To all whom it may concern:

Be it known that I, ALONZO J. ROBERTS, a citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Pneumatic Graders and Metal-Catchers, of which the following is a specification.

This invention relates to devices for sorting out into separate compartments, several different sizes, or weights or kinds of material by currents of air, the peculiarities of which will be hereinafter described and claimed.

The main object of my improvements is the provision of means for pneumatically separating particles of one kind of grain such as corn, from another such as wheat, with which it has become mixed; secondly, for pneumatically separating the lighter, the heavier, and the medium particles of similar grain, or any one kind of grain; thirdly, for pneumatically separating foreign matter, such as metal and gravel, from feed material; and fourthly, for pneumatically separating the medium or stock feed from the light, heavy and foreign particles in a stream of materials supplying a reducing machine.

In the accompanying drawing on which reference letters indicate corresponding parts, Figure 1 represents a vertical sectional elevation of a device illustrating my invention; Fig. 2 a horizontal sectional view on the plane 2—2 of Fig. 1, looking upward; Fig. 3 a similar view looking downward; and Fig. 4 a reducing system illustrating the location of my device.

The letter A designates a first break roll or other reducing machine, B a conveyor, C a stock bin, and D an elevator delivering to said stock bin through my pneumatic grader and metal catcher, now to be described. A drum casing, E, Fig. 1, has a conical bottom F with an outlet controlled by a gravity valve G or other automatic arrangement for letting out the feed and obstructing the inlet of air. The drum has an outlet pipe H, preferably tangentially connected as shown in Figs. 1 and 2, and leading into an exhaust fan I that delivers to a cyclone collector J, Fig. 4. The top of the drum casing has a feed inlet pipe K, centrally located and leading from a hopper L receiving the feed material from the elevator or other source of supply, and discharging it into said pipe K through a regulating valve M. The bottom end of the pipe K is vertically adjustable, and is preferably provided at its bottom end with an upwardly divergent cone frustum N fitting within a depending tubular wall O supported from the top of the casing. Aimed with said feed inlet pipe is an air pipe P having at the top an upwardly flaring divergent cone frustum Q, substantially matching, and similar to, the end of the feed pipe but not so large a diameter, whereby a space is left between the upper edge of the air pipe top Q and the tubular wall O for the overflow downward of the feed delivered from the feed pipe K and caused to diverge by the air current passing upward through the pipe P. The air enters by an air inlet valve R in the pipe P extending outside of the casing, under the suction of the fan I, and draws out the light particles or chaff through the connecting pipe H. The medium heavy particles of the feed are deflected over the top Q and fall in the conical bottom P and pass out through the gravity valve G. The heaviest particles that are not deflected over the flaring top Q fall downward against the upward air current in the pipe P, and are collected in a compartment S, which is air tight. Thus any metal or gravel that is mixed with the material delivered from the hopper L will drop directly down into the compartment S; the lightest particles, such as chaff, will pass over the flaring top Q together with the medium particles of feed, but the light chaff will be drawn upward on the outside of the tubular wall O by the air suction and be delivered to the cyclone collector J, before mentioned; while the medium feed particles or stock size thus cleaned and graded, will be delivered through the gravity valve G to said stock bin C from which they pass to the reducing machine, and secure a better grade of output than when mixed with foreign particles of metal or corn for example, that may be mixed with the supply.

In order to facilitate the separation of the medium from the light particles, I desire to give a whirling motion to said particles, after the separation of the heavier particles of metal or foreign matter. This I do by providing a series of curved blades T preferably depending from the upper cone N of
the feed pipe but may be otherwise supported. By the adjustment up and down of one of said pipes, preferably the feed pipe K, the space between said matching cones N and Q is respectively increased or diminished, and the velocity of the air carrying the light and medium particles is varied. Thus, by diminishing the space the velocity is increased and likewise the whirling action of the particle-laden air passing outward between the cones and then downward and around inside the tubular wall O till discharged at the lower end of the tubular wall. The lower end of the tubular wall is preferably contracted by a conical collar U to direct the light and medium particles inward toward the centrally located air pipe P and assist the separation of the medium from the light particles, which latter are sucked upward between the tubular wall and drum casing to the exhaust pipe H.

The whirling motion is preferably given to the material, after the separation of the heavier particles, such as corn and metal, from the supply stream entering through the feed pipe K, so that the heavier particles will descend to the compartment S without being acted on by the centrifugal force which is preferably utilized for separation of the light and medium particles only.

While the feed pipe is shown adjustable to vary this space between the alined air pipe and feed pipe, other adjusting means may be employed. In some cases and with some material, the curved blades T may be omitted; in all cereal products however, such as screenings, in which the difference between the light and the medium particles is relatively small, the curved blades or other means for giving the whirling motion after the separation of the heaviest particles, are desirable, and likewise with respect to the turned end U at the bottom of the tubular wall. The particles of feed material leaving the hopper L are opened up and spread out as indicated while falling to the end of the feed pipe; there they are met by the opposing upward air currents in pipe P, that allow the heaviest particles to continue falling, but check and deflect the medium and lighter particles which are given a whirling motion as they are carried outward between the cone frustums and curved blades; this whirling motion continues as they gravitate downward inside the tubular wall, and they are deflected sharply inward as they pass the lower end U. The contracted area causes an increased velocity and greater air suction, giving a greater gravitating energy to the medium particles than the lighter particles, thus aiding the air suction in lifting and separating the lighter particles and carrying them off to the fan and cyclone collector.

I claim:

1. A device of the character described comprising a drum casing having an inner cylindrical depending tubular wall, and an air outlet near the top of the casing outside the tubular wall, a feed inlet pipe mounted centrally within said tubular wall, an air pipe alined with the feed pipe, and extending outside the casing, and having an air regulating valve, and having also a flaring upwardly divergent top located centrally within said tubular wall,—one pipe being adjustable to vary the space between the ends of said pipes, a closed compartment connected to the bottom of said air pipe, and exhaust means connected to the casing outlet for inducing a regulated upward current of air in said air pipe, substantially as described.

2. A device of the character described comprising a drum casing having an inner depending tubular wall carried by the top of the casing, and an air outlet near the top of the casing outside of the tubular wall, a feed inlet pipe having an upwardly divergent cone frustum on its bottom end, and fitting snugly within said tubular wall, a pipe alined with said feed pipe and extending outside the casing, and having an air regulating valve, and also having a flaring upwardly divergent frustum top matching the bottom end of said feed pipe, but relatively smaller, and exhaust means connected to said air outlet of the casing, substantially as, and for the purpose described.

3. A device of the character described comprising a casing having an inner depending tubular wall and open at the bottom, and the casing having an air outlet at the top outside said wall, a gravitating feed inlet pipe entering said tubular wall from above, an air inlet pipe alined with said feed pipe and both pipes having on their adjacent ends outwardly flaring cone frustums located within said tubular wall, the upper frustum filling the tubular wall chamber and the lower frustum being smaller to afford an annular feed discharge downward, means to vary the space between said frustums, curved blades located in the space between said frustums, and means to produce air currents upward in said air pipe and outward between said frustums and blades and downward within said tubular wall chamber.

4. A device of the character described comprising a casing having a gravitating feed inlet, and an air outlet near the top and a depending tubular wall supported by the casing top within the casing and having a contracted lower end opening within the casing, and means to produce a whirling action on the feed entering said tubular wall before it is deflected downward and inward by said contracted end, substantially as described.
5. The herein described method of pneumatically grading feed material consisting in spreading out the particles in a vertical gravitating stream of materials whereby the heaviest particles are free to fall, then checking the fall and deflecting in whirling streams only the lighter and medium particles, and separating them from the heaviest gravitating particles which latter are not subjected to the whirling action, then deflecting the medium whirling particles inward and downward, while drawing outward and upward the lighter particles, substantially as described.

6. The combination with a reducing machine and elevating means for supplying a gravitating stream of feed to said machine of a pneumatic grader and metal catcher interposed in said gravitating stream and comprising means for deflecting and whirling outward and then downward only the lighter and medium particles of said gravitating stream, while allowing the continued gravitation of the heaviest particles, and thereby effecting a grading separation of the component parts of said stream.

In testimony whereof I have affixed my signature.

ALONZO J. ROBERTS.