No. 719,877. PATENTED FEB. 3, 1903.

H. C. ROBINSON.

MIDDLINGS PURIFIER.

APPLICATION FILED MAR. 26, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

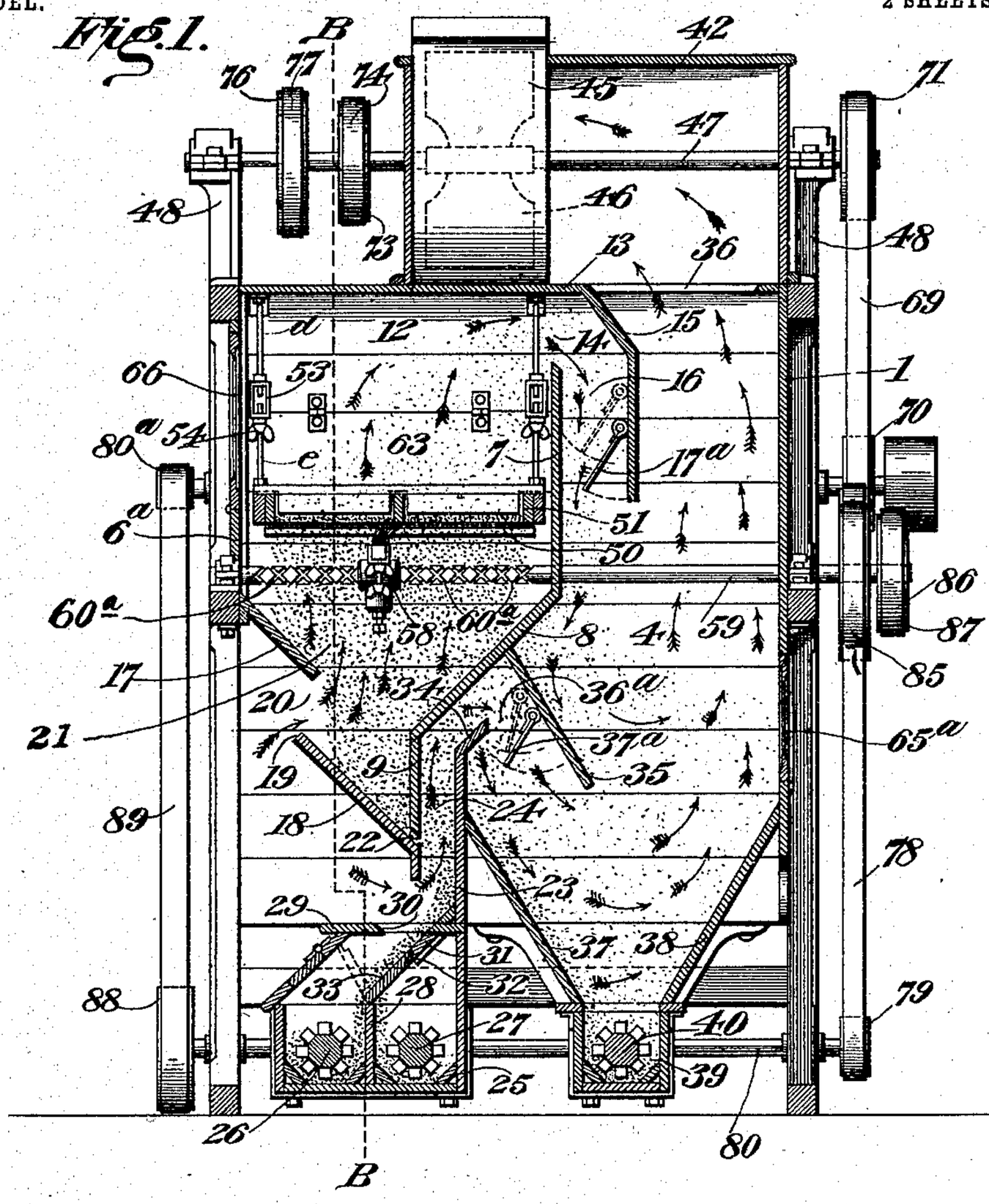
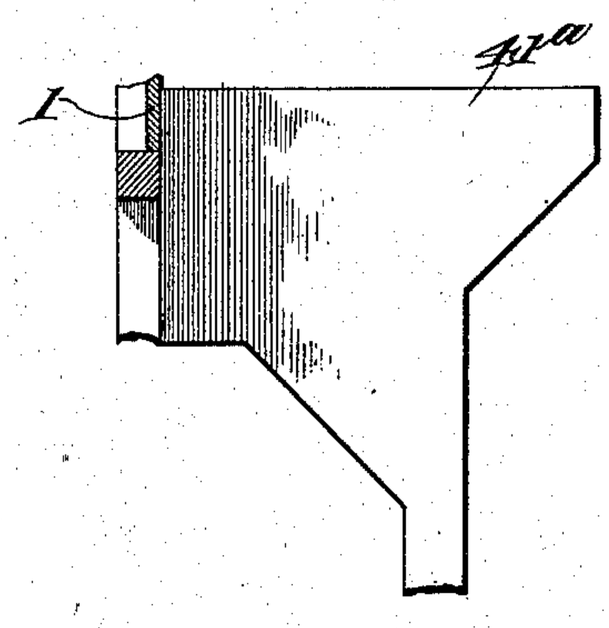


Fig. 3.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

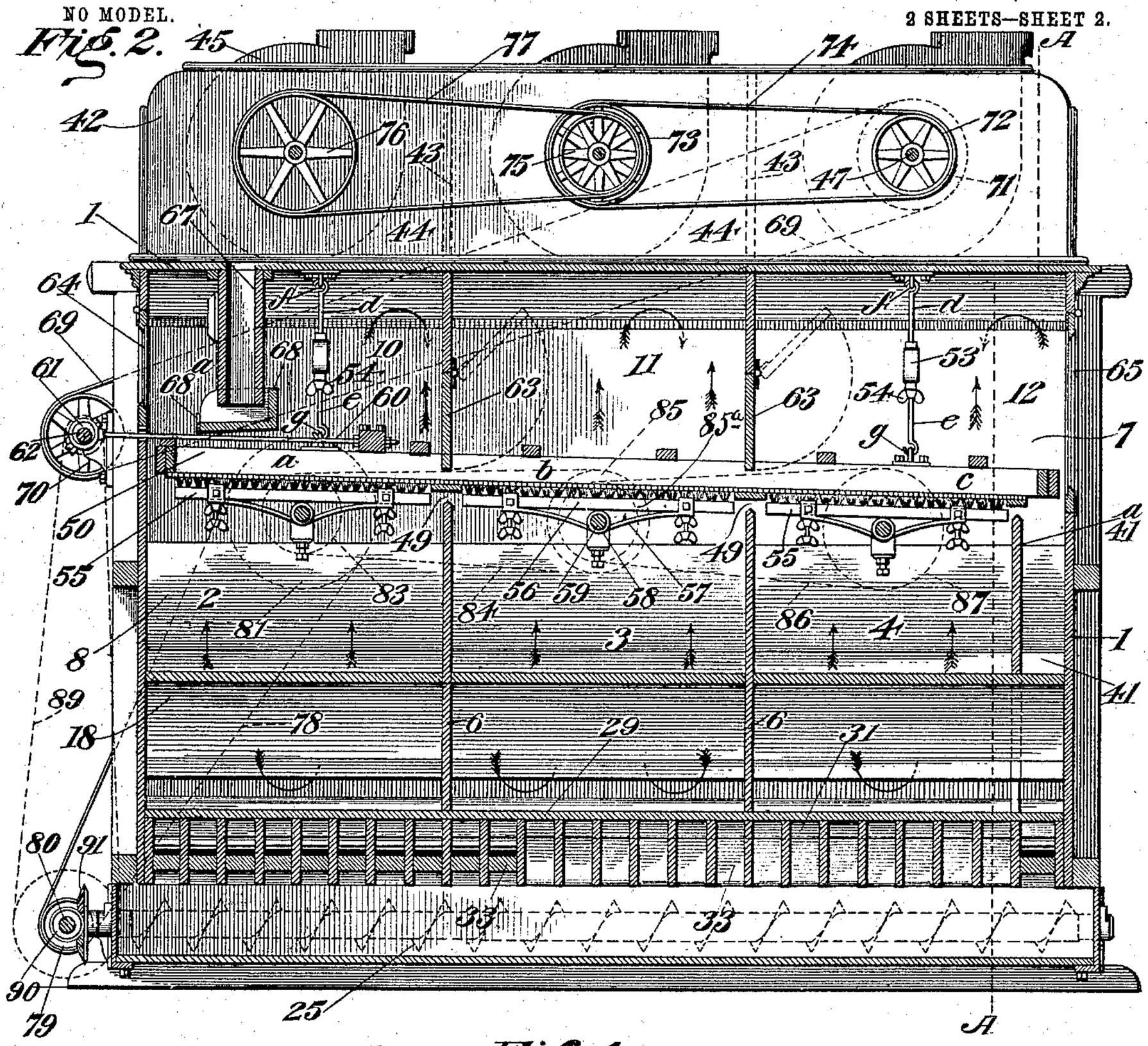
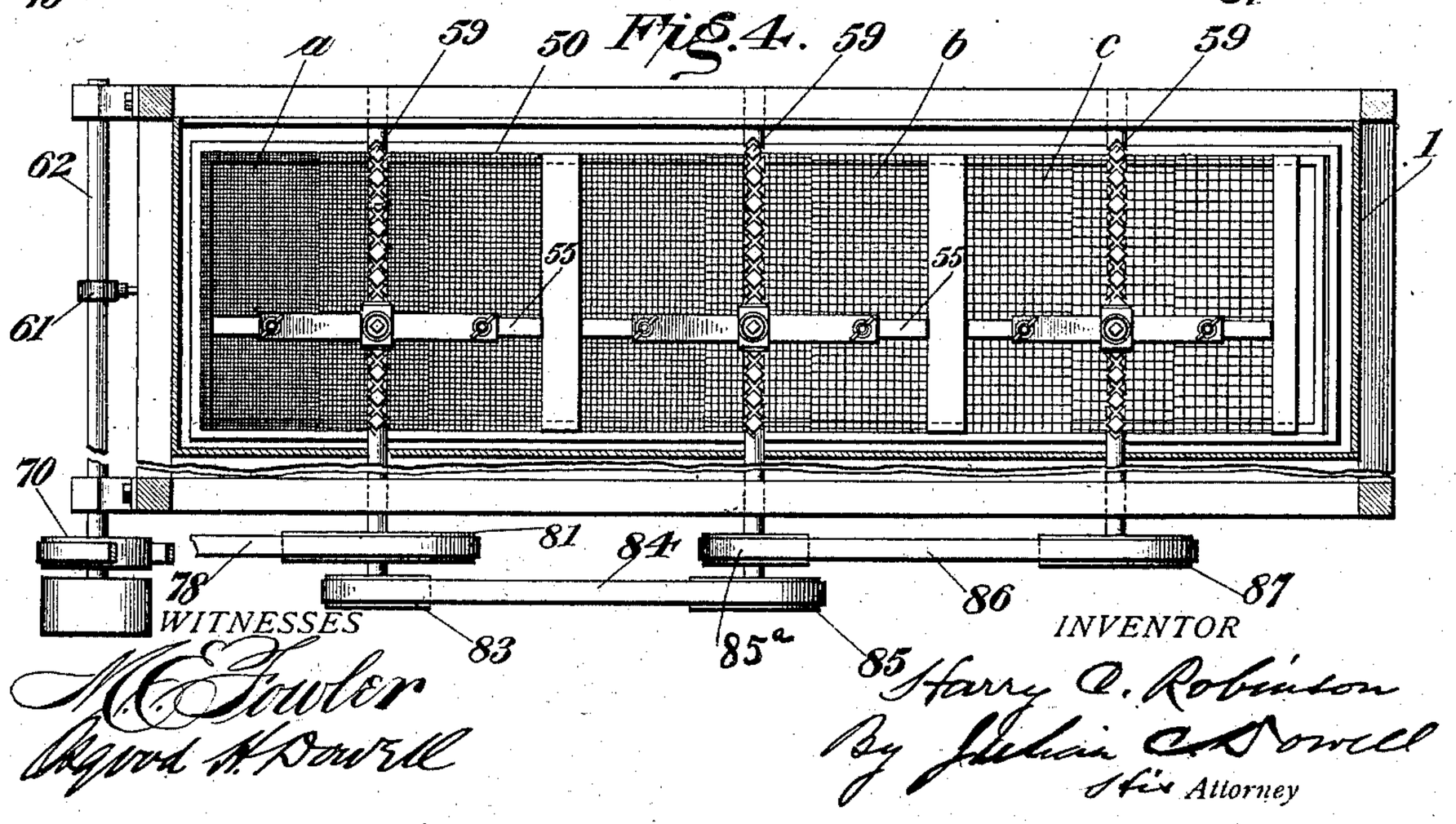


Fig. 4.



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HARRY C. ROBINSON, OF WILLIAMSPORT, PENNSYLVANIA.

MIDDLINGS-PURIFIER.

SPECIFICATION forming part of Letters Patent No. 719,877, dated February 3, 1903.

Application filed March 26, 1901. Serial No. 52,958. (No model.)

To all whom it may concern:

Be it known that I, HARRY C. ROBINSON, a citizen of the United States, residing at Williamsport, in the county of Lycoming and State of Pennsylvania, have invented certain new and useful Improvements in Middlings-Purifiers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to machines for separating and purifying granular materials, and more particularly to that class of machines known as "middlings-purifiers."

The principal object of the invention is to provide an improved machine in which the grading, separating, and purification of the material may be performed in a single continuous operation, thus saving time, labor, and expense and preventing undue handling and exposure of the material under treatment.

Further objects are to effect a closer and finer separation of the material than hitherto and a consequent saving of valuable stock, to purify the material more thoroughly and to prevent the intermingling of dust and impurities with the stock, to collect all impurities within the machine and prevent their escape into the mill-room, to provide means for independently purifying the tailings or coarser particles in the machine without the use of auxiliary devices, and to improve generally upon machines of this character.

The invention will hereinafter be first fully described with reference to the accompanying drawings, which form a part of this specification, and then more particularly pointed out in the following claims.

In said drawings, in which corresponding parts in the several views are designated by the same reference characters, Figure 1 represents a vertical transverse section of my improved machine, taken on line A A of Fig. 2 looking toward the left. Fig. 2 represents a vertical longitudinal section on line B B of Fig. 1 looking toward the right. Fig. 3 is a fragmentary view of a portion of the machine-casing, and Fig. 4 is a bottom plan view of the bolt or sieve with the cleaning devices therefor and their operating mechanism.

The numeral 1 designates the casing of the machine, which is preferably transversely divided into several independent compartments 2, 3, and 4 by means of partitions 6. The said compartments, which are herein three in number, are again longitudinally vertically divided by means of centrally-disposed partitions or division-boards comprising upper vertical boards or portions 7, downwardly and outwardly inclined portions 8, and lower terminal portions 9. Thus are formed at the upper part of the machine between the parts 7 and a part 6^a of the casing a series of chambers 10, 11, and 12, corresponding with the main compartments 2, 3, and 4, said chambers being for the accommodation of the shaking bolt or sieve. The vertical portions 7 of the partitions terminate short of the top 13 of the casing, and thus leave upper openings 14 from the chambers 10, 11, and 12 into the corresponding main compartments 2, 3, and 4.

Overhanging the partitions 7 and separated therefrom are aprons or deflectors 15, forming air-passages 16 from the openings 14 and the said main compartments, which passages are controlled by suitable valves 17^a, operated from the exterior of the machine, whereby the main compartments 2, 3, and 4 may be shut off from communication with the chambers 10, 11, and 12.

Confronting each of the downwardly and outwardly inclined portions 8 of the longitudinal partitions or division-boards is a shorter downwardly inwardly inclined board or partition 17, secured at its upper end to the machine-casing, and confronting and secured to each of the lower vertical portions 9 is an upwardly outwardly inclined board 18, between the upper edge 19 of which and the lower edge of the board 17 an opening 20 is left for the entrance of pure air from the exterior of the machine, which opening may or may not be provided with a suitable controlling-valve. (Not shown.) The boards 8 and 9 with the boards 17 and 18 constitute between them a hopper 21, provided with a lower discharge-slot or elongated opening 22, which is preferably formed in the board 9 directly above its junction with the board 18. Arranged alongside each of the vertical boards 9, at a suitable distance therefrom, is an upright board or partition 23, the space between which and the said board 9 constitutes a suction-pas-

sage 24, into which the material under treatment is discharged from the hopper and subjected to the purifying action of strong ascending air-currents drawn from the exterior of the machine. Beneath the air or suction passages a conveyer-box 25 is located, in which are arranged, preferably, several conveyers, herein two in number, 26 and 27, which are common to all the suction-passages in the machine, but separated from each other by a longitudinal partition 28 in the box. The top 29 of the conveyer-box is provided beneath each suction-passage with one or more openings 30 for passage of the purified material into one or both of the conveyers, as desired. Beneath said top is a longitudinal inclined shelf 31, provided with openings 32, each controlled by a valve 33. Said valves when in the full-line position (shown in Fig. 1) constitute parts of the shelf and serve to conduct the stock to the outer conveyer, but when in the dotted-line position cause the stock to pass to the inner conveyer. By proper manipulation of the valves the operator is enabled to cut off and convey away any desired percentage of a particular grade of stock.

The vertical partitions 23 ars each preferably provided with an upper inclined terminal shelf 34, forming between the same and the inclined partition 8 a continuation of the suction-passage 24. Pendent from each of said partitions 8 is a downwardly-inclined apron or deflector 35, overhanging said shelf 34, and the opening 36^a between said shelf and apron may be controlled by a suitable valve 37^a, operated from the exterior of the machine.

That part of each of the main compartments 2, 3, and 4 of the machine not occupied by the chambers, hoppers, conveyers, and passages described constitutes a settling-chamber for the lighter particles or impurities of the material under treatment, which are carried into said chamber by the air-currents ascending in the suction-passage 24 and passing through the valved opening 36^a. Each settling-chamber is provided with an opening 36 in its top, while at the bottom its sides 37 and 38 are convergingly inclined, as shown, to direct the settlings to a conveyer-box 39, in which is contained a conveyer 40 common to all the compartments. Adjacent to the rearmost compartment or settling-chamber 4 is a narrow independent compartment 41, formed by a partition 41^a, into which the tailings or coarser particles are precipitated and purified in the manner hereinafter explained. As shown in Fig. 3, the partition 41^a between the compartments 4 and 41 is constructed with transverse dimensions equal to those of the sieve-chambers 10, 11, and 12, though the said chamber could be constructed with transverse dimensions equal to those of the partitions 6, if desired.

Longitudinally disposed at the top of the machine and at one side thereof is a closed hood 42, which is transversely divided by partitions 43 into separate compartments 44, corresponding to the main compartments 2, 3, and 4. The several compartments of said hood are in communication with the settling-chambers by means of the top openings 36 of the latter. Each compartment of the hood is also in communication with the interior of the casing 45 of a fan 46 or other suitable suction device mounted on a shaft 47, journaled in bearings 48 at the top of the machine. The several fans may be operated at the same rate of speed, but are preferably driven at different speeds in the manner and for the purpose hereinafter explained.

The transverse partitions 6 are provided with openings 49 just above the mouths of the hoppers 21, and through said openings is passed lengthwise of the machine the frame 51 of a shaking bolt or sieve 50, working in common in all of the chambers 10, 11, and 12. Said sieve, while continuous, may be said to comprise three separate sections *a*, *b*, and *c*, corresponding with the several compartments of the machine. The meshes of the sieve are of different degrees of fineness or of gradually-increasing size from the end of the machine at which the material to be treated is introduced, being preferably so graduated that at least three different sizes are provided for each separate sieve-chamber. The material under treatment is thus gradually graded off and a uniform flow to the suction-passages obtained. Said bolt or sieve in the present construction is loosely suspended from the top of the machine near each end by means of hangers constructed of two parts *d* and *e*, fastened at eyes *f* and *g* to the top of the casing and the sieve-frame, the two parts of each hanger being formed with right and left screw-threads and united by a turnbuckle 53, secured in place by a lock-nut 54. By this construction the most delicate adjustments of the sieve may be secured without alteration of the position of the sieve by the motion imparted thereto. The sieve is also slightly inclined from the end where the material is introduced, whereby the material is carried gradually toward the lower end in the operation of the machine. Beneath the sieve are arranged three separate cleaning devices or brushes 55, one for each sieve-chamber and so-called "section" of the sieve. Said brushes are preferably operated transversely across the bottom of the sieve. The stock 56 of each brush is herein secured to the arms of a bracket 57, centrally provided with a traveling nut 58, through which passes a transverse shaft 59, formed with a right and left screw portion 60^a, whereby the brushes are caused to move back and forth across the sieve. The several brushes may be operated at the same speed, but preferably at different speeds, as hereinafter explained, by reason of the fact that the finer meshes need to be operated upon more rapidly than the coarser meshes to clean the sieve uniformly. The transverse partitions 6 be-

tween compartments 2, 3, and 4 are provided with hinged portions or doors 63, adapted to swing upwardly, as shown in dotted lines in Fig. 2, so as to provide room for insertion or removal of the sieve, which may be effected either through a door 64 at the head end or a door 65 at the tail end of the casing. These doors also afford access into the interior of the machine for other purposes, and similar doors 65[a] and 66 may be provided in the outer sides of the settling-chambers and sieve-chambers for access thereto. In the present construction the sieve is oscillated by a connecting-rod 60 and eccentric 61 on the main driving-shaft 62.

It will be understood that I am not restricted to the particular type of sieve shown, for in some cases a bolting-reel or gyrating bolt could be substituted.

A feed-hopper 67 is provided just above the head end of the sieve for introduction of the material to be treated, and a shaker-shoe 68, which may be fastened to the sieve to move therewith, is located beneath said hopper and serves to level the material to a uniform depth. Said shoe is preferably provided with a front plate 68[a], having saw-teeth, (not shown,) over which the material is sifted and distributed on the sieve in an obvious manner.

As before stated, the several fans and also the cleaning devices are preferably operated at different speeds. In the present construction a drive-belt 69 passes around a pulley 70 on the main shaft 62 and a pulley 71 on the shaft 47 of the third or last fan. This latter shaft is provided with a smaller pulley 72, connected by belt 74 with a larger pulley 73 on the central fan-shaft, and said central fan-shaft is similarly provided with a pulley 75, smaller than pulley 73, but larger than pulley 72, connected by belt 77 with a still larger pulley 76 on the first fan-shaft. The fans or suction devices are thus operated at different speeds, the first at the lowest speed and the last at the highest. The sieve-cleaning devices are similarly operated by belt 78, passing around a pulley 79 on a counter-shaft 80 and a larger pulley 81 on the screw-shaft of the first brush. Said shaft is provided with a smaller pulley 83, connected by belt 84 with a larger pulley 85 on the second screw-shaft, and said second shaft is likewise provided with a smaller pulley 85[a], connected by belt 86 with a still larger pulley 87 on the third screw-shaft. To change the speed of either of the fans or brushes, the operator has only to change the size of the pulleys. The counter-shaft 80 is driven from the main shaft by belt 89, passing around pulleys 80[a] and 88. Said counter-shaft is provided with suitable bevel or other gears 90, engaging similar gears 91 on the shafts of the conveyers for operating the latter.

It will be observed that each compartment or section of the machine comprises in the main a sieve-chamber, a sieve working therein having unobstructed space beneath, a hopper below the sieve, an independent vertically-disposed suction-passage into which the hopper discharges, an independent settling-chamber in communication with said suction-passage, but separated and adapted to be cut off from direct communication with the sieve-chamber, and a fan or suction device in communication with the settling-chamber at its upper part for producing air-currents in the suction-passage.

In operation the middlings or other material being supplied through the feed-hopper to the upper surface of the first section of the sieve or bolt is gradually carried to the lower end of the sieve by the motion imparted to the latter. Certain grades of the material fall through the meshes of the first section of the sieve into the first hopper 21, whence it falls in a thin sheet into the first air or suction passage 24 and is subjected to the action of the ascending air-currents induced by the first fan or suction device which is working at the lowest rate of speed. The finer or impure particles in the material are thus lifted up and carried over into the first settling-chamber, while the valuable stock falls into the box of one of the conveyers beneath, as desired. Such grades of the material as will not pass through the meshes of the first section of the sieve are carried along to the second section, where the next coarser grades fall through and gravitate into the second suction-passage and are subjected to the similar purifying action of the air-currents induced by the second fan operating at the second highest speed. In the same way such grades of the material as will not pass through the second section of the sieve are carried along to the third section, where said material is sifted and dropped into the third suction-passage and similarly subjected to the purifying action of the air-currents induced by the third fan operating at the greatest speed. The tailings or coarsest particles of stock are finally precipitated from the lower end of the bolt into the independent end chamber 41 of the machine, where said tailings are subjected to the purifying action of the air-currents produced by the last fan or suction device. In the drawings the course of the material is indicated by the dotted surfaces, while the courses of the air-currents are indicated by the arrows. The material is thus graded by gravity, simultaneously separated into the different grades, and immediately after such grading and separating is subjected to the purifying action of the strong air-currents in a single continuous operation, thus saving time and labor and preventing undue exposure and handling of the stock. The dust and impurities ascending in the several air or suction passages 24 are deflected by the aprons 35 toward the bottoms of the settling-chambers, and the height of the settling-chambers is such that the very finest of the particles are precipitated before reaching the

fans. Thus fresh pure air is constantly drawn from the outside of the machine for purifying the material and is discharged from the machine in a like pure condition.

With some kinds of substances it is desirable to have air-currents pass upwardly through the sieve to aid in distributing or spreading the material, wherefor the openings 14 and 20 and valved passages 16 are provided; but with other materials such air-currents are not needed, and hence the said openings and passages may be closed or dispensed with altogether. Whether the passages 16 remain closed or open it is obvious that by reason of the relative arrangement of the sieve-chambers and settling-chambers the dust-charged air-currents ascending in the settling-chamber, besides being so deflected as to settle all impurities, are carried away from the upper parts of the sieve-chambers and are thus prevented from intermingling with the fresh stock or the material in the course of its treatment.

It will be understood that the machine described is susceptible of various modifications in details of construction and arrangement without departing from the scope of this invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a machine for separating and purifying granular materials, a sieve-chamber, a bolt or sieve working therein, a separate settling-chamber at the side of said sieve-chamber, an intermediate vertically-disposed suction-passage communicating at its lower end with the external air, said passage having a lower inlet-opening for material from the sieve-chamber, a conveyer beneath said suction-passage for receiving and conveying the purified material, a passage leading from the upper end of the suction-passage into and toward the bottom of the settling-chamber, a hopper at the bottom of said settling-chamber and a conveyer therein for the dust and impurities, and a suction device communicating with the upper part of the settling-chamber; substantially as described.

2. In a machine for separating and purifying granular materials, a sieve-chamber, a separate settling-chamber, and an intermediate suction-passage communicating at its lower part with the external air and at its upper part with the settling-chamber, a bolt or sieve working in the sieve-chamber, a hopper beneath the sieve discharging into the suction-passage and having an independent opening for admission of air to the sieve, an air-passage above the sieve from the sieve-chamber into the settling-chamber, and a suction device communicating with the upper part of the settling-chamber; substantially as described.

3. In a machine for separating and purifying granular materials, a sieve-chamber, a separate settling-chamber, and an intermediate suction-passage communicating at its lower part with the external air and at its upper part with the settling-chamber, a bolt or sieve working in the sieve-chamber, a hopper beneath the sieve discharging into the suction-passage and having an independent opening for admission of air to the sieve, a valve-controlled air-passage above the sieve leading from the sieve-chamber to the settling-chamber, and a suction device communicating with the upper part of the sieve-chamber; substantially as described.

4. In a machine for separating and purifying granular materials, a sieve-chamber, a separate settling-chamber, and an intermediate suction-passage communicating at its lower part with the external air and at its upper part with the settling-chamber, a bolt or sieve working in the sieve-chamber, a hopper beneath the sieve discharging into the suction-passage and having an independent opening for admission of air to the sieve, an air-passage above the sieve leading from the sieve-chamber to the settling-chamber, means for directing air-currents ascending through the suction-passage and sieve-chamber toward the bottom of the settling-chamber, and a suction device communicating with the upper part of the settling-chamber; substantially as described.

5. In a machine for separating granular materials, the combination with a bolt or sieve comprising separate sections of different degrees of fineness, of independent cleaning devices for said sections mounted upon traveling nuts, right-and-left screw-shafts extending through said nuts, and pulleys of different sizes on said screw-shafts whereby the cleaning devices may be reciprocated at different speeds; substantially as described.

6. In a machine for separating and purifying granular materials, a series of sieve-chambers, a corresponding series of separate settling-chambers, and a series of intermediate suction-passages having communication at their lower parts with the external air and at their upper parts with the respective settling-chambers, a sieve working in common in all of the sieve-chambers and comprising corresponding sections of successively greater degrees of fineness, hoppers below the sieve discharging into the suction-passages, and independent suction devices in communication with the settling-chambers for producing ascending air-currents of successively greater degrees of strength in the several suction-passages; substantially as described.

7. In a machine for separating and purifying granular materials, a series of sieve-chambers, a corresponding series of separate settling-chambers, a series of intermediate suction-passages having communication at their lower parts with the external air and at their upper parts with the settling-chambers, an independent tailings-compartment adjacent

the last settling-chamber, a sieve working in common in all of the sieve-chambers and comprising corresponding sections of successively greater degrees of fineness, hoppers below the sieve discharging into the suction-passages, and independent suction devices in communication with the settling-chambers for producing ascending air-currents of successively greater degrees of strength in the several suction-passages; substantially as described.

8. In a machine for separating and purifying granular materials, a series of sieve-chambers, a corresponding series of separate settling-chambers, a series of intermediate suction-passages having inlet-openings for discharge of material from the sieve-chambers and communication above said openings with the settling-chambers, a sieve working in common in all of the sieve-chambers and comprising corresponding sections of different degrees of fineness, independent suction devices in communication with the settling-chambers for producing ascending air-currents of different degrees of strength in the several suction-passages, and means for establishing independent air-currents upwardly through the sieve and into the settling-chambers; substantially as described.

9. In a machine for separating and purifying granular materials, a series of sieve-chambers, a corresponding series of separate settling-chambers, a series of intermediate suction-passages communicating at their upper parts with the respective settling-chambers, a sieve working in common in all of the sieve-chambers and comprising corresponding sections of different degrees of fineness, hoppers beneath the sieve discharging into the suction-passages, and having independent side openings for admission of air to the sieve, valve-controlled air-passages leading from the sieve-chambers above the sieve into the respective settling-chambers, and independent suction devices of different degrees of strength communicating with the settling-chambers; substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HARRY C. ROBINSON.

Witnesses:
HUGH GILMORE,
C. B. COLEMAN.