March 23, 1954

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2,672,970

BARN GUTTER CLEANER

Filed Jan. 22, 1951

4 Sheets-Sheet 1

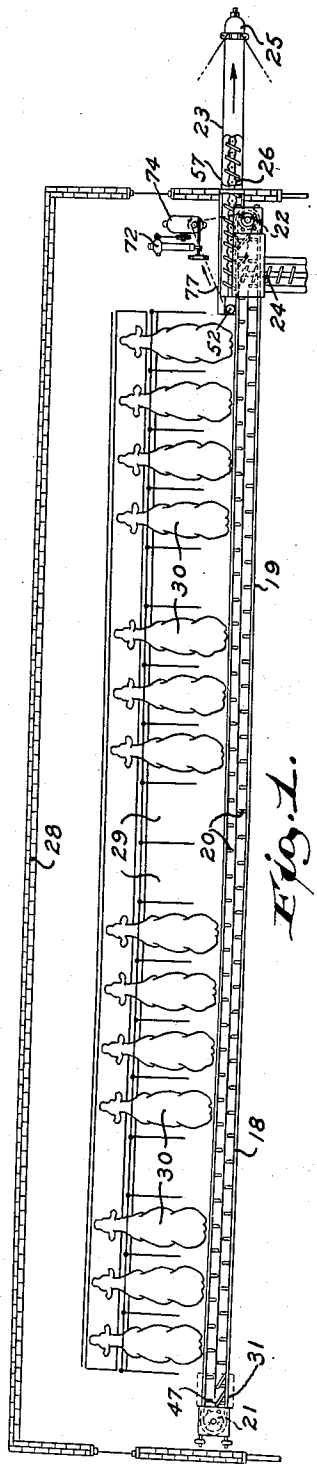


Fig. 1.

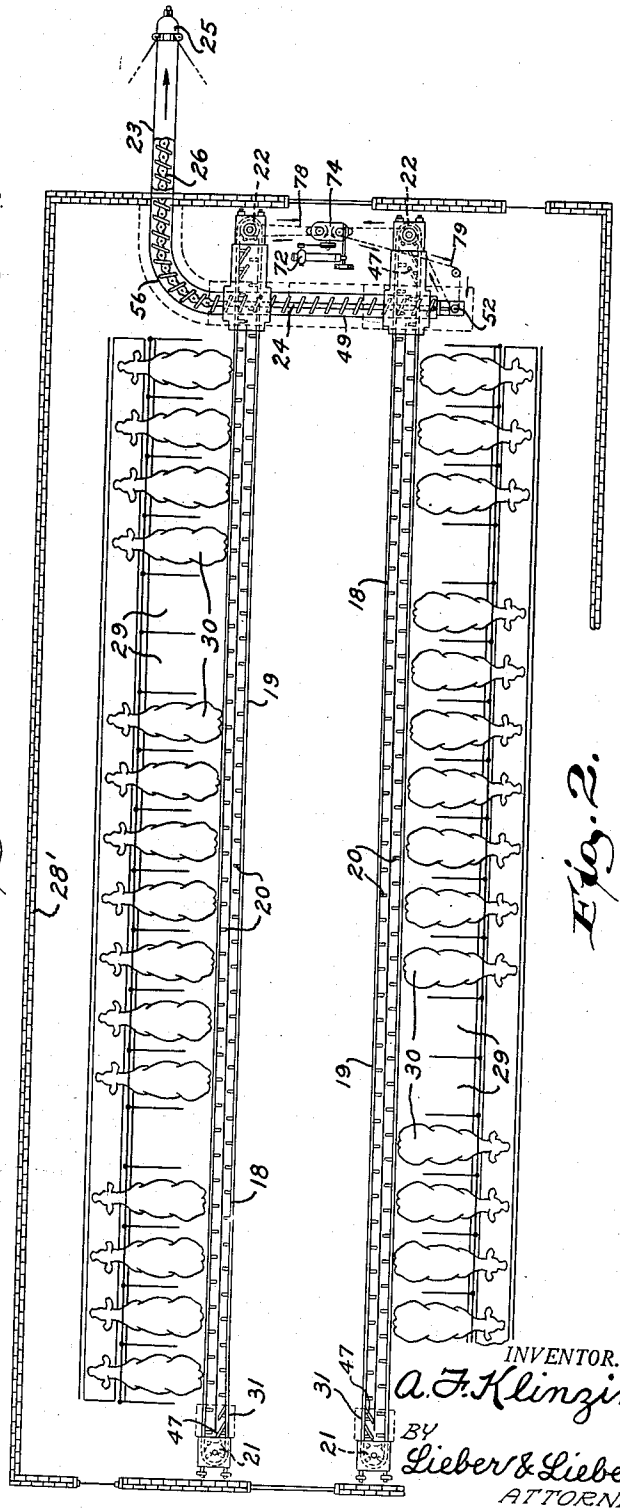


Fig. 2.

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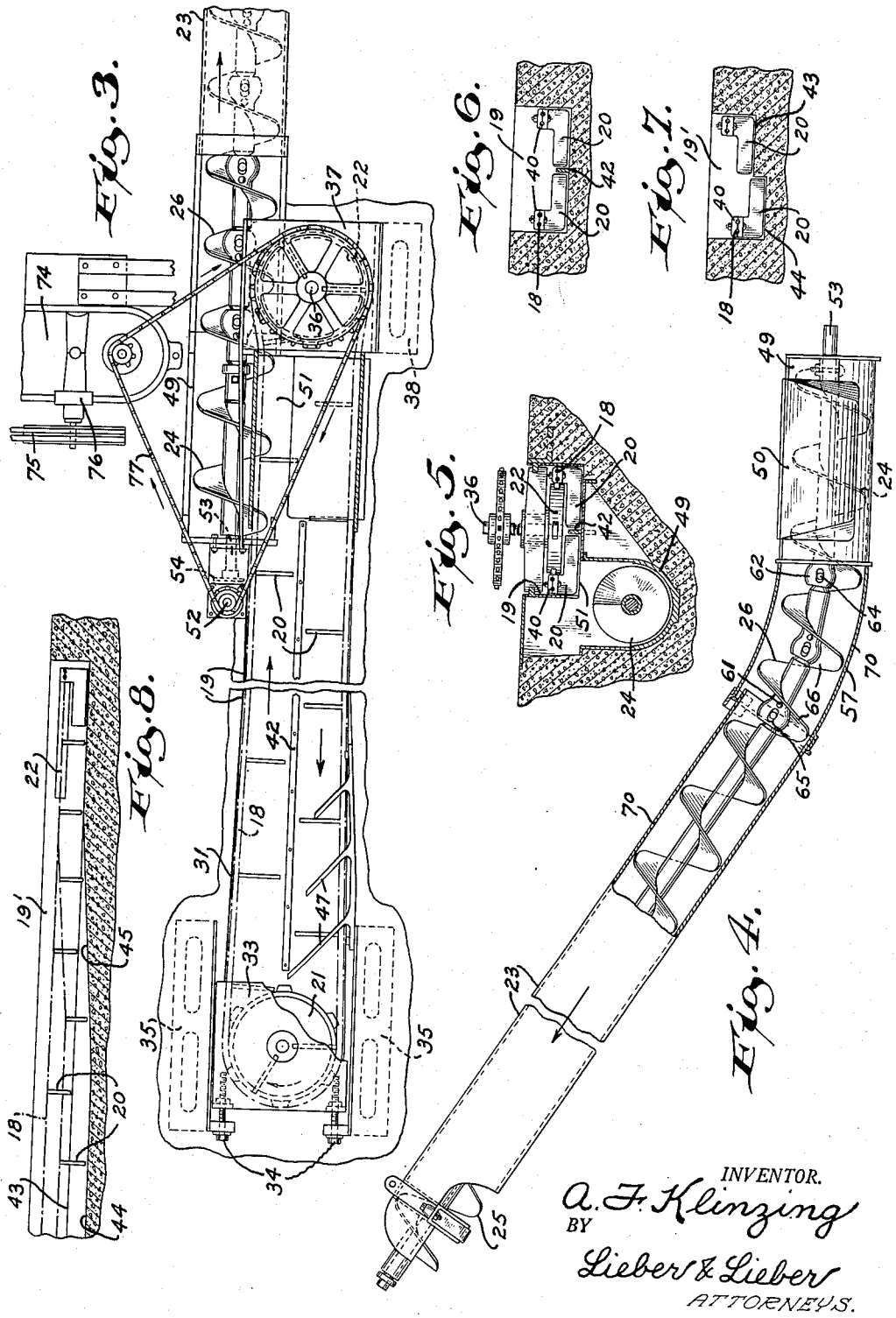
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BARN GUTTER CLEANER

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4 Sheets-Sheet 3

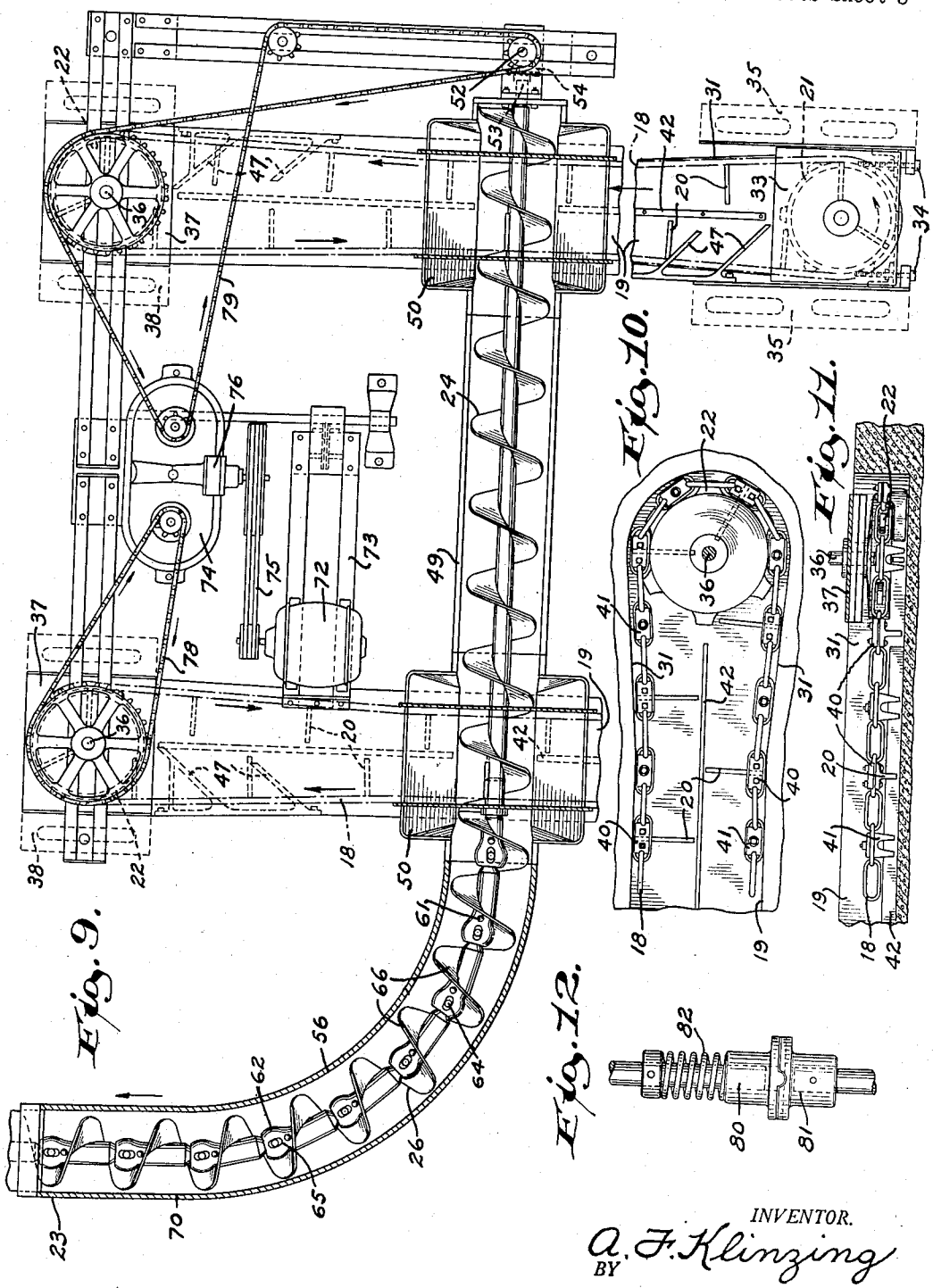


Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

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BARN GUTTER CLEANER

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Fig. 13.

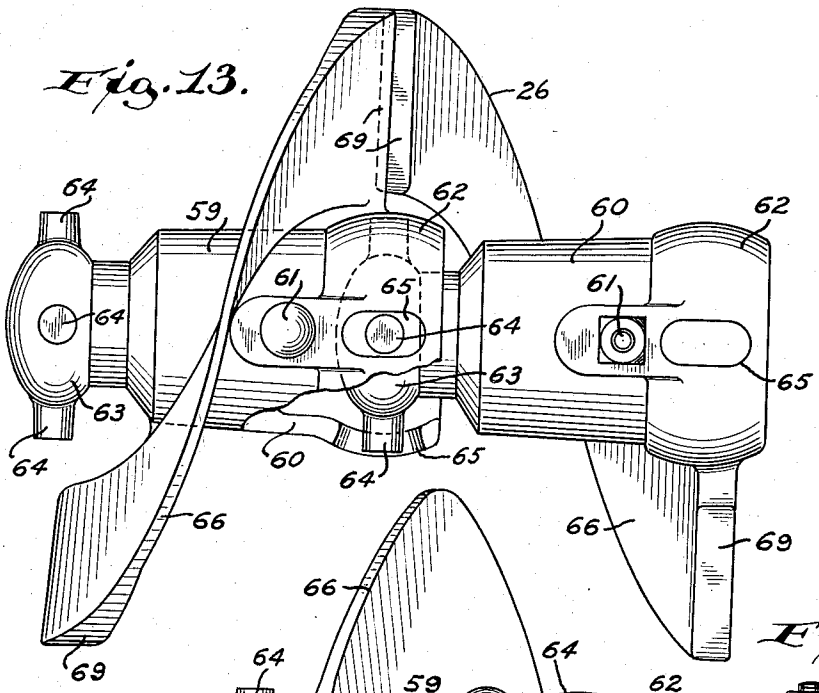
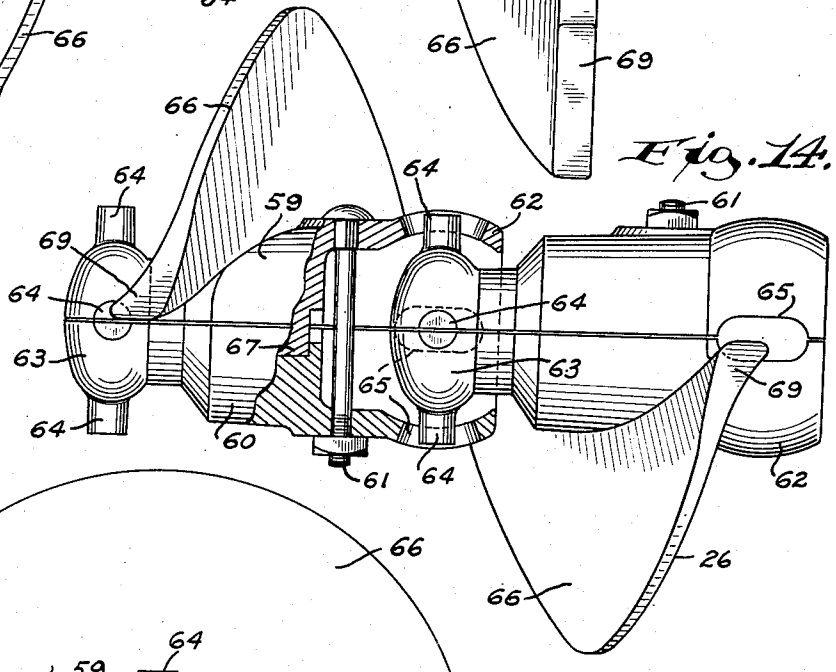


Fig. 14.



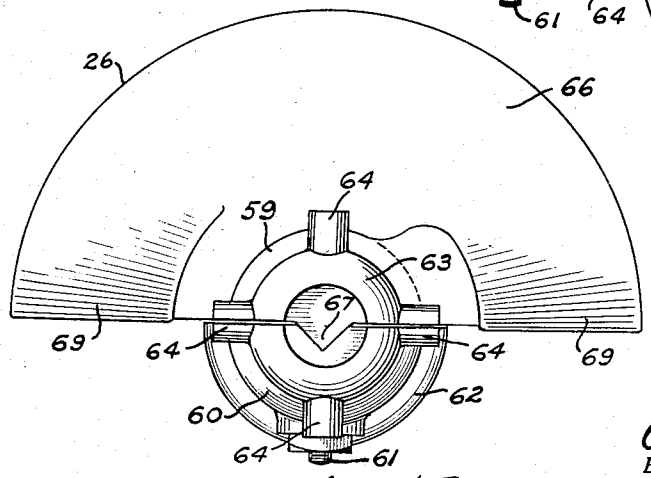


Fig. 15.

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UNITED STATES PATENT OFFICE

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BARN GUTTER CLEANER

August F. Klinzing, Milwaukee, Wis.

Application January 22, 1951, Serial No. 207,149

10 Claims. (Cl. 198—104)

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The present invention relates in general to improvements in the art of maintaining sanitary conditions in the vicinity of animal stables, and relates more specifically to improvements in the construction and operation of mechanism for cleaning the refuse catching gutters in stock housing barns or the like.

Many different types of mechanisms for removing the refuse and spent litter from the catch troughs or gutters near the stables of barns and for delivering the debris from the animal housings, have heretofore been proposed and used with varying degrees of success, and all of these prior devices are either very ineffective and messy, or they are extremely complicated and subject to failure, or they are difficult to install and to operate without endangering the animals, or they are too costly for installation and operation in barns where relatively few heads of stock are confined. In some of the more practical prior barn gutter cleaners an endless conveyor having rigid flights adapted to completely span each gutter, is caused to traverse several independent parallel gutters adjoining a like number of rows of stalls, and in such installations it is difficult to effect delivery of the litter from the several gutters at a single delivery zone near one end of the barn. In others of such previous barn gutter cleaners, a series of pivotally retractable flights is reciprocable within each gutter and in this type of installation the litter tends to interfere with the pivotal movement of the flights and thus prevents effective advancement of the refuse along the gutters. In all of the former gutter cleaners it is impossible to quickly and effectively remove the debris from the delivery ends of one or more gutters, and to direct the same at any elevation and in any desired direction away from the barn, without the aid of complicated and obstructive conveyors and special doors.

It is therefore an important object of my present invention to provide an improved barn gutter cleaner which is simple and compact in construction, highly efficient and reliable in operation, and which may be conveniently installed as a unit in one or more gutter troughs so as to deliver the debris from all of the units collectively to a common dump.

Another important object of this invention, is to provide an effective mechanical barn gutter cleaning unit adapted to be installed entirely within a simple gutter trough so as to protect the animals against possible injury, and which may be operated at will with minimum power and at moderate cost.

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A further important object of the invention is to provide a durable barn gutter cleaning assemblage for troughs of various lengths, which will not clog due to the presence of excess straw in the litter and will not become inoperative due to prolonged idleness.

Still another important object of my invention is to provide improved conveying mechanism for rapidly and effectively removing refuse from the end of one or more gutters and for discharging the same in any desired direction or at any elevation away from the animal stalls and out of the barns through self-sealing closures.

An additional important object of the present invention is to provide a simple but efficient barn gutter installation adapted for use with stock herds of various sizes, and which is applicable to any number of gutters to most effectively maintain the latter in clean and sanitary condition without annoyance to the animals.

These and other objects and advantages of my present invention will be apparent from the following detailed description, but the gist of the invention is the provision of an endless series of flights adapted to travel in opposite directions along each gutter so as to constantly remove the debris from one end of the latter into a cooperating self-sealing screw conveyor adapted to deliver the refuse around corners or curves in any desired direction away from the stables or stalls which are occupied by the animals without utilizing special doors or other closures.

A clear conception of the several features constituting the present invention, and of the construction and operation of two typical barn gutter cleaners embodying the improvement, may be had by referring to the drawings accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views.

Fig. 1 is a diagram of a single barn gutter cleaning installation embodying the present invention;

Fig. 2 is a similar diagram of a double barn gutter cleaning installation embodying the invention and provided with a common refuse discharge conveyor;

Fig. 3 is a fragmentary enlarged top view of the single gutter cleaning installation of Fig. 1, showing the same more in detail but still somewhat diagrammatically;

Fig. 4 is a part sectional and fragmentary side elevation of the refuse discharge conveyor of Figs. 1 and 3, drawn to the same scale as that of Fig. 3;

Fig. 5 is a transverse section through the installation of Fig. 3, taken through the delivery end of the endless gutter conveyor and the receiving end of the screw type discharge conveyor;

Fig. 6 is a similar transverse section through a medial portion of a gutter trough and endless refuse conveyor of the type shown in Fig. 3;

Fig. 7 is another similar transverse section through a medial portion of a modified type of gutter trough and the endless refuse conveyor therein;

Fig. 8 is a fragmentary longitudinal section taken through one of the sprocket confining ends of a modified gutter such as shown in Fig. 7;

Fig. 9 is a fragmentary enlarged top view of the double gutter cleaning installation of Fig. 2, also showing the same more in detail but still somewhat diagrammatically;

Fig. 10 is a further enlarged top view of the sprocket end of one of the endless refuse conveyors and its confining gutter;

Fig. 11 is a longitudinal section through the gutter shown in Fig. 10;

Fig. 12 is a side view of one of the automatic overload releases installed in each drive shaft for the conveyors;

Fig. 13 is an enlarged side elevation of two adjoining flight sections of the improved universally adjustable refuse discharging screw conveyor;

Fig. 14 is a similarly enlarged part sectional side view of the same screw conveyor sections, taken at an angle of ninety degrees relative to the plane of Fig. 13; and

Fig. 15 is an end view of one of the improved screw conveyor flight sections.

While the invention has been shown and described as being advantageously applicable to single and double cattle barn gutter cleaners embodying endless chain refuse conveyors of a specific type, it is not my desire or intention to unnecessarily restrict the utility of the improved features by virtue of this limited showing; and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the actual disclosure.

Referring to the drawings, each of the improved barn gutter cleaners shown therein by way of illustration, comprises at least one endless chain type refuse conveyor 18 confined within each gutter trough 19 so that its laterally spaced stretches will snugly engage the opposite sides of the elongated gutter and will move in opposite directions along the trough when the conveyor chain 18 is advanced; a series of equally spaced upright flights 20 secured to selected links of the conveyor 18 and extending approximately halfway across while resting on the bottom of the gutter 19; opposed end sprockets 21, 22 for supporting and driving the endless conveyor 18; a screw type refuse discharge conveyor 23 having a horizontal lower receiving portion 24 located beneath the delivery end portion of each endless conveyor 18 while its upper discharge portion 25 is connected with the lower receiving portion 24 by one or more angular or curved intermediate portions 26; and common power means for simultaneously driving the conveyors 18, 23 at the will of the operator.

These cleaners may be installed either as a single unit in a barn 28 such as shown in Fig. 1 having only one row of stalls 29 for cows or other animals 30, or as a double unit installation in a barn 28' such as illustrated in Fig. 2 and having two parallel rows of stalls 29 for the animals 30. In barns adapted to accommodate even larger herds of the animals 30, additional rows of stalls 29 may be provided, and each row of these stalls is provided at its rear with an individual gutter trough 19 having a conveyor 18 confined therein, but the delivery ends of all of these endless conveyors should be adapted for the discharge of refuse into a common screw conveyor 23 the final discharge portion 25 of which is disposed externally of the barn enclosure as in Figs. 1 and 2, and above a suitable dump. In all cases the gutter troughs 19 are ordinarily formed in a concrete floor with the aid of suitable forms, and as clearly illustrated in Fig. 10, the chain sprockets 21, 22 have slightly larger diameter than the widths of the medial portions of the gutters 19 so that the trough portions 31 near these sprockets should be gradually tapered as shown.

The endless conveyor 18 of each cleaning unit is preferably of the chain type having a succession of sturdy links drivingly cooperable with the end sprockets 21, 22 of which the sprocket 21 is an idler mounted for rotation in a bearing plate 33 which is adjustable longitudinally of the adjacent gutter 19 by means of jack screws 34 coacting with foundation plates 35 embedded in the concrete floor in order to properly tension the endless chain, as shown in Figs. 3 and 9. The opposite driving sprocket 22 of each cleaning assemblage is mounted upon an upright shaft 36 journalled in a fixed bearing plate 37 and foundation plates 38 likewise embedded in the concrete, and by providing the tapered end portions 31 adjacent to the enlarged sprockets 21, 22 and by properly tensioning the chain 18 with the aid of the jack screws 34, the longitudinal stretches of the endless conveyor may be caused to travel in snug engagement with the opposite side walls of each gutter 19.

The sprockets 21, 22, conveyor chain 18, and the flights 20 are preferably formed of non-corrosive metal, and the successive flights 20 are firmly suspended at their outer ends from equally spaced links of the chain by means of clamps 40 and extend perpendicularly relative to the conveyor stretches approximately half-way across the conveyor confining gutter 19. These flights 20 normally travel in contact with the gutter bottom and the portions of the chains between the successive flights 20 are preferably provided with supporting feet or lugs 41 which are adapted to ride along the side walls and the adjacent bottom surface of the gutters 19 as clearly depicted in Figs. 10 and 11.

As shown in Figs. 6, 10 and 11, the gutter bottom may be a flat surface divided by a central longitudinal ridge 42 into two grooves of equal width so that the flights 20 will travel back and forth in opposite directions in the same horizontal plane; but as shown in Figs. 7 and 8, the bottom of the gutter 19' may be provided with high and low surfaces 43, 44 on opposite sides of its central longitudinal vertical plane so that the flights 20 will return along the high surface 43 and will move forwardly along the low surface 44. In order to cause the chains 18 of the modification to properly coact with the sprockets 21, 22 which are rotatable in the same horizontal plane, the ends of the low surface 44 of each trough bottom are connected to the adjacent ends of the high surface 43 by inclined surfaces 45 as illustrated in Fig. 8.

Each of the gutters 19, 19' is thus provided with two separate paths along one of which the refuse is adapted to be conveyed by the advancing flights 20 in a forward direction or toward the corresponding screw conveyor 23, while the successive flights travel along the other path in a reverse direction and tend to agitate and disintegrate some of the refuse and to carry it rearwardly. In order to cause the refuse in the rearward path to be deposited into the forward path, and to also prevent excessive debris from reaching the sprockets 21, 22, each gutter is provided at the opposite sides of its opposed ends with a series of inclined stationary blades 47 of gradually increasing length directed across the adjacent path in the direction of advancement of the flights 20 therealong, as shown in Figs. 3 and 9. These blades 47 are located directly above and closely adjacent to the paths of travel of the flights 20 and serve to sweep the refuse or debris from the path directly therebeneath into the adjacent path of travel.

The discharge end portion of the forwardly extending path of each gutter 19, 19' terminates in a refuse delivery trough or hopper which in the case of a single unit is a trough 49 disposed below and laterally of the gutter 19, as shown in Figs. 1, 3 and 5; and in the case of a double unit comprises a hopper 50 communicating with a trough 49 disposed below and spanning each gutter 19 as in Figs. 2 and 9. In the single installation the trough 49 is in open communication with the adjacent gutter 19 through an opening 51 near the discharge end of the forwardly directed path of this gutter, while in the double installation the gutter paths extend through the hopper 50 and the latter is in open communication with the adjacent portion of the transverse trough 49. The lower refuse receiving portion 24 of each material discharge screw conveyor is mounted within the adjacent straight trough and is adapted to be driven by an upright shaft 52 connected to the horizontal screw revolving shaft 53 by bevel gearing 54, and in this conveyor portion 24 the helical vane or vanes are rigidly attached to the shaft 53 as in an ordinary screw conveyor.

However, in order to permit the refuse material to be transported from the troughs 49 along a curved conduit 56 as in Fig. 9, and/or at an oblique angle relative to the horizontal through another curved conduit 57 as in Fig. 4, a specially constructed screw conveyor portion 26 has been provided. The details of construction of this universally adjustable or flexible screw conveyor portion 26 are revealed in Figs. 13 to 15 inclusive, wherein this portion of the screw conveyor 23 is composed primarily of a series of identical flexibly interconnected sections each consisting of two parts 59, 60 rigidly united by a bolt 61 and having a spherical socket 62 at one end and a cross head 63 at its opposite end provided with radial pins 64 slidably and drivingly cooperable with slots 65 formed in the socket 62 of the adjacent section. The main part 59 of each of these sections has a semi-circular helical vane 66 formed integral therewith and cooperating with the corresponding reversely disposed vanes 66 of the adjoining sections to provide a continuous helical vane, and this main part 59 is also provided with a central V-shaped projection 67 coacting with a groove in the other part 60 as in Fig. 15 in order to properly position the coacting parts 59, 60 relative to each other.

The several parts of these universally movable screw conveyor sections may be formed by casting of non-corrosive metal, and may be readily assembled without necessitating comprehensive machining or dressing, to provide a conveyor portion 26 of any length disposable in any desired direction. Since the semi-circular vanes 66 shift slightly relative to each other as they revolve, the radial edges 69 thereof are preferably thickened or widened as shown so as to eliminate open gaps between these vane edges, and the successive screw sections are driven by the pins 64 which loosely coact with the slots 65 and oscillate therein as the conveying screw revolves. The delivery end of each curved portion 26 may be drivingly connected to a straight screw portion such as the upwardly inclined discharge portion 25, and all of the screw conveyor portions 26, 29 are confined within tubular casings 70 which are sealed from the ambient atmosphere whenever material is confined therein.

All of the conveyors 18, 23 of either a single or a multiple barn cleaner installation may be driven from a common source of power such as an internal combustion motor or an electric motor 72 mounted upon a compact base 73 and cooperating with a speed reducer 74 through a belt drive 75 and a clutch 76. In a single unit installation such as shown in Figs. 1 and 3, the single speed reducer 74 may be drivingly connected to both of the conveyor propelling shafts 36, 52 by means of a chain drive 77, while a double unit installation such as shown in Figs. 2 and 9 requires a double speed reducer 74 cooperating through separate chain drives 78, 79 with the conveyor driving shafts 36, 52 of the several units. In any case it is preferable to provide a safety release such as illustrated in Fig. 12, between each power take-off shaft of the speed reducer and the chain drives 77, 78, 79, and this safety release may merely consist of a pair of coacting driving and driven flanges 80, 81 interposed between shaft sections and having normally interlocking radial projections and recesses held in engagement by a spring 82 but adapted to disengage when subjected to abnormal loads on the driven shaft.

When the improved barn gutter cleaner has been properly constructed and installed as hereinbefore described, it may be operated at will by merely starting the propelling motor 72 and by throwing in the clutch 76 whereupon both the endless chain conveyors 18 and the screw conveyors 23 of all units will be placed in operation. During such normal operation of each endless chain conveyor 18, the flights 20 will be advanced successively along the forward and reverse paths along the bottom surfaces of their confining gutter 19, and during the forward travel of these flights 20 they will advance the refuse along the forward path toward the discharge opening 51 in the single unit, and toward the hoppers 50 in the duplex unit. The rearwardly advancing flights 20 will agitate and advance the debris in the reverse path toward the fins or blades 47 nearest the idler sprocket 21 and these blades will then function to sweep the refuse into the forward path for conveyance thereof toward the discharge end of the gutter trough. The set of fins or blades 47 at the opposite end of the trough beyond the outlet, will likewise function to sweep material which has failed to drop through the outlet opening into the reverse path, thus preventing excess refuse from reaching either sprocket 21, 22.

After the debris has been delivered by gravity into the inlet end of the screw conveyor 23, the

helical vanes of this conveyor urge the mass of material along the trough 49 and through the upwardly curved conduit portion 57 and inclined conduit portion 70. As the refuse reaches the upper outlet end of the elevating portion 70, the material is ejected through the final outlet opening beyond the wall of the barn, and is deposited by gravity upon the dump. In this manner the debris is quickly, effectively, and automatically removed from each of the gutters 19, 19' and is delivered to the dump, and if abnormal clogging due to the presence of wood or iron deposits in the conveyors 18, 23 should occur, the safety releases will function to disconnect the obstructed elements from the power source.

The tapered portions 31 of the gutters 19, 19' near the enlarged sprockets 21, 22 serve to maintain the longitudinal stretches of the chain conveyors 18 in snug coaction with the opposite side walls of the gutters, and the jack screws 34 should be utilized to properly tension the endless chain so as to insure such snug coaction. While the use of a plane bottom gutter 19 and a dividing ridge 42 such as shown in Fig. 6 has been found quite satisfactory, somewhat more effective removal of the refuse may be obtained by utilizing a modified gutter 19' such as shown in Figs. 7 and 8 in which the return path 43 is disposed above the forward path 44 and the latter is provided with opposite end inclines 45. This modified gutter also avoids necessity of utilizing special dividing ridges between the two paths, but in all cases the length of the flights 20 is equal to approximately one half the width of the gutter trough and these flights are rigidly attached to their transporting chains and are disposed perpendicular to these chains.

From the foregoing detailed description of the construction and operation of the invention, it should be apparent that I have provided an improved barn gutter cleaning unit, which is simple, compact and durable in construction, as well as being highly effective in use. These improved units may be installed either singly or in multiple, and by applying a releasable clutch 76 in each of the endless conveyor driving shafts 36, any or all of the units may be operated at will from the single power source which also actuates all of the conveyors, thus providing extremely flexible cleaning installations. By forming the conveyor elements of non-corrosive metal long life is assured; and the use of the special screw conveyor 23 with the vane sections constructed as in Figs. 13 to 15 inclusive, enables the refuse to be discharged from the barn enclosures in any desired direction and at any height without providing special doors or other closures for the refuse outlets. These screw conveyors 23 when in use are self-sealing and function to positively transport soggy litter from the troughs or gutters in a most effective manner.

The reverse travel of the flights 20 through each gutter tends to break up the mass of material and to disintegrate the straw and litter so that the refuse will readily enter the conveyor screw by gravity. The inclined blades 47 besides protecting the sprockets 21, 22 against excess debris, effectively deliver the material into the forward path of the endless flight conveyor, and the safety releases protect the apparatus against breakage in case a hard object is accidentally dropped into a gutter 19. The improved barn gutter cleaner has proven highly satisfactory in actual operation, and the units may be furnished and operated either singly or in multiple at moderate cost to fit gutters of various lengths and widths. Since the sprockets 21, 22 are normally covered by plates 33, 37 and the flights 20 are disposed vertically and do not swing relative to their carrying chains 18, danger of injury to animals 30 accidentally stepping into the trough, is eliminated; and the compact driving mechanism may be readily located well beyond the danger zone.

It should be understood that it is not desired to limit this invention to the exact details of construction and operations of the typical barn cleaning units herein specifically shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In a barn gutter cleaner, a unitary gutter having high and low adjoining and laterally communicating bottom surfaces, an endless series of flights successively movable along parallel paths and in opposite directions in substantial engagement with said bottom surfaces, and means for directing refuse from the higher of said paths into the lower path.

2. In a barn gutter cleaner, a single gutter having high and low longitudinal bottom surfaces, a refuse discharge conveyor communicable with the delivery end of said low bottom surface, an endless series of flights successively movable along parallel paths and in opposite directions in scraping engagement with said surfaces and within the gutter, the delivery end of one of said paths communicating with said conveyor, and means for directing refuse laterally from the other of said paths into the receiving end of said conveyor communicating path.

3. In a barn gutter cleaner, a unitary gutter having adjoining high and low longitudinal bottom surfaces, a refuse discharging screw conveyor at one end of said gutter, an endless series of flights movable in succession and in opposite directions along said high and low gutter surfaces, the delivery end of said low bottom surface communicating with said screw conveyor, and means for directing refuse laterally from the delivery end of said high bottom surface into the receiving end of said low bottom surface.

4. In a barn gutter cleaner, a single elongated gutter divided longitudinally into high and low adjoining paths, an endless conveyor coacting with sprockets at the opposite ends of said gutter and having a series of flights successively movable in opposite directions along said paths, and a series of fixed inclined vanes near the delivery end of said high path and cooperating with said flights to direct material into the receiving end of said low path.

5. In a barn gutter cleaner, a single elongated gutter having laterally communicating high and low paths, a sprocket of greater diameter than the width of said gutter journalled centrally at each end of the gutter, an endless conveyor chain coacting with said sprockets and having reversely movable stretches movable along and in snug engagement with the opposite sides of said gutter, a series of flights movable by said chain in succession along said paths, and fixed inclined vanes near the delivery end of said high path and cooperating with said flights to direct material into the receiving end of said low path.

6. In a barn gutter cleaner, a single elongated gutter having laterally communicating paths extending throughout its length, an endless conveyor coacting with sprockets at the opposite ends

of said gutter and having a series of flights successively movable in opposite directions along said paths, and fixed inwardly directed inclined vanes near the delivery end of one of said paths and cooperating with said flights to direct material into the receiving end of the other path.

7. In a barn gutter cleaner, a single elongated gutter having laterally communicating paths extending throughout its length, an endless conveyor coacting with sprockets at the opposite ends of said gutter and having a series of flights successively movable in opposite directions along said paths, and a series of fixed inwardly directed inclined vanes of progressively increasing lengths approaching the delivery end of one of said paths and cooperating with said flights to direct material into the receiving end of the other path.

8. In a barn gutter cleaner, a single elongated gutter having laterally communicating high and low longitudinal paths, end sprockets journalled for rotation substantially in the plane of said high path, an endless chain conveyor coacting with said sprockets and having a series of flights successively movable in opposite directions along said high and low paths, and means providing gradually downwardly inclined flight guiding surfaces connecting the ends of said high path with portions of said low path remote from said sprockets.

9. In a barn gutter cleaner, a unitary gutter having high and low adjoining and laterally communicating bottom surfaces each extending approximately half-way across the gutter, end sprockets rotatable in planes parallel to said surfaces, an endless chain conveyor coacting with said sprockets and having a series of inwardly projecting flights successively movable in opposite directions along said high and low surfaces, and means near each of said sprockets for gradually conducting the advancing flights from the delivery end of one surface onto the receiving end of the other surface.

10. In a barn gutter cleaner, a unitary gutter having laterally communicating bottom surfaces each extending approximately half-way across the gutter and disposed at different elevations, a conveyor having a series of inwardly projecting flights successively movable in opposite directions along and in scraping cooperation with the higher and lower of said bottom surfaces, and means near each end of said gutter for gradually conducting the advancing flights from one of said surfaces onto the other.

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