June 13, 1939. B. C. WOODFORD 2,162,190

MAGNETIC SEPARATOR

Filed Dec. 28, 1936

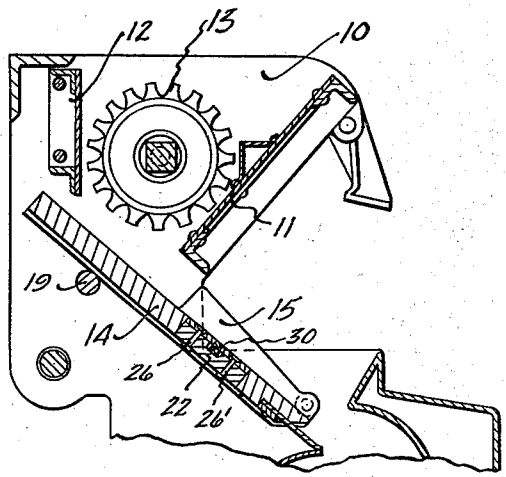


Fig. 1

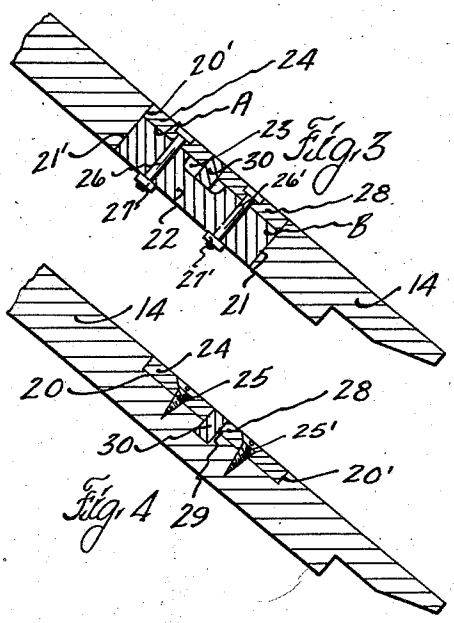


Fig. 3

Fig. 4

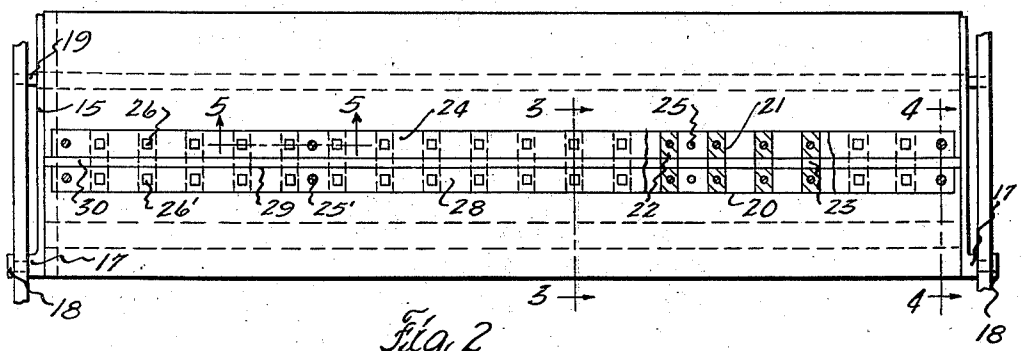


Fig. 2

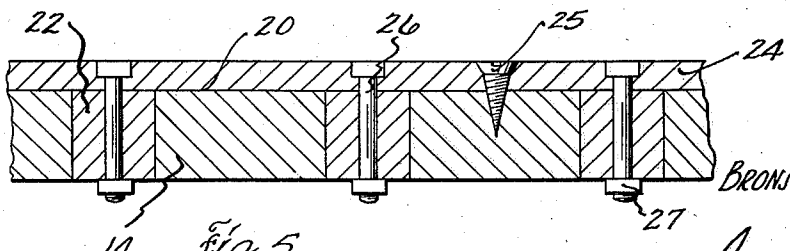


Fig. 5

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MAGNETIC SEPARATOR

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1 Claim. (Cl. 209—223)

This invention relates to new and useful improvements in magnetic separators.

One object of the invention is to provide an improved means for detecting and extracting metallic objects from a mass of non-metallic material which is particularly adapted for use in cotton linters or gins.

An important object of the invention is to provide an improved detector and extractor which includes a permanent magnet mounted in an inclined conductor or chute, whereby the metallic objects present in a mass of non-metallic material passing along the surface of said chute are attracted by the magnet and thus separated from the mass.

An important object of the invention is to provide an improved feed chute or board for linters which is provided with a permanent magnet mounted therein, whereby the usual electro-magnets, together with the expense incidental to their installation, are eliminated.

Another object of the invention is to provide an improved feed board having a plurality of permanent metallic magnets mounted therein, together with metallic bars connecting said magnets, the face of the bars being flush with the face of the board, whereby as the seeds move downwardly on the board, any extraneous metallic objects admixed with the seed are attracted by and held by said bars.

A further object of the invention is to provide an improved linter feed board wherein permanent magnets are mounted, whereby installation is simple and cost minimized and also whereby, after the magnets are once installed, they need never be remagnetized and will efficiently operate substantially throughout the life of the linter.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawing, in which an example of the invention is shown, and wherein:

Figure 1 is a vertical, sectional view of the inlet hopper of a linter having a feed chute or board, constructed in accordance with the invention applied thereto,

Figure 2 is an elevation of the board, having a portion of the retaining bars broken away to show the magnetic blocks therebeneath,

Figure 3 is a transverse, vertical, sectional view, taken on the line 3—3 of Figure 2,

Figure 4 is a transverse, vertical, sectional view, taken on the line 4—4 of Figure 2, and

Figure 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Figure 2.

For purposes of illustration, the invention is shown as applied to a cotton linter but it is noted that the invention is not to be limited to this use, as it may be employed wherever it is desired to separate metallic objects from a mass of non-metallic material.

In the drawing, the numeral 10 designates the feed hopper of a cotton linter which may be of any desired construction. The hopper includes the usual inclined front wall 11 and adjustable rear wall 12, and the transverse feed roller 13 is mounted therebetween. The cotton seed is fed into the top of the hopper and falls downwardly past the feed roller 13 onto an inclined feed chute 14. This chute has its lower end disposed above the chamber wherein the linter saws (not shown) are located so as to direct the seed from the hopper to the saws.

The feed chute comprises a transversely extending plate or board which is preferably constructed of wood although it may be made of any suitable material. For supporting the board in position within the linter, a bracket 15 is secured to each end of said board. This bracket is angular in cross-section and engages the edge and underside of the board, being suitably fastened thereto. Near its lower end, each bracket is provided with an outwardly extending collar 17 for receiving the end of a pin 18, which pin is journaled in the wall of the linter frame, whereby the lower end of the board is supported within the linter. The upper end of the board rests on a transverse shaft 19 which extends across the interior of the linter. It is pointed out that this mounting of the feeder chute or board 14 forms no part of the present invention and is, therefore, subject to variation.

Manifestly, all of the seed which is introduced into the linter must fall downwardly along the upper surface of the chute or board before it can enter the saw chamber. In the event that any nails, screws, washers or other metallic objects should become mixed with the seed, their introduction into the saw chamber would damage the saws and interfere with the efficient operation of the linter. To prevent the entrance of extraneous metallic objects into the saw chamber, it has been the practice to mount electro-magnets in the face of the board so that as these extraneous metallic objects are passed downwardly therealong, said magnets would attract the same

and hold them, thereby preventing their falling between the linter saws. These electro-magnets, now in general use, involve considerable mechanism and wiring and are not only difficult and expensive to install but require a good deal of attention to maintain them in working order.

In carrying out the invention, a longitudinal, shallow groove or recess 20 is formed in the face of the board or chute 14, preferably near the lower end thereof. The groove is comparatively wide and extends throughout the length of the board. A plurality of openings 21 are provided in the board and are located in spaced relation throughout the length thereof. Each opening extends from the base of the recess or groove 20 to the opposite side of the board, and has a general rectangular shape in cross-section. It is noted that each opening has a height substantially equal to the width of the groove, whereby the end walls 21' thereof form a continuation of the side walls 20' of said groove, as is clearly shown in Figures 2 and 3.

A permanent magnet block or yoke 22, which may be purchased on the open market and known to the trade as an "Alnico" permanent magnet, is inserted in each opening 21. The usual magnetic material has been found unsuitable because to obtain the necessary strength, the size of the magnet would make the same prohibitive for use in cotton machinery. The magnet blocks or yokes 22 are constructed of a metal alloy known as "Alnico" which is sold by the General Electric Company of Schenectady, New York. The maximum available energy is higher for "Alnico" than for the usual magnet alloys and occurs at a lower flux density and a higher demagnetizing force and therefore, maximum magnetic force may be obtained with a minimum size magnet. The resistance to being demagnetized in an "Alnico" magnet is approximately seven times as great as in chrome or tungsten magnets which are the magnets ordinarily used in large volume, and about twice that of 36% cobalt magnet steel which heretofore has been considered the very best. Shock and temperature have little effect on "Alnico" and the magnet is substantially permanent, developing and retaining a determined amount of flux indefinitely. The properties of "Alnico" are such that it will lift, when first charged or saturated, from sixty to seventy times its own weight. Its composition is entirely different than anything previously considered as possible in magnetic material and its development has completely upset past theories of what constituted magnet steel. Thus, it will be seen that by constructing the magnet blocks or yokes 22 of the material, it is possible to make them sufficiently small to embed them in the chute 14. The magnet block snugly fits within the opening and is of such depth that the face of each of its poles A and B lie flush with the base of the groove 20, as shown in Figure 5.

After all of the magnet blocks are in position within the openings, it will be seen that the poles A of the blocks are exposed in the upper end of the groove (Figure 2) while the poles B are exposed in the lower end of the groove. Due to the shape of each magnet block, an air space 23 is provided between the poles and due to this space, the central portion of each block is not flush with the base of the groove (Figure 2).

A longitudinal metallic bar 24 is inserted in the upper end of the groove and extends throughout the length thereof. The underside of this bar contacts the pole A of each magnet block or yoke. The bar is fastened to the board by wood screws 25 which have their heads countersunk in said bar so as to lie flush with the surface of said bar. Bolts 26 pass through the bar and the magnet blocks and receive nuts 27 on their opposite ends to securely connect the bar with the pole A of each magnet block. The heads of the bolts 26 are also countersunk in the bar 24. A similar connecting bar 28 is disposed in the lower end of the groove 20 and has its underside engaging the pole B of each block 22. This bar is similarly fastened to the board by screws 25' and to the magnets by bolts 26' and nuts 27'.

The thickness of the connecting bars 24 and 28 is such that when fastened in position in the groove, their outer surfaces lie flush with the face of the board 14, as clearly shown in Figure 4. It is further pointed out that with these bars in place (Figure 2), their inner edges do not contact whereby a longitudinal central channel 29 is formed therebetween. A longitudinal insulating strip 30, constructed of suitable insulating material, is inserted within this channel and insulates the connecting bars from each other.

With the above arrangement, it will be seen that the magnetic blocks 22, after being once installed, are permanent. As seed falls downwardly along the face of the board 14, any extraneous metallic objects admixed with said seed will strike the magnetized bars 24 and 28 and will adhere thereto until removed. Installation of the blocks is simple and inexpensive and requires no electrical hook-up. The magnets need no further attention and will operate efficiently during the life of the machine. In the event one of said magnets 22 need replacing for any reason, such magnet may be easily removed and a new one substituted therefor. Through actual experiments, it has been found that the "Alnico" permanent magnet bars are successful, but the invention is not to be limited to this specific magnet, as any permanent bar could be used. It is again pointed out that although the detector is shown and described as applied to a cotton linter, it may be used in other fields where it is found adaptable.

It is pointed out that although the bars 24 and 28 have been shown as extending throughout the length of the board, each bar could be divided into a plurality of short bars which when inserted in the grooves would form a substantially continuous bar. Further, the bars, whether a plurality of short sections or a single longitudinal section, could be made integral with the magnets instead of bolted thereto as shown.

What I claim and desire to secure by Letters Patent, is:

An inclined magnetic separating chute board, said chute board being of planular structure including two major surfaces, a main groove having a bottom wall formed in the upper surface of said chute board and running transversely of the axis of inclination, a sub-groove substantially centrally located in the bottom wall of said main groove and extending lengthwise thereof, both of said grooves extending substantially throughout the width of said board, a plurality of spaced elongated slots arranged transversely of said main groove extending entirely through the chute board from the bottom of said main groove to the bottom of said chute board, a plurality of narrow blocks of high flux density permanent magnetic alloy material ar-

ranged in said slots with their lower portions within the plane of the lower surface of said chute board, each of the blocks having upwardly extending projecting portions at their ends flush with the bottom of the main groove, a pair of spaced long pole bars extending throughout the length of the main groove and having their upper surfaces in the plane of the upper surface of the chute board and their lower surfaces contacting the said upwardly projecting portions, a long combined aligner and spacer of non-magnetic material arranged between the pole bars and in said sub-groove and extending throughout the length thereof, said spacer having its upper surface in the upper plane of the chute board and its lower surface extending below the bottom of the main groove, said bars contacting the sides of the spacer and operating to hold it in place, means for securing the bars to the chute board and means for securing the blocks to the bars, whereby a separator of planklike configuration results.

BRONSON C. WOODFORD.