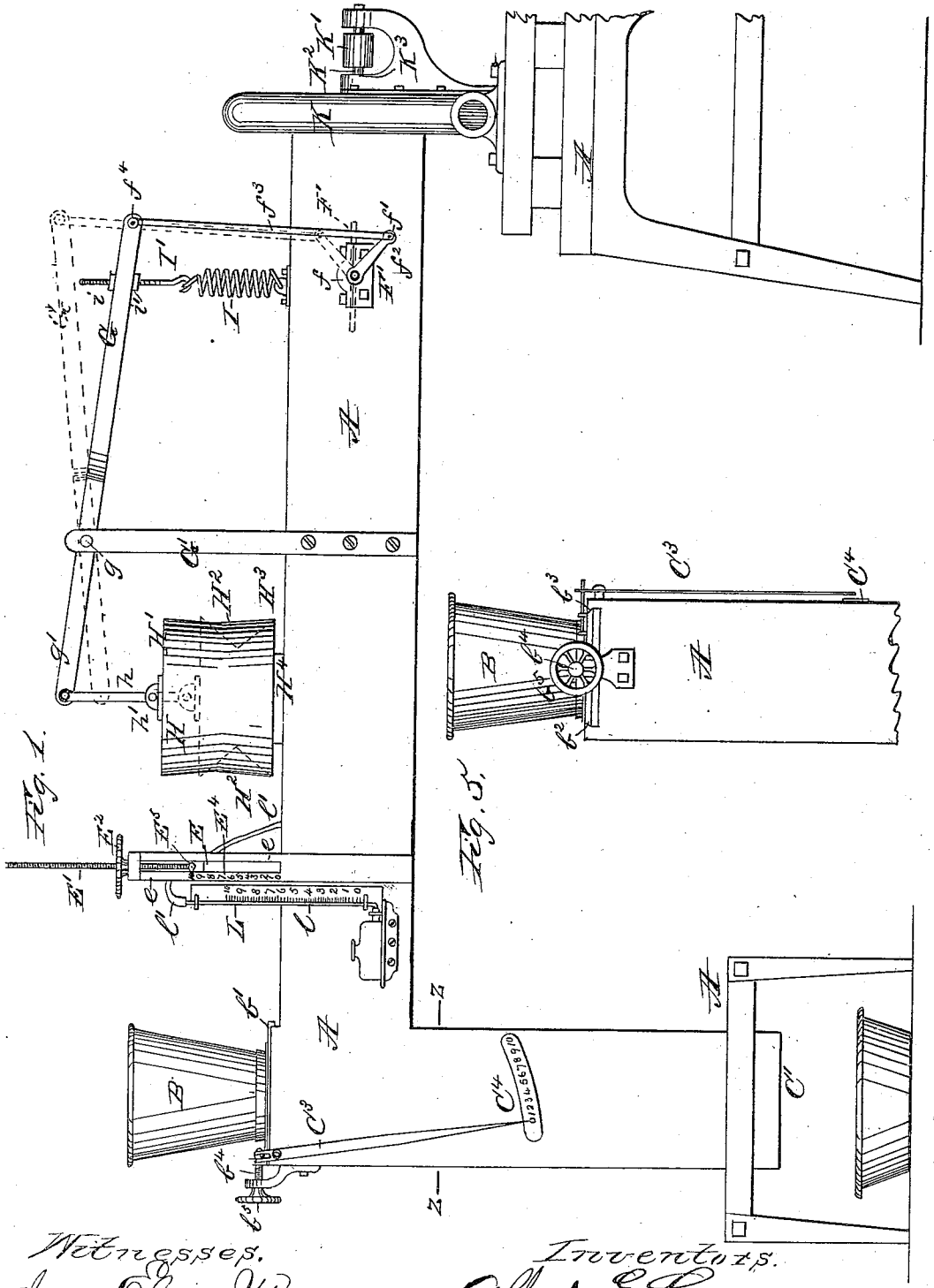
(No Model.) 2 Sheets—Sheet 1.

A. E. & W. L. CROW.

APPARATUS FOR SEPARATING OR CONCENTRATING MATERIALS OF DIFFERENT SPECIFIC GRAVITIES.

No. 312,333. Patented Feb. 17, 1885.



Witnesses.
James E. Cain Werner
Richard G. Wedekind

Inventors.
Alfred E. Crow
William L. Crow

N. PETERS. Photo-Lithographer, Washington, D. C.

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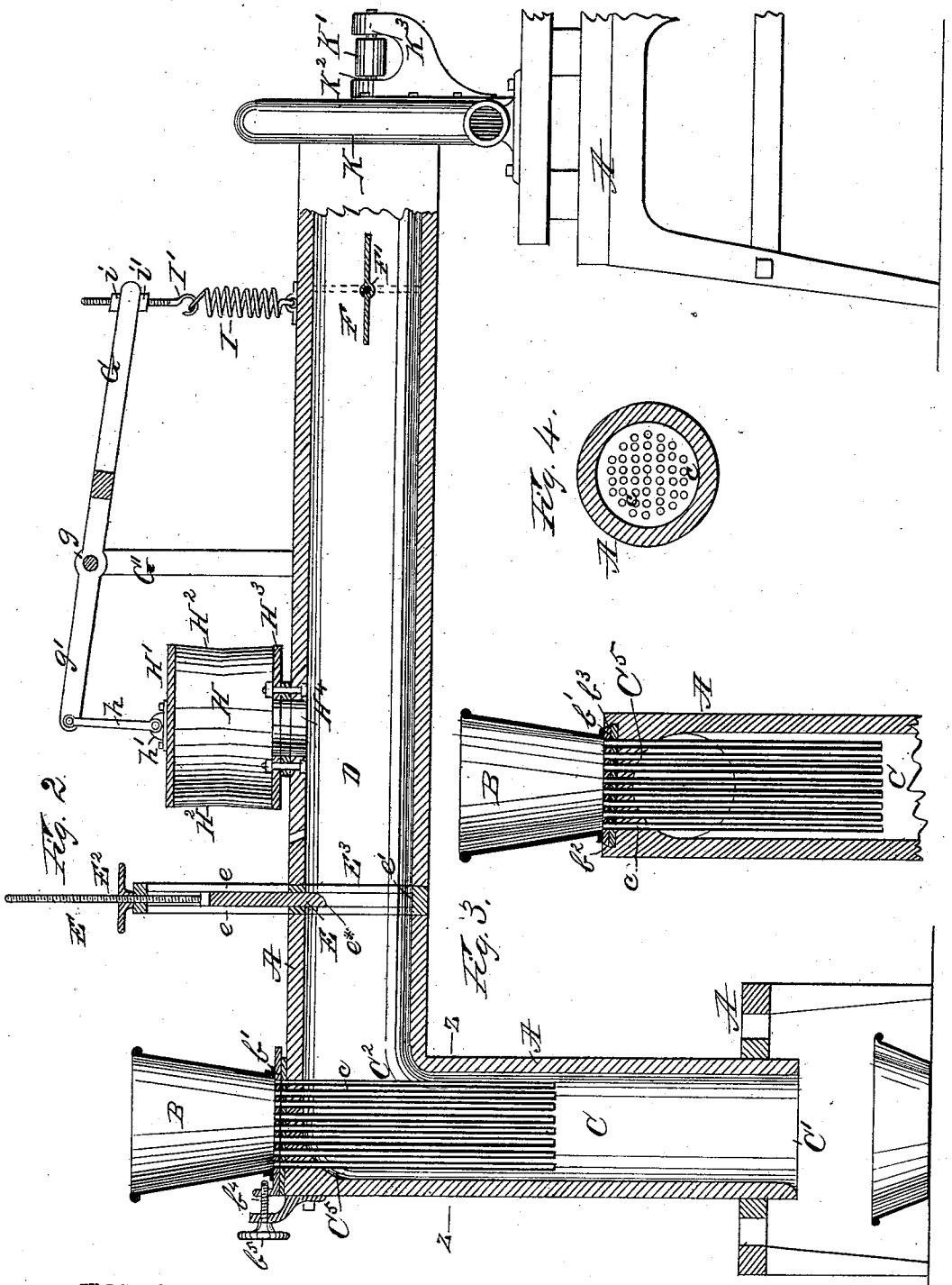


Fig. 2.

Fig. 4.

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALFRED E. CROW AND WILLIAM L. CROW, OF NEW YORK, N. Y.

APPARATUS FOR SEPARATING OR CONCENTRATING MATERIALS OF DIFFERENT SPECIFIC GRAVITIES.

SPECIFICATION forming part of Letters Patent No. 312,333, dated February 17, 1885.

Application filed July 3, 1884. (No model.)

To all whom it may concern:

Be it known that we, ALFRED E. CROW and WILLIAM L. CROW, citizens of the United States, residing at New York, in the county and State of New York, have invented an Improved Apparatus for Separating or Concentrating Materials of Different Specific Gravities, of which the following is a specification.

Our invention relates to an improved apparatus for separating or concentrating materials of different specific gravities. According to our invention the ore or material to be separated or concentrated is placed in a hopper having a bottom formed by a perforated regulating-slide. The holes or apertures in the bottom of the hopper are in communication with the mouths of tubes or passages extending vertically downward within a separating-chamber, which is open to the atmosphere at its under side, while its upper end is connected with a vacuum-chamber, by preference arranged horizontally, and provided with an air-gate, and also an air-valve, controlled by a collapsible chamber connected by levers with the air-valve. Air is drawn through the apparatus at a regulated pressure by means of an exhaust-fan or other suitable mechanism driven by a steam-engine or other suitable motive power. The material is fed to the apparatus in the exact reverse direction to the direction of the air employed in treating the material, thereby utilizing the momentum acquired by the particles of material falling through a given space, and then entering a separating-chamber provided with an opposing air-current for the purpose of dividing the lighter from the heavier particles. The material to be acted upon by the current of air is supplied in the form of small streams or of a shower equally distributed over the whole area of the resisting current, thereby allowing the heavy particles to fall in a vertical line from the point of separation, while the lighter particles are carried in the reverse direction, or at an angle of one hundred and eighty degrees from the point of separation. The regulation of the air-current is automatic, and the device is provided with a vacuum-gage to indicate the pressure or speed of such current.

But that our invention may be fully understood, we will proceed to describe the same in detail by aid of the accompanying drawings, which form part of this specification.

Referring to the drawings, Figure 1 is a side view of our apparatus arranged to carry out our invention. Fig. 2 is a corresponding sectional view. Fig. 3 is a vertical central section of the upper part of the separating-chamber. Fig. 4 is a transverse section on the line Z Z, Figs. 1 and 2. Fig. 5 is a partial front view of the apparatus.

In each of the views similar letters of reference are employed to indicate corresponding parts wherever they occur.

A represents the main framing of the apparatus, and B a hopper having a perforated bottom formed by a perforated regulating-slide, b', controlled in position by guides b^2 b^3, and operated in position by a screw, b^4, and hand-wheel b^5. The holes in the bottom each communicate with the upper end of a tube, c, extending vertically downward within a separating-chamber, C, which is open to the atmosphere at C′, while its upper end, C^2, is connected with a vacuum-chamber, D, provided with a vertically-sliding air-gate, E, working in guides e and controlled in position by a vertically-threaded rod, E′, and hand-wheel E^2, by turning which in either direction, as required, the air-gate E will be elevated or depressed, and consequently the amount of air passing through the airway E^3 will be regulated. The under edge, e^*, of the air-gate E is formed knife-shaped, as shown in Fig. 2, for the purpose of facilitating the closing down of the edge e^* upon the sill e' in the event of any particles of material resting on the sill e'.

E^4 is a gage arranged on the side of the framing of the air-gate E, for the purpose of indicating by aid of a pointer, E^5, formed on or affixed to the gate, the position of the said gate E.

F is an air-valve, which is mounted on a shaft, F′, supported in bearings f, carried by the framing A.

Upon the outer end of the shaft F′ is affixed a lever, f', which at f^2 is pivoted to the lower end of a connecting-rod, f^3, the upper end of which is pivoted at f^4 to one end of one of the

forks of a forked lever, G, which is pivoted at *g* to a standard, G′, affixed to the main framing A.

To the end *g′* of the lever G is pivoted one end of a connecting-link, *h*, which, at *h′*, is pivoted to lugs formed on or affixed to the upper surface or frame, H′, of a collapsible chamber, H, the sides H^2 of which are formed of leather, rubber, cloth, or other suitable material. The bottom or fixed head H^3 of the collapsible chamber H is bolted to the upper surface of the framing A, and is provided with a central aperture, H^4, connecting with the vacuum-chamber D.

I is a spring attached at one end to the framing A, while at its upper end it is connected by a screw-hook bolt, I′, and nuts *i i′* to one of the forks of a forked lever, G. Air is drawn through the apparatus at a regulated pressure by means of an exhaust-fan, K, driven by a pulley, K′, mounted on a shaft, K^2, supported in stationary bearings K^3. Motion is communicated to the pulley K′ by means of a belt (not shown) driven by a steam-engine or other suitable motive power.

The screened or sized material is fed to the apparatus through the hopper B, and it is allowed to fall gradually in regulated quantities through the perforations in the slide *b′* to the tubes *c*, down which the said particles pass and are discharged at the mouths of the tubes *c*, at and below which point they are brought directly in contact with the volume of air being drawn up through the separating-chamber C and between and around the tubes *c*. The material passing down the pipes *c*, to be acted upon by the air passing up the separating-chamber C, being supplied in the form of small streams or of a shower of particles, equally distributed over the whole area of the resisting current passing up through the separating-chamber C, a thorough separation of the light and heavy particles is effected. The light particles are drawn up between and around the tubes *c* by the current of air in the separating-chamber C, while the heavy particles fall vertically, and are collected in any suitable receiver arranged beneath the lower end of the separating-chamber C, or are shoveled or otherwise transported away.

L is a vacuum-gage provided with an indicating-scale, *l*, and a pipe, *l′*, connected with the vacuum-chamber D, for the purpose of indicating the vacuum-pressure in the said chamber D. The pipe *l′* being connected at one end with the chamber D and at the other with the tube of the gage L, the fluid in such tube will rise and fall according to the amount of vacuum created in the tube of the gage, which will correspond with (and consequently indicate on the scale *l*) the vacuum for the time being existing in the chamber D.

The operation of the device will be self-evident. The material being supplied to the hopper B as described, and the exhaust started, the fine and heavy particles will become separated. The extent of the draft is controlled by the gate E, and also automatically by the value F, operated by the collapsible chamber H and its connections, as hereinafter explained.

Before starting the machine, or at any other suitable time, the draft is regulated primarily by means of the gate E, which is opened or closed to an extent which shall control the maximum area of passage-way which can be available for the draft. The valve F is a secondary and automatic means of regulating the draft. Immediately an extra draft is exerted, and an increase of vacuum-pressure is caused in the vacuum-chamber D, as a consequence the upper surface of the collapsible chamber H will be drawn down, thereby actuating the valve F to close the same by means of the connections f^3, G, and *h;* but immediately the vacuum-pressure is reduced the valve F will again open and an increased volume of air be allowed to pass through the apparatus. In practice it may, however, be found in certain cases necessary to increase or diminish the power of the vacuum-draft, irrespective of the size of the particles passing down the tubes.

When supplying the material to the hopper B, the extent of pressure of the spring is regulated in proportion to the size of the particles of material being operated upon. If the particles are large, and the slide *b′* is opened so as to allow of large particles passing down the tubes *c*, as a general rule a greater exhaust is required, while if the particles are small the blast will under ordinary circumstances be less. The extent of the automatic regulation of the vacuum-draft will be regulated by regulating the tension of the spring I. The upper end of the separating-chamber C is rounded off, as shown at C^5, for the purpose of preventing any accumulation of material in the corner, which might occur if the said part C^5 were square.

C^3 is a pivoted pointer, connected to the perforated slide *b′*, for the purpose of indicating the position at which the holes in the slide *b′* are placed from time to time in relation to the upper ends of the tubes *c*, and consequently the quantity of material passing into the device from the hopper B. The end of the pointer C^3 acts in conjunction with a segmental indicator, C^4, as shown by Figs. 1 and 5.

Modifications may be made in our apparatus without departing from the spirit of our invention. We can in some cases employ a weight in place of the spring I. We can also employ a piston in place of the collapsible chamber H, and the operating-connections may be modified to suit different manufacturers, or the position in which the apparatus is to be employed.

In our machine it is very necessary that the blast should be free from all vibration, and steady and regular in speed and quantity independent of any fluctuation in speed of the fan or air-exhausting means or engine or other power driving the same. The air-gate E regulates, broadly, the quantity and speed of current, but the mechanism operating the draft-

regulating valve F automatically regulates the said current independent of speed of fan, &c. Thus, if the speed of fan slackens, the air is less rapidly exhausted from the vacuum-chamber D, thereby allowing the drum H to be extended by the weight or spring, and by means of levers opening the valve F, thus allowing the air in the vacuum-chamber D freer access to the fan K, and increasing the draft. Should this increase become too great, the head of the drum H will be drawn down, thereby shutting, by means of the levers, the valve F, and thus closing more or less the access to the fan K. This action is so instantaneous and delicate that a practically steady current is obtained.

In using the machine for materials of different specific gravities or of different sizes, it is necessary to accordingly vary the draft. In case the drum H is controlled by a fixed weight or spring of fixed tension, the draft is varied by opening or closing the gate E, the automatic regulator simply preventing fluctuations in the current. In case an adjustable weight or spring is used, as represented in the drawings, the gate may be left wide open under ordinary circumstances, and the automatic regulator will not only modify the current as may be desired by means of the said weight or spring, but will also prevent said fluctuations, and the gate will be used simply as a cut-off between the machine and the fan.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The combination, with a regulated supply-hopper and a separating-chamber and vacuum-chamber, of a series of material-supply tubes opening into the supply-hopper and extending downward within the separating-chamber in position to discharge the material to be operated upon at considerable momentum against an opposing air-current entering the separating-chamber and passing up between and around the supply-tubes, and a suitable vacuum or draft mechanism for producing the said current, substantially as and for the purpose set forth.

2. The combination, with a regulated supply-hopper, of a vacuum or draft mechanism, a vacuum-chamber having an automatic vacuum-regulating valve, and a vertical separating-chamber formed with tubular passages extending down within the said separating-chamber and opening into the material-supply hopper, substantially as and for the purpose described.

3. The combination, with a regulated supply-hopper, a vacuum or draft generating mechanism, a vacuum-chamber having a primary draft-regulating gate or valve, and a valve actuated automatically by the vacuum-pressure, of a vertical separating-chamber having tubular passages opening into the supply-hopper, and extending downward within the separating-chamber in position to discharge the material to be operated upon at a high momentum against an opposing air-current passing up through the separating-chamber and between and around the supply-tubes, substantially as shown and described.

4. The combination, with a regulated supply-hopper, a vacuum or draft generating mechanism, and a vertical separating-chamber having tubular passages opening at their upper ends into the supply-hopper and extending down within the separating-chamber, of a vacuum-chamber having a vacuum-regulating valve, a collapsible drum connected with the vacuum-chamber, and levers for actuating the vacuum-regulating valve, substantially as shown and described.

5. The combination, with a vacuum-chamber, vacuum or draft generating device, an automatic vacuum-regulating valve, a collapsible drum, and a series of connecting-levers, of a supply-hopper, and a vertical separating-chamber having tubular supply-passages opening into the material-supply hopper, and a regulating-valve for said hopper, the said supply-passages extending down within the vacuum-chamber, and discharging their material into an open space within and at the lower part of the separating-chamber at a considerable momentum, and in a direction directly opposed to the direction of a current or draft passing upward through the separating-chamber, substantially as and for the purpose described.

In witness whereof we have hereunto set our hands this 1st day of July, 1884.

ALFRED E. CROW.
WILLIAM L. CROW.

Witnesses:
JAMES B. SHELDON,
FRED W. BALDWIN.