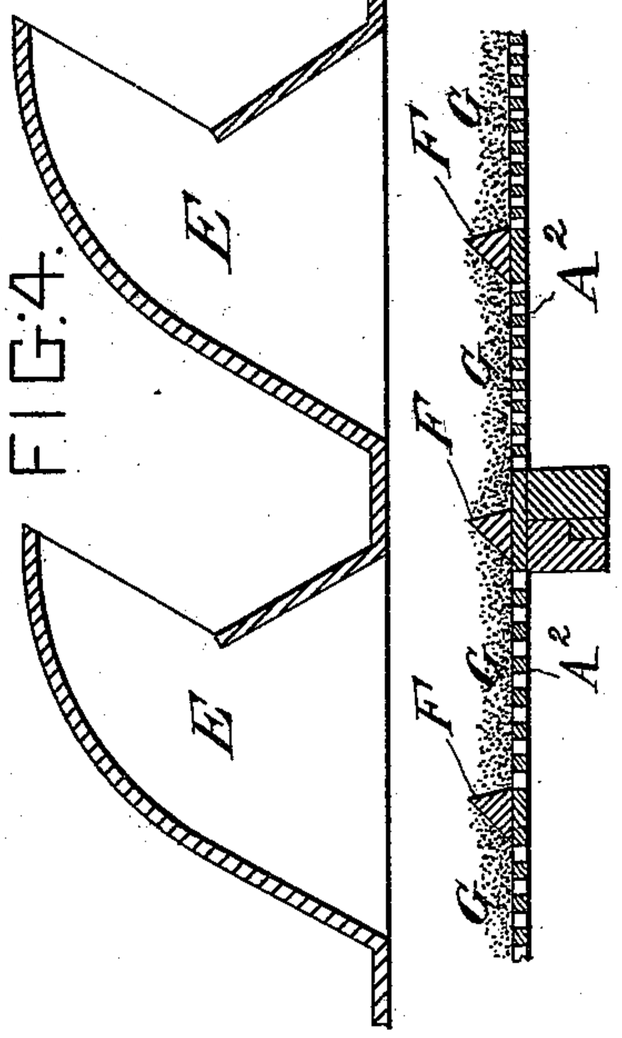


FIG. 4.



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UNITED STATES PATENT OFFICE.

JAMES HIGGINBOTTOM, OF LIVERPOOL, ENGLAND.

SIEVING, SEPARATING, AND PURIFYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 556,148, dated March 10, 1896.

Application filed September 10, 1889. Serial No. 323,498. (No model.) Patented in England January 16, 1889, No. 793, and August 12, 1889, No. 12,692.

To all whom it may concern:

Be it known that I, JAMES HIGGINBOTTOM, a subject of the Queen of Great Britain, and a resident of Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Sieving, Separating, and Purifying Apparatuses, (for which I have been granted patents in England, January 16, 1889, No. 793, and August 12, 1889, No. 12,692,) of which the following is a specification.

My invention relates to certain improvements in the method of and apparatus for sieving, separating, and purifying granular, pulverulent or other like material in cases where such material is passed, during treatment, over a horizontal or inclined vibratory sieving-surface which is under the action of an uprising current of air.

The invention is specially applicable to the separation of bran, cellulose, or the like from semolina, coarse middlings, dunst or fine middlings, and flour.

At the various stages of the modern flour-milling systems now in use there are many intermediate products. These products are known to the trade by various terms, such as "break-meals," "semolina," "middlings," "dunst," (that is, fine middlings,) and "flour," and they are of varying degrees of fineness or coarseness, according to the meshes of the wire, silk, &c., by which such products have been separated.

The products are made in the "breaking down" and reducing of the wheat, and each product consists of a mixture, in varying proportions, of, first, the white interior of the wheat; second, the exterior or skin of the wheat; third, the germ of the wheat, both broken and whole, (or unbroken;) fourth, some of the particles of each product, when closely examined, are found to contain thin flakes or layers of branny matter from the outside of the skin of the wheat; fifth, other particles consist of the outer skin or bran of the wheat with a small portion of the white interior of the wheat adhering to the same; sixth, other particles consist of cellulose or fluffy matter, which is disintegrated in breaking down the white interior of the wheat; seventh, other particles consist of branny dust, which has been produced during the breaking down of the wheat, from the abrasion of the outer skins of the wheat and branny or germy dust from the torn or broken edges of the wheat-skins and from the torn edges of the broken germs.

The bulk of the particles of the flour, dunst, middlings and semolina products consists of the good material—namely, the white interior of the wheat mentioned in the above paragraph.

In the ordinary processes of modern milling it is usual to separate the good white material in the dunst, middlings, and semolina from the impure material therein as perfectly as possible before such good material is reduced into or used as flour for bread-making purposes, and my invention enables this to be done, as I believe, more perfectly than hitherto.

My invention is also applicable for separating and purifying the flour itself—namely, for removing the very fine impurities which have become incorporated with the flour and which have passed through the same mesh as the flour.

To accomplish these purposes, millers use the well-known sieve-purifier, and the object of my invention may be explained in the best and simplest manner by describing its application in detail to the purification of one of the above-named products—namely, to the semolina from the break-meal obtained in breaking down the wheat.

In the accompanying drawings, illustrative of my invention, Figure 1 is a longitudinal vertical section of a purifier provided with an apparatus constructed according to my invention. Fig. 2 is a transverse section of the same on the line $x\ x$ in Fig. 1. Figs. 3 and 4 are detail views, on an enlarged scale, of parts of my apparatus to be hereinafter fully described.

The before-mentioned semolina product having been separated or passed through, say, for example, a mesh of eighteen per inch and having passed over a mesh, say, of fifty per inch, it is, in ordinary practice, passed onto a sieve $A'\ A^2\ A^3\ A^4$ of a purifier having a mesh of forty per inch at the head end, a, and gradually becoming coarser, say to a mesh of thirty per inch, at the tail end, a', such gradations of covering being preferably in four distinct sections, say as follows: first, section of sieve A', forty meshes per

inch; second, section of sieve A^2, thirty-four meshes per inch; third, section of sieve A^3, thirty-four meshes per inch; fourth, section of sieve A^4, thirty meshes per inch; also, the overtails are usually aspirated after leaving the sieve by an aspirator, such as B. Such semolina product is passed at a suitable rate of feed through a feed-hopper C onto the sieve of the purifier, and its composition, as it is fed onto the sieve, consists of particles which are of the above-described kinds, and they are also of varying sizes and shapes. The size of the largest and the smallest of each kind is regulated by the size of the meshes by which the semolina has been previously separated. It is obvious that there are all sizes of particles of each kind of material between the limits of those particles which will not pass through a mesh of fifty per inch and those particles which will pass through a mesh of eighteen per inch.

In a purifier having, as ordinarily constructed, a vibrating sieve A' A^2 A^3 A^4 and an exhaust-fan D adapted to produce uprising currents of air through the meshes of the vibrating sieve, and having also a series of channels or a tray of nozzles E over the sieve for collecting and removing the impurities which are separated and deposited thereon by such air-currents, the action of the apparatus is as follows: The semolina feed consisting of finer and coarser particles of the above mixture passes onto the sieve at the head end, a, thereof, and as it gradually travels toward the tail end, a', thereof it is under the combined action of the vibratory motion of the sieve and the uprising air-current, which conjointly cause the particles of impurities which are of a less specific gravity than the good white material to accumulate near the top of the material on the sieve, while the good material passes down through the meshes of the sieve, and is thereafter collected; also, the uprising air-current carries away a portion of the lighter and finer impurities, and these are deposited in channels and carried away by the same, or they are deposited on a collecting-tray of nozzles E placed over the sieve, or in cases where channels or nozzles are not used these impurities are carried away by the fan and deposited outside the machine in stive-rooms, cyclones, or dust-collectors, as will be well understood by millers, or in some cases these impurities are collected inside the machine by means of textile dust-collectors or other equivalent devices.

It is well known to millers that the best purification of the material is effected when the surface of the vibrating sieve is covered with the material to such a sufficient depth that the impurities are kept floating or suspended near the top of the layer and out of direct contact with the sieve-surface.

Now my invention enables the layer of the material on the sieve to be kept at any desired thickness over any portion of the surface as it is traveling over the same toward the tail a' thereof, and this is accomplished without the necessity of allowing a large proportion of the good material to pass over the tail of the sieve.

To accomplish the above result, I place ribs F, either fixed or adjustable, at intervals across the sieve-surface, thus forming a series of sieve-surface spaces G, having a rib F between each two adjacent spaces, the top edges or faces of such ribs being fixed at such a height above the sieve-surface, having regard to the pitch and the inclination, if any, of the sieve, as will cause the surface of the sieve between each two successive ribs to become covered to the desired depth by the material passing over said surface. I prefer to make these ribs F of a sloping or curved form on their upper faces, so as to facilitate the passage of the material over the top of the ribs from space to space, as seen in Figs. 3 and 4. When the sieve-covering is formed of silk or other textile material, it is preferable to make the ribs of cord, as seen in Fig. 3, and to stitch them to the covering; but when the sieve-covering is of metal, as in Fig. 4, it is preferable to make the ribs also of metal and solder or otherwise fix them thereto. I have represented the difference of mesh of the sieve-sections only in Figs. 3 and 4, as the scale to which Fig. 1 is drawn is too small to show it.

The ribs keep the surface constantly covered with material to the desired depth, and the vibratory motion of the sieve and the uprising air-current conjointly cause the particles which are of a less specific gravity to accumulate near the top of the material on the sieve, so that such particles do not come into actual contact with the sieve-surface. Under these conditions there results, as is well understood by millers, a better purification of the material than could have been obtained in a case where, through deficiency of feed, the layer of material under ttreament is so thin that the heavier particles quickly pass into actual contact with the sieve-surface; also, with a sieve provided with ribs, as above described, any desired depth of material on the sieve-surface may be obtained without the necessity of providing such a heavy feed that a portion of the good material is discharged into the tails. It will also be seen that however small may be the rate at which the feed is admitted to the purifier the ribbed sieve can be arranged with meshes of such a coarseness as to allow a minimum quantity of the material to pass over the tails, and at the same time the ribs keep all the spaces G full of material, because if any particles of the material are too large to pass through the meshes of the sieve such particles fill up the spaces between the ribs before they can pass over the tail of the sieve, and thereby the sieve-surface is covered with the material to any desired depth.

When treating on ordinary purifiers, the

mixed material, as enumerated and described above it is found in practice that the air-current, rising through the material as it passes over the sieve, rapidly removes a portion of the light loose flakes of the outer layers of skin, also a portion of the lighter portion of the fluffy matter, as described. These flakes and fluffy matter are of a very light nature, and they are lifted by the air through the nozzles E and deposited on the upper surfaces of the collecting-trays; but it is also found in practice that the larger portion of the particles of impurities enumerated above are too heavy in character to be lifted by the air in the ordinary course of working onto the collecting-tray, also that such heavier portions of impurities are carried over the surface of the sieve and passed over the tail a' thereof, although the largest portion of such particles of impurities will readily fall through the meshes of the coarser tail-sheet A^4 of the sieve were it not that they are prevented from so doing by the sustaining power of the uprising current of air. The reason of this is that when the air-current is so adjusted as not to prevent the good white semolina from freely falling through the meshes of the sieve its strength of velocity is then sufficient to prevent the heavier particles of impurities from also falling through the meshes of the sieve; but its strength or velocity is not sufficient to lift the whole of such impurities onto the collecting-tray of nozzles E, or onto the channels, where such are employed. In practice it is found that the heaviest of the impure material mixes with the largest of the white semolina or germ which is passed over the tail of the sieve, and thus it becomes necessary to retreat the material which has passed over the tail of the sieve. Now by my invention I am enabled to accomplish the removal or separation of the greater portion of these heavier impurities and to prevent the same from becoming mixed with the coarser good material which passes over the tail of the sieve.

To effect the above result, I arrange the sieve A' A^2 A^3 A^4 of the purifier in such a manner that one or more sections—say the section A^3—of the sieve-surface is not under the action of the uprising current of air. Consequently a large portion of the heavier impurities, consisting mainly of the finer particles thereof, passes through this part of the sieve before reaching the tail and is led away by a special hopper or spout H, or other contrivance, to any convenient point. I also give the name of "dead-sheet" to this section A^3 of the sieve, because it is not under the action of the uprising air-current.

According to the quantity of feed per hour, I make the sieve of such a length and of such a size of mesh that the purified finer semolina and germ pass through the meshes of the sections A' and A^2 before reaching the above-named dead-sheet A^3, and I make the dead-sheet of such a length and size of mesh that the finer portion of the heavier impurities which have been sustained by the air-current while traveling over the sections A' and A^2 will pass through the sieve when the said particles arrive at such dead-sheet section.

In some cases I may use two or more of the dead-sheets on which there is no upward air-current, and I may attach separate collecting hoppers or spouts H to carry away the material coming through such dead-sheets; also, I may place such dead-sheets alternately with the active sheets, which are under the action of the uprising air-current, in such a manner as to cause a better and more complete separation of both small, medium, and large heavy impurities.

I may employ any suitable device to prevent the passage of the uprising air-current through the dead sheet or sheets. In the machine shown in the drawings I simply place an air-tight diaphragm J, of metal or other suitable material impermeable to air, over the sieve-surface thereof, as seen in Fig. 1.

It will be obvious that the invention is also applicable to the treatment of break-meal, middlings, dunst, and flour, or to the treatment of similar products of a granular or pulverulent nature, whether obtained from wheat or otherwise.

Having thus described my invention, I claim—

1. In a machine for the purpose set forth, the combination with a vibrating sieve having a ribbed portion open to the air-current and a plain portion shut off from the air-current, of a flat depositing-tray situated above and in close proximity to the entire sieve-surface, a series of nozzles E on said tray above the ribbed portion of said sieve-surface, an air-exhausting mechanism arranged to draw air up through said ribbed portion of the sieve and through said nozzles, and separate discharge-chutes situated directly below the said ribbed and plain portions of the sieve, respectively, substantially as set forth.

2. In a machine for the purpose set forth, the combination with a vibrating sieve formed of sections of different mesh some of which have transversely-arranged ribs F, a plate J arranged over said sieve and close to its upper surface, nozzles E, carried by said plate and arranged over the ribbed sections of the sieve, an air-exhausting mechanism arranged above said plate J, for drawing air up through said nozzles, and hoppers below said sieve, substantially as set forth.

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

JAMES HIGGINBOTTOM.

Witnesses:

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JAS. CLELAND.