

June 7, 1960

R. ASHTON

2,939,581

COMBINE CLEANING SHOE

Filed Aug. 16, 1956

4 Sheets-Sheet 1

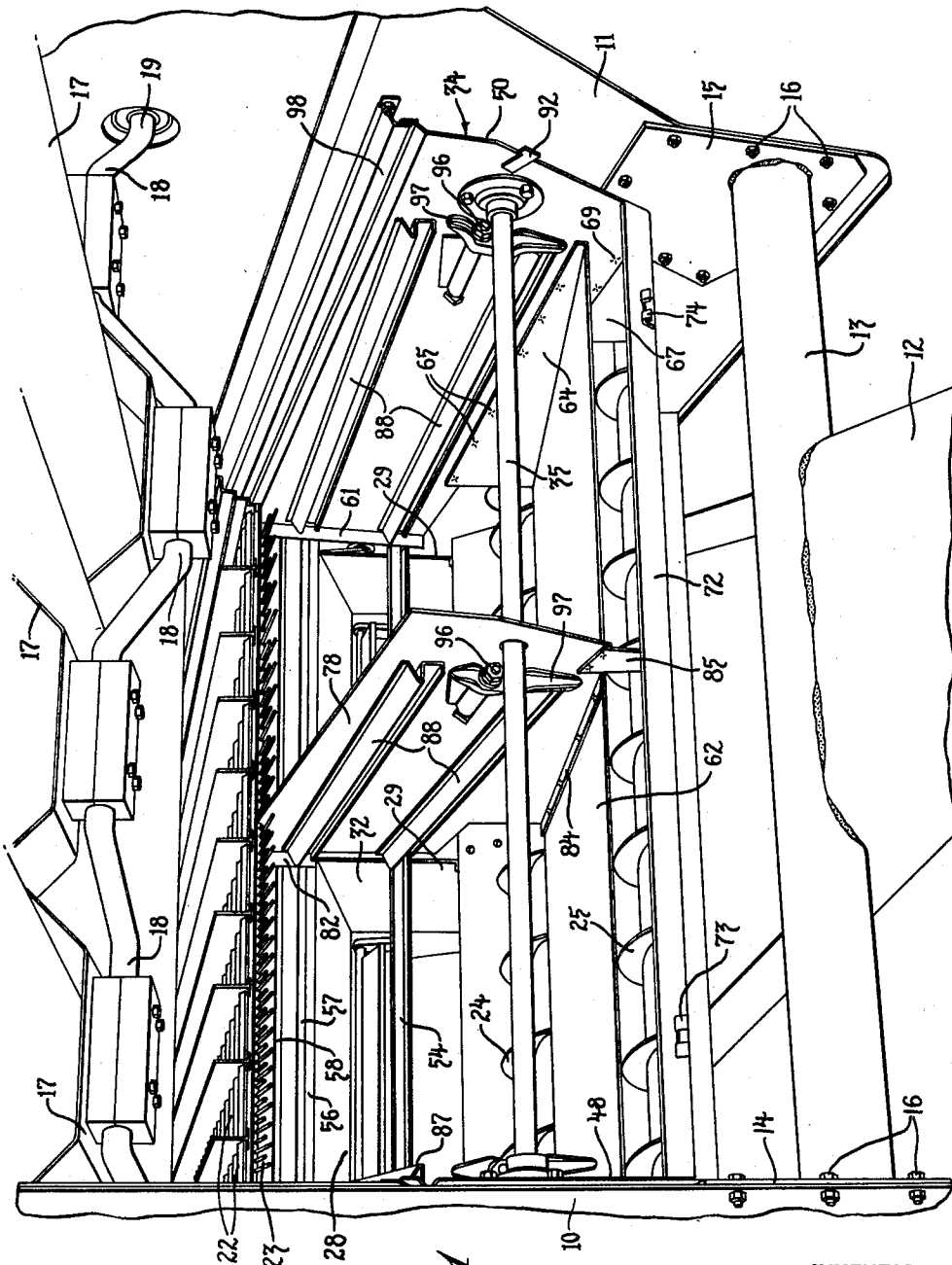


Fig. 1

INVENTOR.
ROBERT ASHTON

BY

James E. Milles
ATTORNEY.

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R. ASHTON
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4 Sheets-Sheet 2

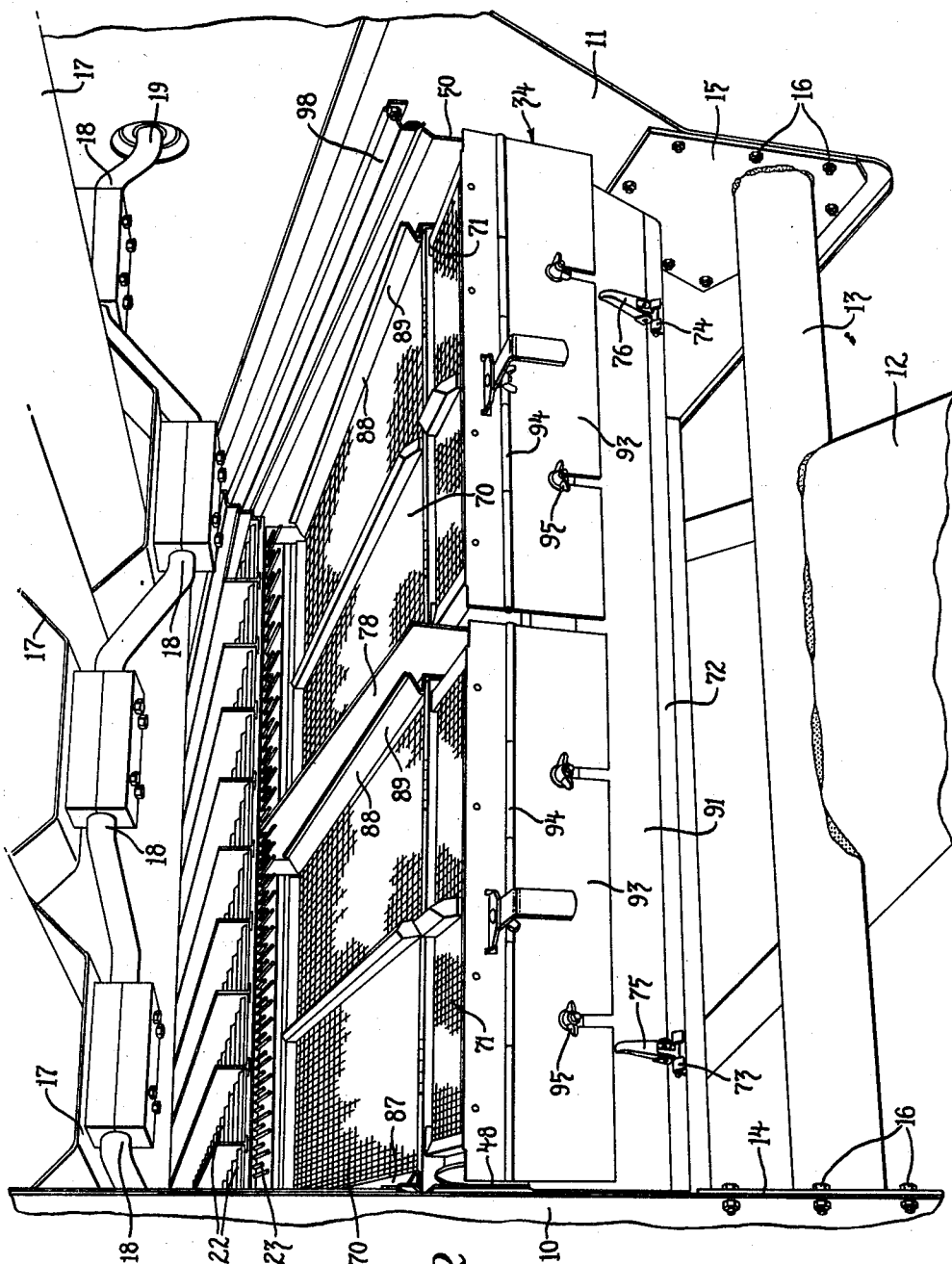


Fig. 2

INVENTOR.
ROBERT ASHTON
BY
James E. Nilles
ATTORNEY.

June 7, 1960

R. ASHTON
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4 Sheets-Sheet 3

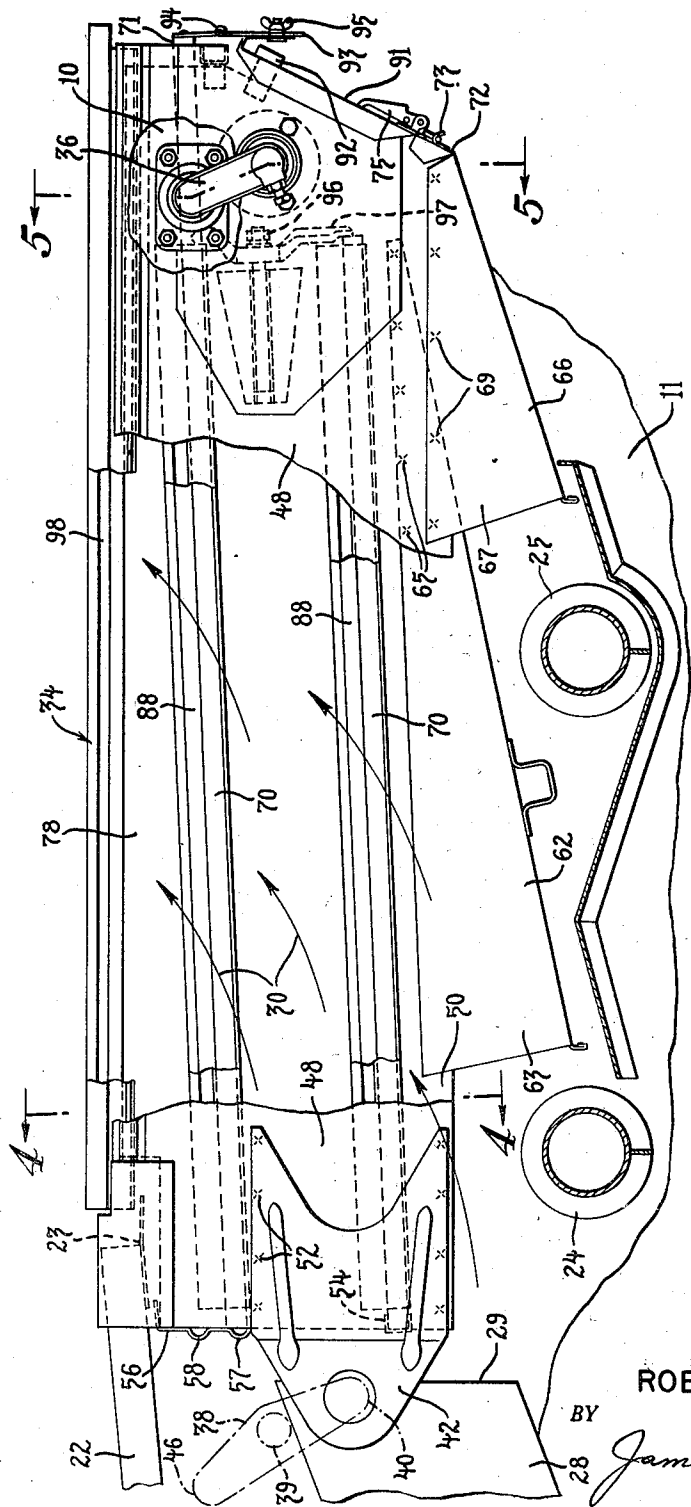


Fig. 3

INVENTOR.
ROBERT ASHTON

BY

James E. Nilles
ATTORNEY.

June 7, 1960

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4 Sheets-Sheet 4

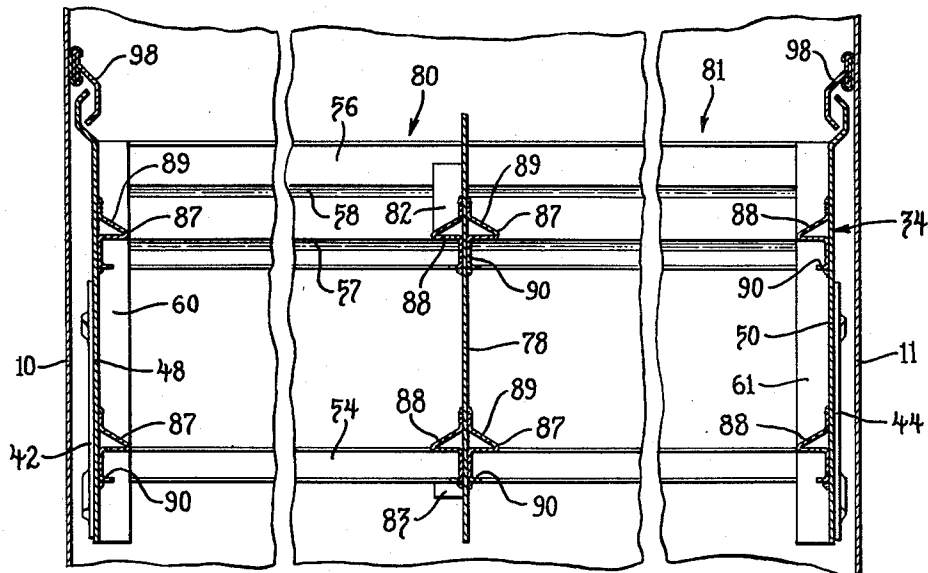


Fig. 4

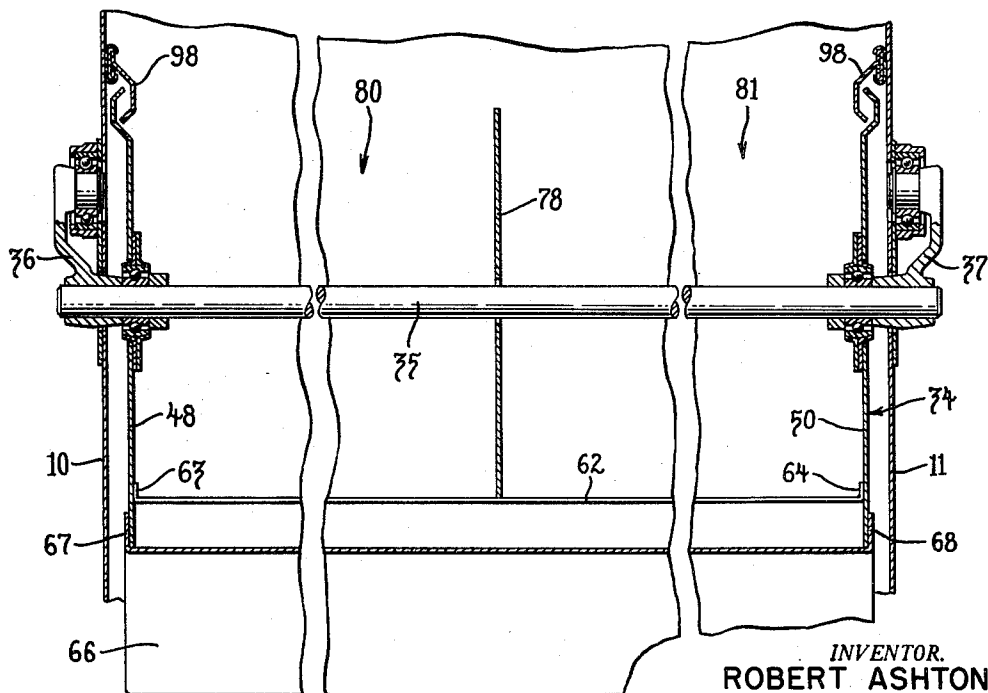


Fig. 5

INVENTOR.
ROBERT ASHTON

BY

James E. Nilles
ATTORNEY.

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2,939,581

COMBINE CLEANING SHOE

Robert Ashton, Toronto, Ontario, Canada, assignor to Massey-Ferguson Inc., a corporation of Maryland

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4 Claims. (Cl. 209—318)

This invention relates generally to combines, and is more particularly concerned with the cleaning and separating mechanism therefor, which is commonly referred to as the shaker shoe.

During the operation of a combine, a portion of the crop material comprising grain, chaff, weed seeds, particles of straw and other refuse is delivered to the cleaning shoe for separation of the grain from the rest of this material. The shoe usually comprises a series of vertically spaced separating and classifying screens or sieves which are reciprocated rapidly in a fore and aft direction to facilitate the passing of the grain through the screens. At the same time a blast of air is delivered to the underside of the shoe by the fanning mill which is generally of the same width as the shoe itself. This blast of air is directed upwardly and rearwardly through the sieves and acts to carry the lighter material, such as the chaff and straw, off the shoe and out the rear end of the combine. The material as it is delivered to the reciprocating cleaning shoe is not always spread evenly across the width of the shoe but often comes in bunches. In other words, the thickness of the layer of crop material across the width of the shoe varies considerably and this uneven loading of the cleaning mechanisms has been a troublesome problem. The difficulty has been aggravated in more recent years with the advent of increasingly wider machines where the width of the cleaning mechanism and fan mill may be on the order of 42 inches.

The air pressure delivered by the fan mill varies accordingly therefore, across the width of the bottom of the shoe, depending on how the latter is loaded. Stated otherwise, the distribution of the air flow is not uniform across the shoe width, the flow of air taking the path of least resistance, that is, through the "thin" area or lightly loaded portions of the screens. This results in inefficient and incomplete separation of the grain, the large air volume through the thin areas tends to carry grain "over the shoe" with the refuse, and the heavily loaded areas progressively build up to a point where they plug the machine.

Accordingly, it is one object of this invention to provide a cleaning mechanism of the above type which controls the distribution of air over the width of the shoe.

It is a more specific object of the invention to provide a shaker shoe of the above type which maintains completely separate air streams throughout the entire length of the shaker shoe.

It is a general object of this invention to provide an improved and highly efficient reciprocating cleaning mechanism for a combine which is exceptionally strong and rigid and which permits more efficient operation when working on a hillside.

Another object of this invention is to provide an improved cleaning shoe for a combine which utilizes the air blast delivered to it in an efficient manner and results in being able to use a fan mill of smaller capacity with a corresponding more economical use of other component parts.

Other objects and advantages of this invention will be-

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come more apparent from the following detailed description and attached sheets of drawings wherein a form of the invention is illustrated. Accordingly, the present invention may be considered as comprising the various, constructions, combinations, or subcombinations of parts as is hereinafter more fully set forth in the detailed description and in the claims, reference being had to the accompanying drawings in which:

Figure 1 is a perspective view into a combine embodying the invention, taken generally from the rear of the combine, certain parts being broken away and others removed and also having the sieves removed for the sake of clarity.

Figure 2 is a view similar to Figure 1, but with the sieves in place and the cleaning shoe assembled.

Figure 3 is a left side elevational view of the improved cleaning mechanism shown in Figures 1 and 2, certain parts being in section and others removed or broken away for clarity of the drawings.

Figure 4 is a sectional view taken on line 4—4 of Figure 3 but on an enlarged scale.

Figure 5 is a sectional view taken on line 5—5 of Figure 3, but on an enlarged scale.

Referring more particularly to the drawings, the left and right sides 10, 11 of the combine body are carried by the main frame structure 12 for movement over the field. A support tube 13 which forms part of the frame structure has plates 14, 15 welded to its ends to which are rigidly secured by bolt means 16, the sides 10, 11 respectively.

As shown in Figures 1 and 2, conventional straw walkers 17 are mounted within the combine body on the throw portions 18 of the crank 19 for a bodily rotative movement in the well known manner.

A conventional grain pan 22 is also provided within the combine body and serves to deliver the grain, chaff, particles of straw and other refuse, rearwardly over its discharge end 23.

Also within the body proper of the combine and at its lowermost side, are the conventional "clean grain" auger 24 and the "tailings" auger 25 which are rotatably mounted in the body sides 10, 11 and driven so as to convey the clean grain and the tailings into their respective elevators for subsequent storage and rethreshing, respectively, in a manner well known in this art.

A fanning mill, indicated generally by numeral 28, is provided within the combine body and the mill has a discharge opening 29 which faces in a rearward direction, in respect to the normal direction of combine travel. The fan mill is approximately the same width as the combine body and serves to deliver a stream of air under pressure, commonly called the "air blast" in a rearward and upward direction, as indicated by the arrows 30 in Figure 3, and through the cleaning mechanism to be described. In accordance with the teachings of my co-pending U.S. application Serial No. 566,708, filed February 20, 1956, now Patent No. 2,849,118, and entitled, "Fanning Mill for Combines," a center baffle plate 32 is provided which has overcome some of the difficulties of uneven air distribution over the width of the shaker shoe. The present invention finds particular utility when used with a fanning mill of the general type disclosed in my said application, although it is not limited to such use. If further details of construction or operation of the fanning mill is deemed necessary, reference may be had to said application.

The cleaning shoe 34 is reciprocatingly mounted within the combine body on the rear shaft 35 by the hangers 36, 37 which are swingably mounted at their upper ends in the body sides 10, 11 respectively. The reciprocatory drive for the shoe 34 comes from the cranks 38 (only one shown) which are secured to each end of shaft 39 which

in turn is mounted to the body sides 10, 11. The lower ends 40 of the cranks 38 are rotatably attached to plates 42, 44 respectively (Figures 3 and 4) extending forwardly from the sides of the shoe 34. The upper ends 46 are reciprocated in the conventional manner to cause the entire shoe to reciprocatorily swing fore and aft and thereby cause the material delivered to it by the rear edge 23 of the grain pan to move rearwardly thereover.

The shaker shoe 34, as it is also commonly referred to, includes substantially vertical side walls 48, 50 which extend in a general fore and aft direction, regarding normal combine travel. The shoe walls 48, 50 are spaced apart in a transverse direction so the shoe is of a width substantially the same as that of the combine body and fan mill 28. In the larger self-propelled combines which are being advocated in these times, this "straight through" width is on the order of 42 inches. This invention is directed to means for controlling the flow or distribution of air across this relatively wide shoe regardless of the manner in which it has been loaded with crop material.

Crank attaching plates 42, 44 are secured, as by spot welding 52, to shoe walls 48, 50 and extend forwardly therefrom. Rigidly connecting the front ends of walls 48, 50 is the lower screen retaining channel strip 54 and the upper screen retaining plate 56 having strengthening channels 57, 58 pressed therein. Retaining strip 54 and plate 56 are welded to the inwardly turned flanges 60, 61 of side walls 48, 50. Bottom edges of walls 48, 50 are rigidly secured together by the clean grain chute 62 having upturned flanges 63, 64 which are spot welded as at 65 to walls 48, 50 respectively. This chute 62 serves to deliver the grain, which has passed through the shoe, to the auger 24. A tailings chute 66 is also spot welded as at 69 to walls 48, 50 by its upturned flanges 67, 68, respectively. This chute 66 delivers the tailings, which have passed over the chaffer screen 70 and through the tailings screen 71, to the auger 25. Chute 66 also has an upwardly turned flange 72 extending along its rear edge to which are secured hooks 73, 74 of the overcenter door latches 75, 76 respectively. Thus the framework of the shoe includes side walls 48, 50, front members 54, 56; chutes 62, 66 and also the rear mounting shaft 35 which together form a rigid cleaning shoe capable of being reciprocated as a unit. The shoe further includes a substantially vertical intermediate baffle plate or wall 78 which is arranged in a fore and aft direction in substantial parallelism with side walls 48, 50. It will be noted that plate 78 is substantially coextensive with the length of the side walls as well as with their height. In other words, the intermediate plate 78 divides the entire shoe into two separate compartments 80 and 81.

The center baffle 78 is also rigidly secured by its front flanges 82, 83 (Fig. 4) to front shoe members 54, 56. The lower flange 84 of the baffle is welded to chute 62 while a bracket 85 is welded to the rear end of the baffle and to chute 66.

Complementary guide means are provided for slidably receiving the various screens. These guide means comprise sheet metal strips 87, 88 of a cross section best shown in Figure 4. These strips 87, 88 are similar except that they are complementary to each other, one being a "left" and the other being a "right." They all have an inclined upper grain shedding portion 89 which causes the crop material to fall onto the screen and prevents accumulation of material along the edge of the screens. The strips 87, 88 also include a lower channel shaped screen receiving portion 90 which is adapted to slidably receive its screen.

The strips thus formed are exceptionally rigid and add a considerable degree of strength to the entire shoe when welded to their respective walls and baffle plate. An upper and lower screen is easily inserted in their respective pair of complementary strips between each side wall 48, 50 and the intermediate baffle plate.

A single rear door 91 encloses the rear end of the 75

shoe and is removably attached on hooks 92 and held by overcenter latches 75. The tailings screens 71 each have a plate 93 hinged at 94 to its rear side and by the wing nut and bolt means 95 is adjustable as to its angle.

In other words, by raising the rear end of the screen 71, it will be inclined upwardly and rearwardly to retard the flow of tailings thereover. The entire shoe can be made readily accessible from the rear end by loosening wing nuts 95, removing screens 71, opening latches 75 and then lifting the entire door 91 off of its hooks 92. The regular screens 70 which fit in strips 87, 88 can then be removed by simply loosening nuts 96 of the screen retaining brackets 97. Eaves 98 are secured along the inner side of the body walls 10, 11 and overhang the shoe sides 48, 50 as best shown in Figures 4, 5. Sufficient room is provided between these eaves 98 and shoe sides 48, 50 so as to permit reciprocatory swinging movement between these parts. These eaves prevent accumulation of material along the shoe sides and also prevent grain loss.

It will be noted (Figure 2) the baffle extends above the upper screen 70. When operating on a hillside the machine is tilted in a transverse direction and the baffle also acts to keep the material from shifting entirely to one side of the shoe and therefore enhances more efficient operation in this manner.

It will now be appreciated by those skilled in this art that a plurality of these intermediate baffle plates may be provided across the width of the shoe. By this means the air is evenly distributed across the shoe and prevented from seeking a path of least resistance there-through. Separate streams of air under pressure are maintained throughout the entire length of travel through the shoe. By this efficient use of air pressure a smaller volume fan, either in size or r.p.m., can be utilized. Furthermore, a more rigid and stronger cleaning shoe results from this construction.

It should be understood that it is not intended to limit the invention to the above described forms and details, and that the invention includes such other forms and modifications as are embraced by the scope of the appended claims.

I claim:

1. In a combine, a cleaning shoe including two laterally spaced and substantially vertical side walls extending in a fore and aft direction in respect to the direction of combine travel, a substantially vertical baffle plate between and substantially coextensive with said walls and extending generally in said fore and aft direction, said walls and plate being rigidly secured together and adapted to be reciprocated as a unit, said walls and plate having opposed pairs of complementary guide means for slidably receiving a plurality of vertically spaced screens therebetween, said guide means permitting said screens to be slidably received from the aft end of said combine.

2. In a combine, a cleaning shoe comprising, in combination, a pair of laterally spaced, vertical side walls adapted to extend longitudinally of a combine, a baffle plate positioned intermediate said walls and extending generally parallel thereto, the opposite sides of said baffle plate and the opposed sides of said walls having a plurality of vertically spaced, opposed pairs of horizontal guides, the guides of each pair lying in a common plane and each pair between one wall and the baffle plate being horizontally aligned with a pair between the other wall and the baffle plate, a plurality of screens with each screen being slidably fitted within a pair of said opposed guides so as to define a plurality of vertically spaced screen layers extending between said side walls and divided by an intermediate baffle plate, and means for locking each of said screens within their respective guides.

3. In a combine, a cleaning shoe comprising, in combination, a pair of laterally spaced, vertical side walls

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extending longitudinally of the combine, a baffle plate positioned intermediate of said walls and extending generally parallel thereto, said side walls and said baffle plate being rigidly connected to form a unitary box-like structure, the opposite sides of said baffle plate and the opposed sides of said walls having a plurality of vertically spaced, opposed pairs of horizontal guides, the guides of each pair lying in a common plane and each pair between one wall of the baffle plate being horizontally alined with a pair between the other wall and the baffle plate, a plurality of screens with each screen being slidably fitted within an opposed pair of said guide so as to define a plurality of vertically spaced screen layers extending between said side walls and divided by an intermediate baffle plate, means for locking each of said screens within their respective guides, means to swingably support one end of said box-like wall and plate structure, and means coupled to the other end of said structure for reciprocating the entire shoe.

4. A cleaning shoe for a combine comprising, in combination, a pair of laterally spaced, vertical side walls adapted to extend longitudinally of a combine, a baffle plate positioned intermediate said walls and extending generally parallel thereto, the opposite sides of said baffle plate and the opposed sides of said walls defining surface carrying a plurality of vertically spaced, opposed pairs of horizontal guides, said guides being formed of an integral strip of metal folded longitudinally to define a screen-edge receiving channel, the upper wall of said

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strip being folded back so as to slope rearwardly and upwardly from said channel and extending to a vertical plane passing through the back of said channel, the upper edge of said sloping wall being folded to define a flange lying in said vertical plane and abutting the surface on which the guide is carried, the guides of each of said pairs lying in a common horizontal plane and each pair between one wall and the baffle plate being horizontally alined with a pair between the other wall and the baffle plate, a plurality of screens with each screen being slidably fitted within the receiving channels of said opposed guides so as to define a plurality of vertically spaced screen layers extending between said side walls and divided by an intermediate baffle plate, and means for locking each of said screens within their respective guide channels.

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