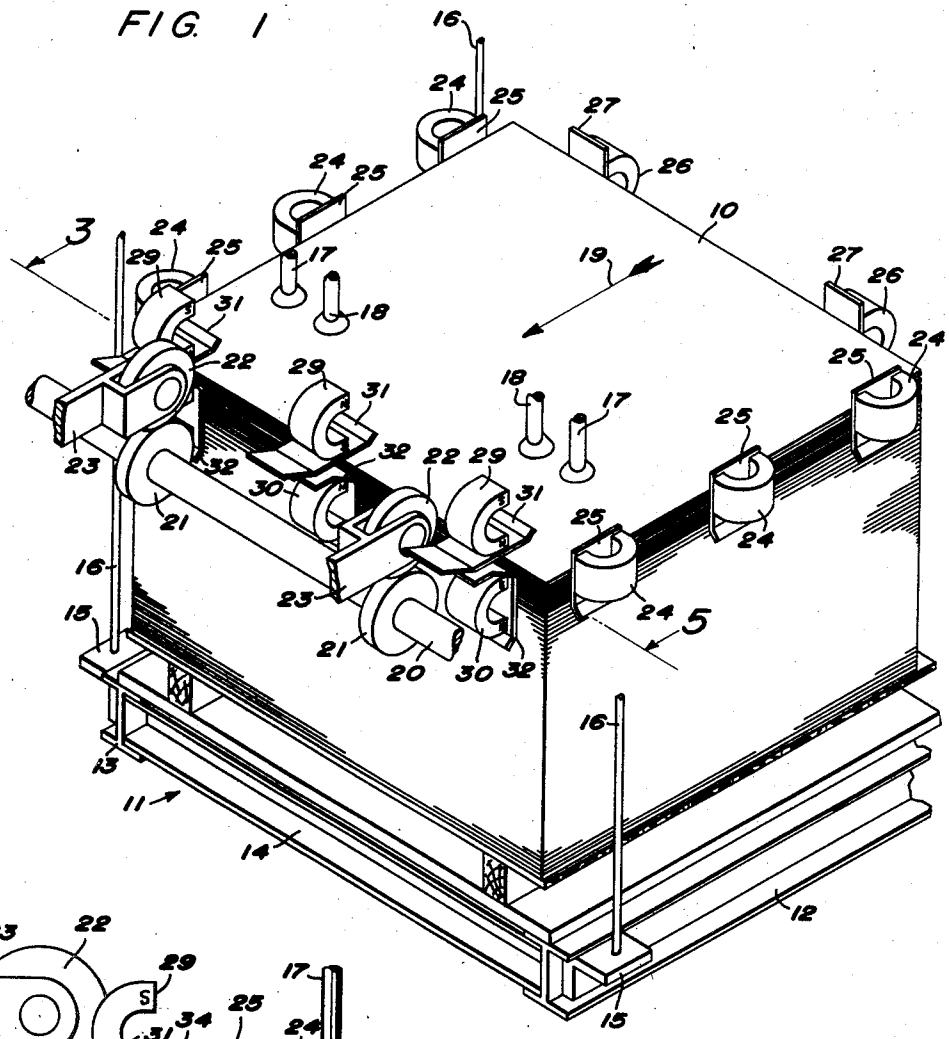
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MAGNETIC SEPARATION OF PILED MAGNETIC SHEETS

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FIG. 1



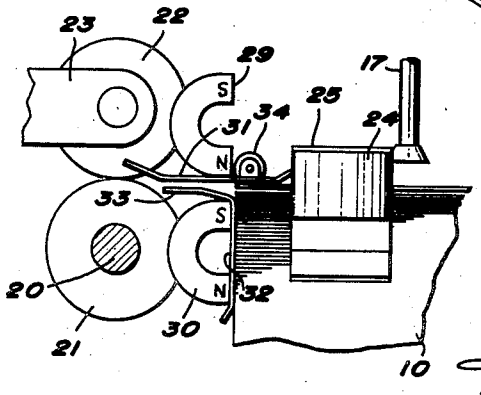


FIG. 2

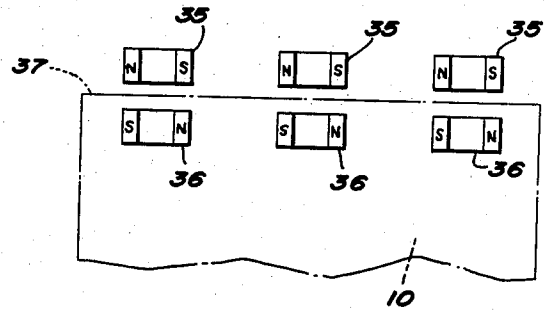
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MAGNETIC SEPARATION OF PILED MAGNETIC SHEETS

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FIG. 3



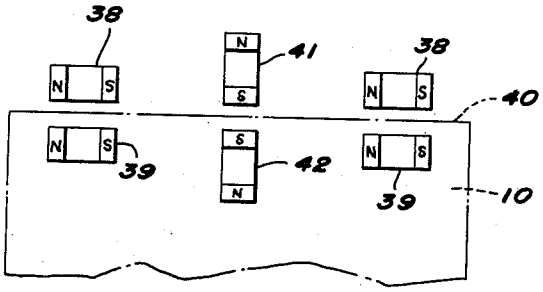
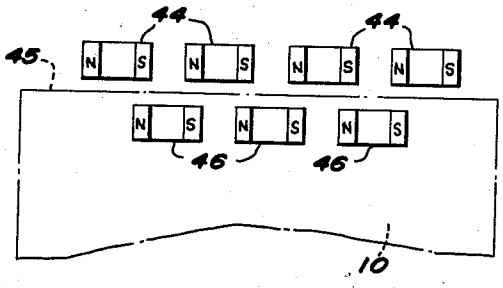


FIG. 4

FIG. 5



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2,860,874

MAGNETIC SEPARATION OF PILED MAGNETIC SHEETS

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Application June 16, 1955, Serial No. 515,944

13 Claims. (Cl. 271—10)

This invention relates to improvements in magnetic separation of piled magnetizable sheets. The invention has to do primarily with piled ferrous metal sheets, although it is applicable to other less frequently encountered materials and alloys having magnetic qualities.

The preliminary separation of the uppermost sheets of a pile of iron or steel sheets by magnetizing them with permanent magnets or electromagnets is known and conventional. In pile feeders for such sheets as previously built magnets are supported along the sides of the pile and sometimes at the rear end of the pile. In order to obtain the best results, that is the best magnetization of the uppermost sheets of the pile, horizontally disposed magnets should stand with about half their height or width above the top level of the pile. When the magnetic poles are spaced vertically the most effective sheet separation is accomplished when the top sheet of the pile is about one-third of the way down from the top of the magnet. In either case the upper portions of the magnets are materially above the top of the pile when the most effective separation is obtained. This fact makes it inadvisable to use magnets at the front end of the pile, because if they were to be so used the sheets as they were fed off the pile would need to have their front ends raised materially so as to clear the magnets.

The conventional way of handling and forwarding metal sheets is by means of a pair of transversely spaced suckers. They are positioned a short distance behind the front edge of the sheet. The sheets are generally of thin gauge and large area, and if they were to be raised materially by the suckers the portions forward of the suckers would tend to bend and sag and at times strike against the magnets. This can cause the sheets to be dropped by the suckers or, if only one corner stumbles, the sheet may be fed at an angle. Furthermore raising the sheets before forwarding them would seriously limit the top speed of a high speed feeder. As a consequence of these difficulties feeders for metal sheets as previously constituted have employed no magnets at the front end of the pile.

The principal object of the present invention is the provision of magnetic sheet separating means which shall be capable of effective use at the forward end of a pile of magnetic sheets.

Another object is the provision of front magnet means which shall do away with the necessity for raising materially the front end of the top sheet of the pile before it is fed forward off the pile.

Another object is the provision of front end magnet means which has an open space at the level of the top of the pile through which the sheet being fed may pass with a minimum of upward movement.

A further object is the provision of pairs of magnets spaced apart vertically, the top of the lower magnet and the bottom of the upper magnet of each pair being below and above the top of the pile respectively, for effecting magnetic separation of the front edges of the uppermost sheets, whereby an open space is provided between the magnets at the top level of the pile through which sheets

may be fed horizontally while requiring little or no raising.

Other objects and features of novelty will appear as I proceed with the description of those embodiments of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which

Fig. 1 is a somewhat diagrammatic isometric view of a pile feeder embodying the invention.

Fig. 2 is a fragmentary side elevational view illustrating one arrangement of magnets which may be employed in connection with the invention, and

Figs. 3, 4 and 5 are diagrammatic elevational views looking forward from a vertical plane corresponding to the line 3—5 of Fig. 1 and illustrating other arrangements of magnets which may be utilized for carrying out the invention.

As sheet metal feeders of the type with which this invention is to be used are known in the art, only so much of the feeder is herein illustrated as is believed necessary for a complete understanding of the invention by those skilled in the art.

Referring to Fig. 1, a pile of sheets **10** responsive to magnetic lines of force is carried on a pile support **11** of a pile feeder for metal sheets. The pile support comprises side arms **12** and **13** which may be I-beams connected at their forward ends by a crossbar **14** which is shown as of channel shape. Each of the arms **12** and **13** is provided with a pair of brackets **15** near its ends, one only being illustrated on each side, these brackets being supported by cables **16** of the pile feeder. It is to be understood that the pile support **11** is provided with conventional means for raising it intermittently during automatic feeding in response to control by pile height governing means (not shown) to maintain the top of the pile at a predetermined level.

After the uppermost sheets of the pile are preliminarily separated by magnetic means, as will presently appear, the top sheet of the pile is lifted slightly by conventional lifting suckers **17** and transferred to forwarding suckers **18**. The top sheet is then fed horizontally by the forwarding suckers **18** in the direction of arrow **19** to the bight of conventional pullout rolls. If desired, the lifting suckers **17** may be eliminated, since the top sheet will be approximately at the line of feed. As illustrated herein the pullout means comprises a shaft **20** driven continuously from the machine being fed. Shaft **20** carries two or more rolls **21**. Freely rotatable upper rolls **22** are carried by arms **23** which are swung down to cause rolls **22** to contact driven rolls **21** during a part of each cycle. The rolls **22** assist the lower rolls **21** to impart traction to the sheet. The pullout rolls **21**, **22** take over the forwarding action as the suckers **18** release the sheet and feed it either to a conveyor or directly to the sheet treating machine to which sheets are to be fed.

As is customary in pile feeders for magnetizable sheets, magnets **24** may be arranged alongside the top of the pile for effecting preliminary separation of the uppermost sheets of the pile. These magnets may be supported from the frame of the feeder (not shown) by any suitable means. Preferably they should stand at such a level that the uppermost sheet of the pile will intersect the magnets half way between their tops and bottoms. Brass or other non-magnetic guide plates **25** may be secured to the magnets on the sides facing the pile. They may have outwardly deflected lower ends which may assist in guiding the uppermost sheets as the pile is initially brought into position for the feeding of sheets therefrom.

At the rear end of the pile there are provided magnets **26** with guide plates **27**. These magnets may be arranged horizontally like the magnets **24**, or may have their poles disposed one above the other as herein illustrated,

These magnets **26** in addition to functioning as preliminary separating means also serve to hold or restrain the sheets next beneath the top sheet as the latter is drawn forward by the suckers **18**.

At the front end of the pile preliminary separation of the uppermost sheets is effected in a novel manner by providing a physically unobstructed magnetic field which may be created by one or more pairs of magnets arranged one magnet above the other. In the form shown in Fig. 2 one pair comprises an upper magnet **29** and a lower magnet **30**. In this case the magnets are disposed vertically and the north pole of magnet **29** is adjacent the south pole of magnet **30**. The distance between the adjacent poles of the two different magnets is less than the distance between the opposite poles of each magnet. Consequently the magnetic field between the two magnets is strong and it functions to effectively separate the front edges of the magnetic sheets. Although the arrangement illustrated, that is with opposite poles adjacent each other, is preferred, that arrangement is not essential. In other words an arrangement in which like poles of the two magnets are disposed adjacent each other will also effect good preliminary separation of the uppermost sheets of the pile. The great advantage of the pairs of magnets above and below the top level of the pile is that their spacing apart vertically provides an open space at the top level of the pile through which the sheets may be fed one after another without requiring lifting.

Below the magnet **29** and preferably fastened to it there is a brass or other non-magnetic guide plate **31** disposed horizontally, while on the rear side of magnet **30** there is a guide plate **32** of non-magnetic material with a horizontally disposed upper portion **33** spaced somewhat from the guide plate **31**. These guide plates serve to direct a sheet being fed off the pile into the bight of pullout rolls **21** and **22**. If desired one or both of these plates **31, 32** may carry antifriction means for facilitating the movement of the sheet being fed. As illustrated herein this antifriction means may consist of a small roller **34** carried by plate **31** and projecting through a slot in the plate slightly below the lower surface of the plate.

In Fig. 3 of the drawings magnets **35** and **36** are horseshoe magnets which are arranged horizontally instead of vertically as in the Fig. 2 form of the invention, the magnets **35** and **36** of each pair being mounted respectively above and below the top level **37** of the pile and somewhat closer together than the distance between the opposite poles of each individual magnet. In this case also the unlike poles of adjacent magnets **35** and **36** are disposed opposite each other.

In Fig. 4 there are two pairs of magnets **38, 39** disposed respectively above and below the level **40** of the pile. Here however like poles of the magnets **38, 39** are disposed opposite each other. While three pairs of magnets **38, 39** could be employed there may be instances where it will be more convenient to arrange the intermediate pairs of magnets **41, 42** vertically instead of horizontally and they are thus illustrated in this form of the invention. Where like poles of superposed magnets are arranged opposite each other, as in this figure, it is evident that the forward edge portions of the uppermost sheets near each pole will be correspondingly magnetized, so that those portions of adjacent sheets will repel each other.

In Fig. 5 upper magnets **44** are disposed above the level **45** of the top of the pile and lower magnets **46** are disposed beneath the level **45** in staggered relation. In this case the positive poles of one set of magnets are arranged opposite the negative poles of the other set, so that the magnetic action is presumably similar to that of Figs. 2 and 3.

In all forms of the invention heretofore described the same principle obtains, namely that magnetic poles above and below the level of the top of the pile at its forward end with open space between the poles effects sheet separation without interposing any obstacle to the feeding off of the top sheet and without requiring any substantial raising of the sheet. Two magnets spaced apart vertically create a magnetic field between them, much the same as the opposite poles of a single magnet create a field between them. By spacing two magnets vertically, applicant of course takes advantage of the omission of iron between the poles adjacent the top of the pile, which iron would present an obstacle to the forwarding of the sheets.

While in the forms of the invention shown permanent magnets have been illustrated, it should be understood that electromagnets may be used to accomplish the same results.

Having thus described my invention, I claim:

1. The method of feeding magnetizable sheets from a pile thereof, which comprises positioning in front of the forward end of the pile magnet means above the level of the pile, positioning a second magnet means below the pile level with a space therebetween, whereby the uppermost sheets are magnetically separated, and feeding off the top sheet through the space between said magnet means.

2. The method of feeding magnetizable sheets from a pile thereof, which comprises positioning in front of the forward end of the pile a pair of permanent magnets one spaced above the other, whereby the uppermost sheets are magnetically separated, and feeding off the top sheet through the space between said magnets.

3. The method of feeding magnetizable sheets from a pile as defined in claim 2, which comprises arranging said magnets with the poles of each magnet one above the other.

4. In apparatus for feeding magnetizable sheets one after another from the top of a pile of such sheets, a plurality of magnets in front of the forward end of the pile partly close above and partly close below the path of sheet feed for creating a magnetic field for separating the front edges of said sheets, there being a space between the portions of said means above and the portions of said means below said path of feed for permitting unobstructed travel of sheets between said portions, and means for feeding sheets one at a time through said unobstructed space.

5. Apparatus substantially as defined in claim 4, comprising a non-magnetic guiding plate beneath the upper magnet and a non-magnetic guiding plate above the lower magnet, between which guiding plates the sheets are directed as they are fed off the pile by said feeding means.

6. Apparatus substantially as defined in claim 5, wherein one of said non-magnetic plates carries antifriction means projecting slightly beyond the surface of the plate into the path of travel of the sheet being fed off the pile.

7. Apparatus substantially as defined in claim 6, wherein said antifriction means is carried by the upper non-magnetic plate and projects downward slightly beneath the lower surface thereof.

8. Apparatus substantially as defined in claim 4, comprising magnet means at the rear end of the pile for attracting and restraining the uppermost sheets of the pile beneath the top sheet thereof while the latter sheet is being advanced by said feeding means.

9. Apparatus substantially as defined in claim 4, comprising magnet means at both sides of the pile for separating the side edges of the uppermost sheets and for thereby aiding and facilitating the forwarding of the top sheet by said feeding means.

10. In apparatus for feeding magnetizable sheets one after another from the top of a pile of such sheets, a plurality of transversely spaced magnets disposed below the top of the pile in advance of the forward end thereof, a plurality of magnets above the first named magnets

and above the top of the pile, said magnets serving collectively to magnetically separate the forward edges of the uppermost sheets of the pile, a plurality of magnets along each side of the pile disposed partly beneath and partly above the uppermost sheets of the pile for separating the side edges of the uppermost sheets, and sucker means for feeding off the top sheet through the space between the upper and lower magnets at the forward end of the pile.

11. Apparatus substantially as defined in claim 10, comprising magnet means at the rear end of the pile for attracting and restraining the uppermost sheets beneath the top sheet while the latter sheet is being advanced by said sucker means.

12. Apparatus for feeding magnetizable sheets substantially as defined in claim 4, wherein said sheet feeding means comprises a pair of suckers, said apparatus comprising a pair of pullout rolls disposed in front of the pile with their bight at substantially the same level as the top of the pile, said rolls being timed to take each sheet at approximately the same time that the vacuum in said sucker forwarding means is broken.

13. In apparatus for feeding magnetizable sheets one after another from the top of a pile of such sheets, a plurality of transversely spaced magnets disposed below the top of the pile in advance of the forward end thereof, a plurality of magnets above the first named magnets and above the top of the pile, all of said magnets serving collectively to magnetically separate the forward edges of the uppermost sheets of the pile, and means for feeding off the top sheet at the pile level through the space between the upper and lower magnets at the forward end of the pile.

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