H. O. LITTLE.

AUTOMATIC MAGNETIC SEPARATOR FOR MILLS.

APPLICATION FILED NOV. 4, 1916.

1,217,613.

Patented Feb. 27, 1917.

2 SHEETS—SHEET 1.

FIG. 1.

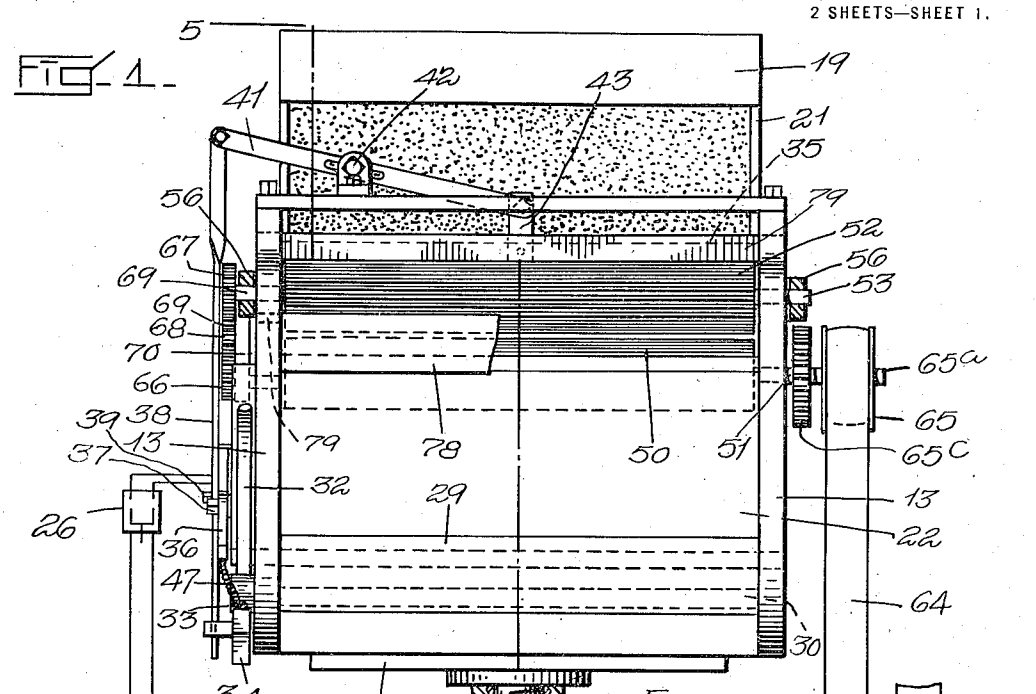


FIG. 3.

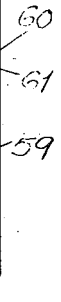


FIG. 2.

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2 SHEETS—SHEET 2.

FIG. 4.

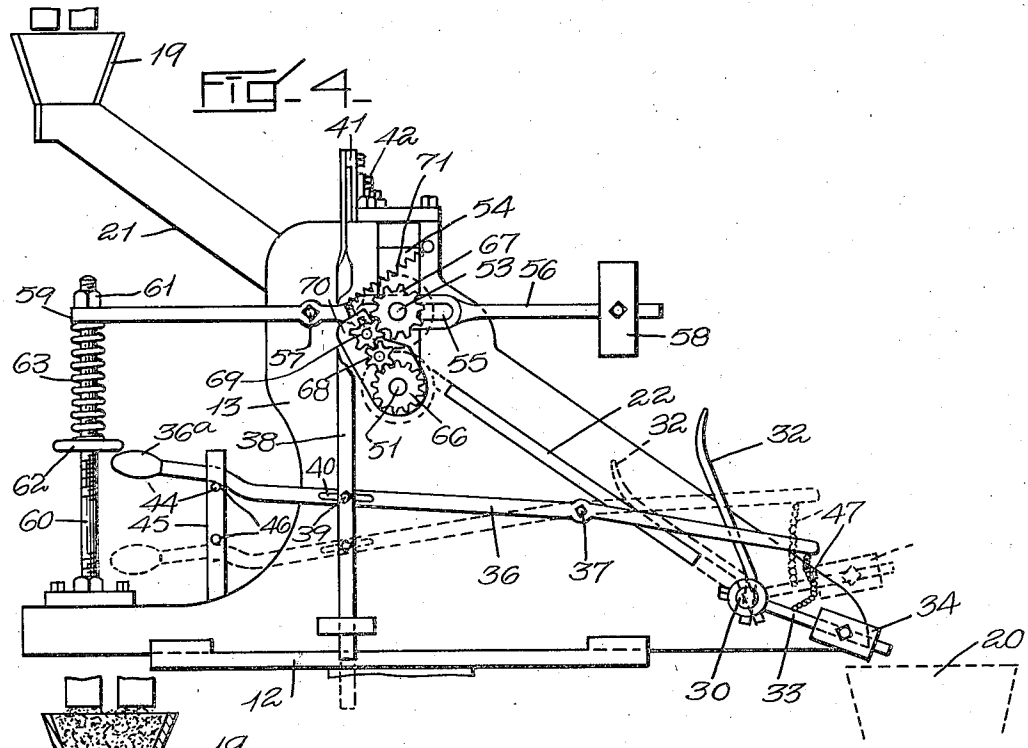
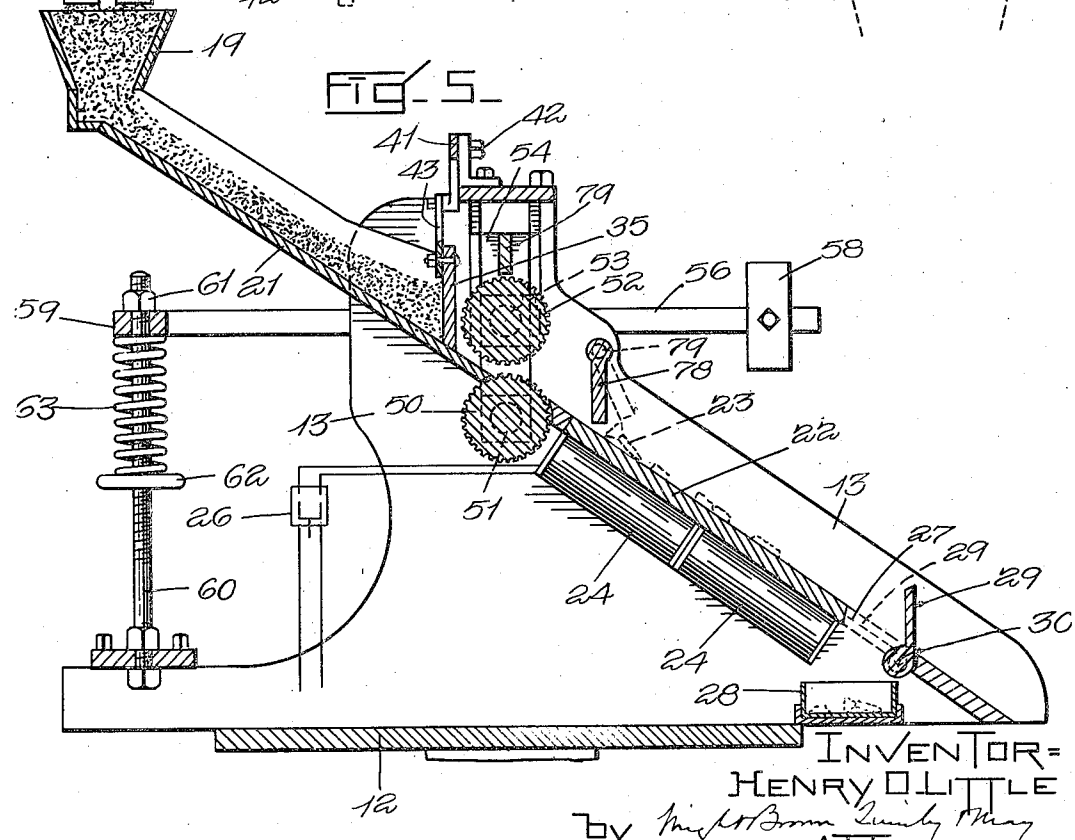


FIG. 5.



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HENRY O. LITTLE, OF BRIDGEWATER, MASSACHUSETTS.

AUTOMATIC MAGNETIC SEPARATOR FOR MILLS.

1,217,613. Specification of Letters Patent. Patented Feb. 27, 1917.

Application filed November 4, 1916. Serial No. 129,489.

To all whom it may concern:

Be it known that I, HENRY O. LITTLE, a citizen of the United States, residing at Bridgewater, in the county of Plymouth and State of Massachusetts, have invented new and useful Improvements in Automatic Magnetic Separators for Mills, of which the following is a specification.

This invention relates particularly to means for conducting grain to the hopper of a grinding mill and for separating from the grain during its passage to the mill magnetizable bodies such as nails, pieces of wire, etc., and preventing such bodies from passing with the grain to the mill.

The invention is embodied in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings forming a part of this specification,—

Figure 1 represents a front elevation of a grain-conducting chute embodying my invention, parts being broken away and parts shown in section.

Fig. 2 represents a side elevation of a portion of the chute.

Fig. 3 represents a fragmentary plan view showing the cross bar which connects the roll-supporting levers hereinafter described.

Fig. 4 represents a side elevation of the chute looking toward the side opposite that shown by Fig. 2.

Fig. 5 represents a section on the line 5—5 of Fig. 1.

The same reference characters indicate the same parts in all of the figures.

The frame supporting the chute and the mechanism hereinafter described coöperating therewith, as here shown, include a base 12 and two spaced-apart uprights 13, the base being supported by a standard secured at its lower end to a floor or other support 15. As here shown, said standard includes a base member 16 rigidly attached to the floor and a tubular upright 17 the upper end of which receives a shank 18 rigidly attached to the base 12.

The upright frame members 13 are spaced apart to receive between them a chute having an inclined bottom which extends from a receiving hopper 19 communicating with a source of supply to the hopper 20 of the grinding mill.

The bottom of the chute includes an upper portion 21 of any suitable material, and a lower portion or section 22 of iron or steel adapted to be magnetized, and to attract and hold loose magnetizable bodies such as nails, pieces of wire, etc., passing with a stream of grain through the chute. I have provided suitable means for magnetizing and demagnetizing the section 22, said means as here shown being embodied in electro-magnets 24 and suitable circuit connections between the said magnets, the section 22 and a source of electrical energy such as a magneto generator 25, said connections including a manually operable circuit breaking and closing switch 26. When the magnets 24 are energized by the closing of said switch, the section 22 is magnetized and caused to hold magnetizable bodies passing downwardly with the grain through the chute.

The bottom of the chute is provided below the section 22 with an outlet port 27 through which the said magnetizable bodies may fall into a removable tray or receptacle 28.

29 represents a deflector hinged to the chute, preferably by means of a rock shaft 30 journaled in bearings at the lower end portion of the chute, said deflector being adapted to stand in the position shown by dotted lines in Fig. 5 to close the port 27 and form a part of the bottom of the chute. When the deflector stands in the position shown by full lines in Fig. 5, it deflects metallic bodies sliding down the chute through the port 27 and into the receptacle 28.

I have provided yielding means normally holding the deflector in its deflecting position, said means being embodied in the rock-shaft 30, and an arm 33 thereon having a weight 34, said arm and weight being adapted to swing the deflector to its deflecting position. I have also provided adjustable deflector-restraining means adapted, under one adjustment to prevent the action of said yielding means, and positively hold the deflector in its port-closing position, and under another adjustment to permit the action of said yielding means and the shifting of the deflector to its deflecting position. I have embodied the restraining means in a two-armed operating lever 36, fulcrumed at 37 and provided with a handle 36ª, a flexible connection or chain 47 connecting one arm of said lever with the weighted arm 33, and a detent, here shown as a pin 44 adapted to be inserted in the lower one of two orifices 46 in a fixed upright 45, and, when so in-

serted, to engage the other arm of the lever 36 and hold the lever in the position shown by dotted lines in Fig. 4, the lever and the chain 47 being thus caused to positively restrain or hold the deflector in its port-closing position. When the lever 36 is moved to the full line position, (Fig. 4), the chain 47 is slackened and the deflector-shifting action of the said yielding means is permitted. It is necessary from time to time to arrest the flow of grain through the chute preparatory to removing an accumulation of magnetizable bodies from the section 22. To this end I provide a vertically movable gate 35 adapted to obstruct the chute above the section 22, as indicated by Fig. 5. Said gate is connected with one arm of the lever 36 by a sliding bar 38 having a pin 39 movable in a slot 40 in said lever arm and a two-armed lever 41, fulcrumed at 42, one arm of the lever 41 being connected with the upper end of the bar 38, and the other end with an arm or stud 43 on the gate 35. The described connections are so organized that, when the lever 36 is in the position shown by full lines in Fig. 4, and permits the shifting of the deflector, the gate is closed, and when the lever 36 is in the position shown by dotted lines and positively holds the deflector in its port-closing position, the gate is open. The lever may be confined in the full line position by the detent pin 44, the latter being inserted for this purpose in the upper orifice 46.

It will now be seen that when the lever 36 is adjusted and confined to positively hold the deflector in its port-closing position, the gate 35 is held open, and that when the lever is adjusted to permit the shifting of the deflector, it closes the gate.

The switch 26 may be manually operated to break the circuit after the lever 36 has been moved to close the gate and permit the shifting of the deflector.

I find it desirable to briefly hold the deflector in its port-closing position after the closing of the gate and the release of said shifting means, to give time for the proper discharge of the grain below the gate before the deflector is shifted to its deflecting position. To this end I attach to the rock-shaft 30 a metallic arm or armature 32 adapted to contact with and be attracted by the section 22, when the latter is magnetized, and thus hold the deflector in its port-closing position, as indicated by dotted lines in Fig. 4, until the circuit is broken, care being taken by the operator to move the lever 36 to position to close the gate and permit the shifting of the deflector before breaking the circuit.

One of the inclined edges of the section 22 projects laterally from one side of the chute, and the armature 32 is located outside the chute in position to contact with the projecting edge portion of the section, so that the armature does not obstruct the chute.

I am enabled by the described deflector-restraining means to prevent any liability of the accidental shifting of the deflector to its deflecting position, said means being positively acting and not dependent on magnetism or on a spring or springs.

The upper roll 52 is normally maintained at a predetermined distance from the lower roll by yielding means which permit the upper roll to yield upwardly in case a metallic body of maximum thickness or bulk passes between the rolls.

As here shown, the ends of the shaft 53 project from the outer sides of the frame members 13 into slots 55 in a pair of two-armed levers 56 fulcrumed at 57. One arm of each lever 56 is provided with a weight 58 which is preferably adjustable, said weights exerting a downward yielding pressure through the levers on the upper roll.

To vary the normal distance between the upper and lower feed rolls, I provide means preferably embodied in a cross bar 59, Fig. 3, connecting two of the arms of the levers 56, a fixed upright screw-threaded standard 60 passing loosely through said cross bar and having a nut 61 bearing on the upper side of the cross bar, a nut 62 preferably formed as a hand wheel engaged with the threaded portion of the standard 60, and a spring 63 interposed between the nut 62 and the cross bar 59. It will be seen that a vertical adjustment of the nut 62 causes the corresponding adjustment of the upper feed roll through the spring 63, said spring yielding to permit the upper feed roll to be raised by the passage of a metallic body of maximum bulk between the two feed rolls.

The lower feed roll may be driven by the means shown by Figs. 1 and 2 and including a belt 74 engaged with a driving shaft, not shown, and moving on a pulley 73 on a shaft 72 journaled in a bearing on the standard 18, a belt 64 connecting a pulley 64^a on said shaft with a pulley 65 on a shaft 65^a which is connected by gears 65^b and 65^c with the shaft 51 of the lower roll. Motion is transmitted from the lower roll to the upper roll through a gear 66 attached to the shaft of the lower roll, a gear 67 attached to the shaft of the upper roll, and intermediate gears 68, 69 mounted on a swinging arm 70 which is pivoted to swing on the shaft of the lower roll and is controlled by a spring 71 which holds the gear 69 in engagement with the gear 67. The described connections between the shafts of the two rolls compensate for independent vertical movements of the upper roll.

78, Fig. 5, represents a drag suspended to oscillate on an axis 79 which is located above the upper portion of the section 22, and is adapted to be held by gravity with its lower

edge separated from said section by a space permitting the passage of a shallow stream of material, said drag being movable outwardly, as indicated by dotted lines, so that its lower edge bears on the surface of a deeper stream and is adapted to depress magnetizable bodies thereon toward the section 22, to the end that said bodies may be brought within the influence of the section 22 instead of riding over the same without being attracted thereby.

I have set forth and claimed a chute having flow-controlling means, including the feed rolls 50 and 52, independently of the magnetic separating means, in another application for Letters Patent of the United States, Serial No. 129,490, filed November 4, 1916. It is obvious that the invention is not limited to chutes for conducting grain or cereals, and that a chute equipped with the described improvements may be used for conducting streams of cotton seed and other materials.

The inclined chute and its adjuncts hereinbefore described may constitute a part of the structure of a grinding mill instead of being constructed independently thereof as here shown.

I claim:

1. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, yielding means normally holding the deflector in its deflecting position, and deflector-restraining means including an adjustable member and a detent therefor, and adapted under one adjustment of said member to prevent the action of said yielding means, and positively hold the deflector in its port-closing position, said member when under another adjustment permitting the action of said yielding means.

2. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, yielding means normally holding the deflector in its deflecting position, and deflector-restraining means including a lever, a flexible connection between said lever and said yielding means, the lever being movable to a position preventing the action of the yielding means, and a detent for releasably securing the lever in said position, the release of said lever and its movement from said position permitting the action of said yielding means.

3. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, yielding means normally holding the deflector in its deflecting position, deflector-restraining means including a lever, a flexible connection between said lever and said yielding means, the lever being movable to a position preventing the action of the yielding means, and a detent for releasably securing said lever in said position, the release of said lever and its movement from said position permitting the action of said yielding means, a gate adapted to close the chute at a point above said magnetizable section, and gate opening and closing connections between said lever and the gate, adapted to close the gate when the lever is moved from said position.

4. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, yielding means normally holding the deflector in its deflecting position, deflector-restraining means including a lever, a flexible connection between said lever and said yielding means, the lever being movable to a position preventing the action of the yielding means, and a detent for releasably securing said lever in said position, the release of said lever and its movement from said position permitting the action of said yielding means, a gate adapted to close the chute at a point above said magnetizable section, gate opening and closing connections between said lever and the gate, adapted to close the gate when the lever is moved from said position, and an armature having a rigid mechanical connection with the deflector and adapted to be temporarily held by the magnetizable section after the closing of the gate with the deflector in its port-closing position to permit the delivery of material remaining on the chute below the gate, before the movement of the deflector to its deflecting position.

5. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section located above said port and projecting laterally from one side of the chute, means for

magnetizing and demagnetizing said section, a movable deflector adapted when in one position to close said port and form a portion of said bottom and when in another position to direct magnetizable bodies through said port, a rock shaft carrying said deflector, an armature on said rock shaft located outside the chute and adapted to be held by the laterally projecting portion of said section with the deflector in its port-closing position when the section is magnetized, and yielding means acting on said rock shaft to turn the latter and move the deflector to its deflecting position when the section is demagnetized.

6. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to close said port and form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, a rock shaft carrying said deflector, an armature on said rock shaft adapted to be held by the section with the deflector in its port-closing position when the section is magnetized, and a weighted arm attached to the rock shaft and acting thereon to turn the rock shaft and move the deflector to its deflecting position when the section is demagnetized.

7. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to close said port and form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, a rock shaft carrying said deflector, an armature on said rock shaft adapted to be held by the section with the deflector in its port-closing position when the section is magnetized, and yielding means acting on said rock shaft to turn the latter and move the deflector to its deflecting position when the section is demagnetized, means being provided for moving the deflector to its port-closing position and moving the said armature into contact with said magnetizable section.

8. In combination, a chute having an inclined bottom and provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted when in one position to close said port and form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, a rock shaft carrying said deflector, an armature on said rock shaft adapted to be held by the section with the deflector in its port-closing position when the section is magnetized, yielding means acting on said rock shaft to turn the latter and move the deflector to its deflecting position when the section is demagnetized, and an operating lever flexibly connected with said rock shaft and adapted to move the deflector to its port-closing position and to move the said armature to contact with said magnetizable section.

9. In combination, a chute having an inclined bottom provided with an outlet port near its lower end and a magnetizable section above said port, means for magnetizing and demagnetizing said section, a movable deflector adapted, when in one position, to form a portion of said bottom, and when in another position to direct magnetizable bodies through said port, a gate adapted to close the chute at a point above said magnetizable section, an armature connected with the deflector and adapted to be confined by said section to hold the deflector in its port-closing position when the section is magnetized, a two-armed operating lever, gate-opening and closing connections between said lever and the gate, and connections between said lever and the deflector organized to move said armature into contact with the magnetizable section when the gate is opened.

In testimony whereof I have affixed my signature.

HENRY O. LITTLE.