Jan. 16, 1962 E. M. OLSON 3,017,008

BARN CLEANING APPARATUS

Original Filed May 10, 1954 2 Sheets-Sheet 1

Fig. 1

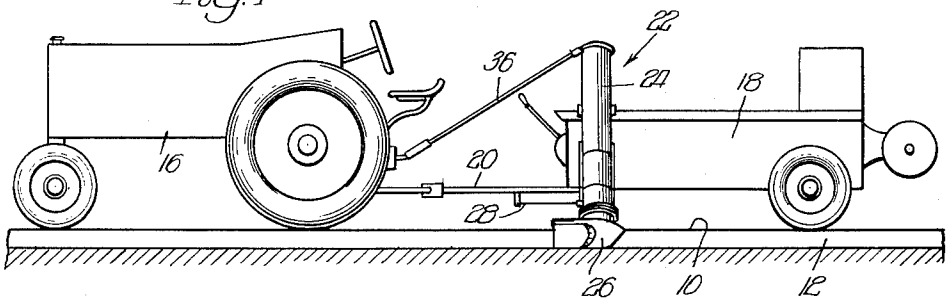
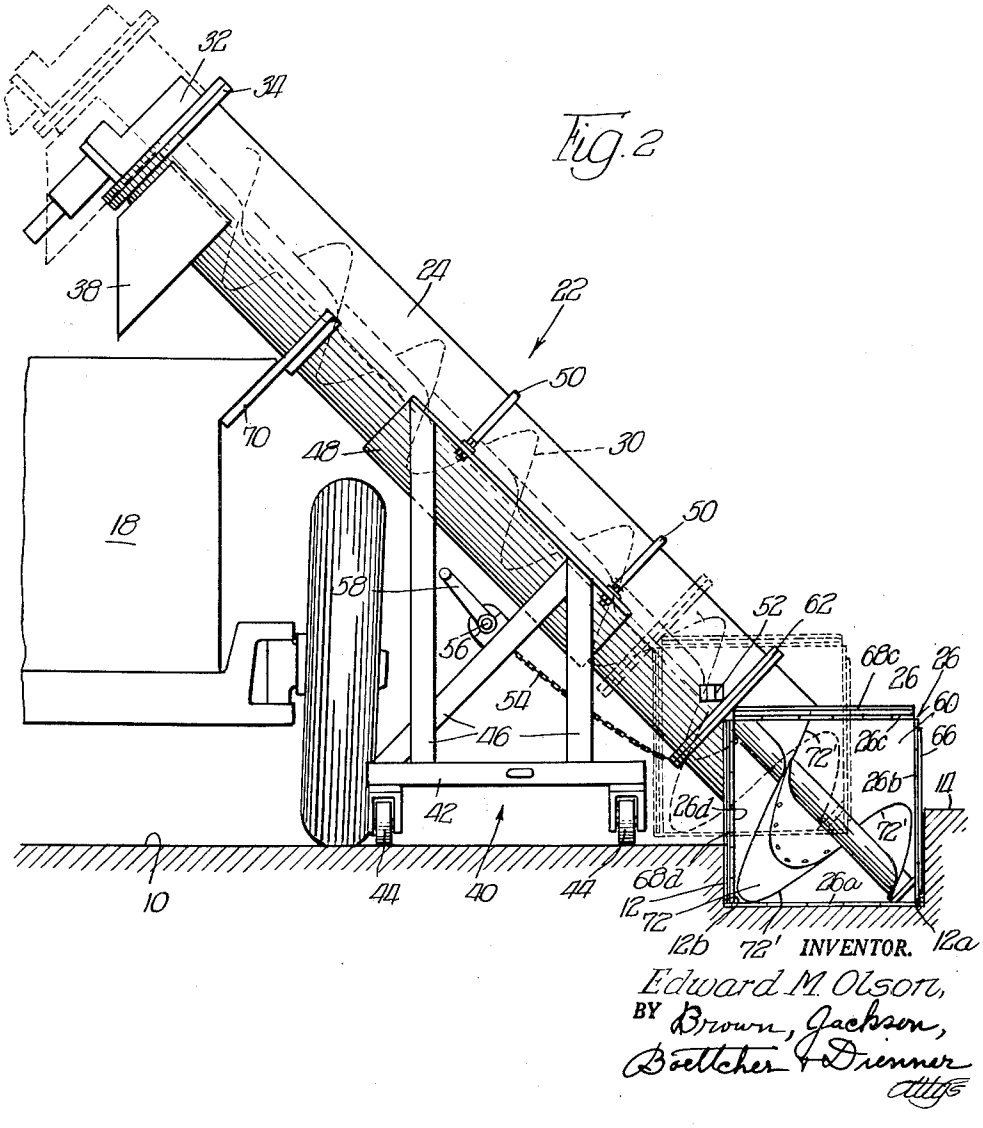


Fig. 2



INVENTOR.
Edward M. Olson,
BY Brown, Jackson,
Boettcher & Dremner
attys

Jan. 16, 1962 E. M. OLSON 3,017,008

BARN CLEANING APPARATUS

Original Filed May 10, 1954 2 Sheets-Sheet 2

Fig. 3

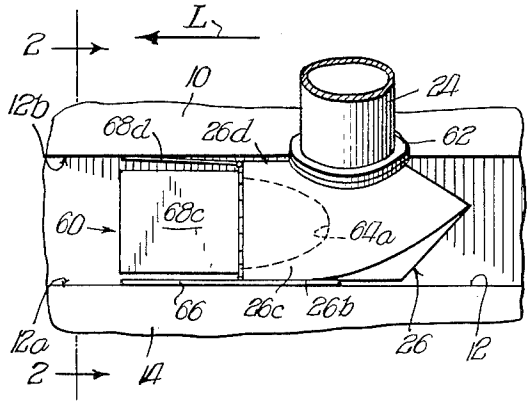


Fig. 4

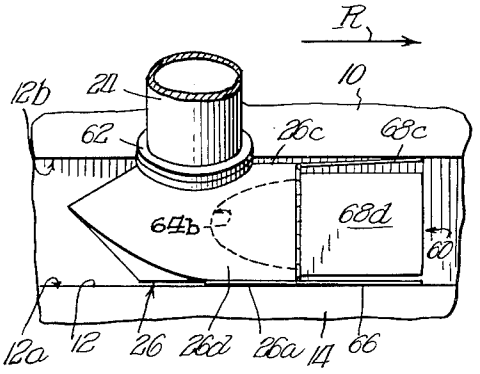


Fig. 5

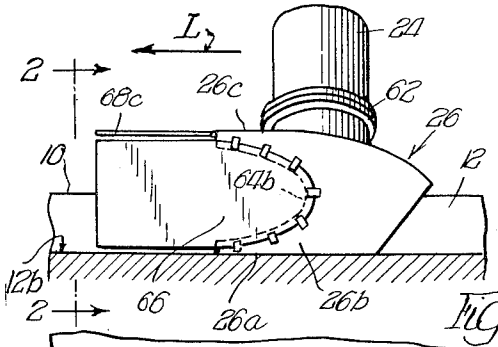


Fig. 6

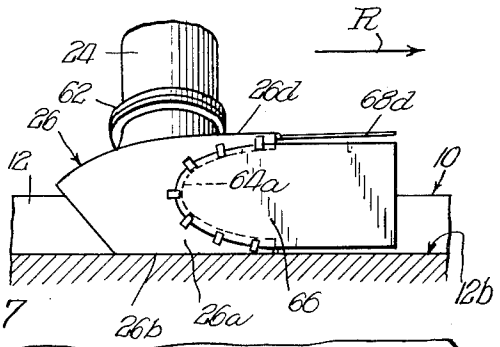
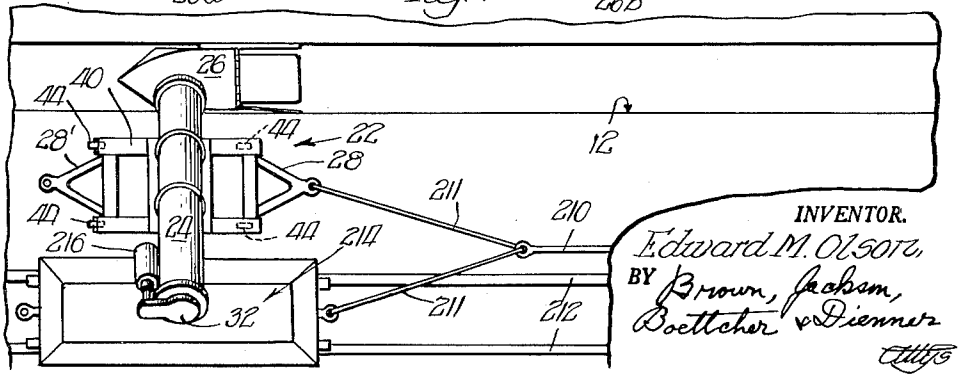


Fig. 7



INVENTOR.
Edward M. Olson,
BY Brown, Jackson, Boettcher & Dienner
Attys

United States Patent Office 3,017,008 Patented Jan. 16, 1962

3,017,008
BARN CLEANING APPARATUS

Edward M. Olson, Lake Geneva, Wis.

Original application May 10, 1954, Ser. No. 428,474, now Patent No. 2,855,085, dated Oct. 7, 1958. Divided and this application July 31, 1958, Ser. No. 752,356
7 Claims. (Cl. 198—7)

The present invention relates to barn cleaning apparatus and, particularly, to improved apparatus adapted for association with a tractor and a manure spreader, or like vehicles, automatically to remove manure from the troughs or gutters of a barn, this aplication being a division of my prior copending application Serial No. 428,474, filed May 10, 1954, issued as Patent No. 2,855,085 on October 7, 1958.

While this general field of application has enjoyed substantial development heretofore, prior endeavors have failed to solve all of the problems involved in a practical and economical manner. It is the object of the present invention to provide improved barn cleaning means that meets all requirements as to practicality, operability and efficiency, and at the same time is incorporated in economical embodiments.

Prior developments in the art have extensively employed vertical or inclined flight augers or screw conveyors disposed within a tube for elevating manure and waste matter from barn troughs or gutters to a suitable receptacle, and the present invention follows this general concept since it is a most practical and efficient manner for effecting material transfer. However, the feed or inlet end of the usual screw conveyor and tube is not adapted to effect a cleaning or scouring of the gutters, with the result that only a portion of the gutter has been cleaned with prior devices, thus failing to accomplish the intended function.

An object of the present invention is to provide improved barn cleaning apparatus employing an inclined flight screw conveyor and tube and including a novel inlet or feed end head for the tube adapted to be quite intimately received within a barn gutter to insure complete and efficient cleaning of the gutter.

Another object of the invention is the provision in barn cleaning apparatus of the character above described, in conjunction with the novel feed end head, of means motivated with the screw conveyor for effecting a gutter scraping function to insure complete cleaning of the gutter regardless of the consistency or degree of caking of the waste matter in the gutter.

According to the present invention, I provide improved barn cleaning apparatus comprising a ground engaging wheeled carriage adapted to be disposed adjacent a gutter for movement parallel to the gutter, a conveyor tube mounted on the carriage at an inclination to the horizontal, a screw conveyor rotatably mounted in the tube, drive means for rotating the conveyor, a feed end head connected to the feed end of the tube, the head being adapted to be disposed in a gutter for movement therethrough, and means disposed within the head and actuated in conjunction with the conveyor to scrape the gutter as the head is moved through the gutter. The apparatus may be connected to any suitable or customary drive means to be moved thereby, and the tube may be associated with a suitable container or receptacle for removing the manure from the barn. An acceptable and customary arrangement is to employ a tractor drawn manure spreader, wherein the cleaning apparatus is drawn by, and may be operated by the tractor, and wherein the tube of the cleaner is detachably associated with the spreader, the tube including a discharge outlet disposed to empty into the manure spreader. While this arrangement is referred to herein as preferred, it will be appreciated that other drive arrangements may be employed with the cleaner, all within the scope of the invention.

In use of the cleaning apparatus of the invention, the tractor and the manure spreader, or like vehicle, are driven into the center aisle of the barn and the head of the cleaner is disposed in one gutter and the conveyor is set in operation. The tractor is then driven through the barn to move the head of the cleaner along the gutter to remove all waste material from the gutter and automatically to deposit the same in the manure spreader. The cleaning thus performed is thorough and effective and the manure and waste matter are removed from the barn in a careful and sanitary manner. The old manual removal of manure by shovel is no longer acceptable and does not meet modern sanitation requirements because of the general sloppiness of the method, the possibility of air contamination, and so on. The present invention overcomes these difficulties and provides a sanitary method of manure removal.

In addition to the foregoing, it is an object of the invention to provide improved barn cleaning apparatus that is adapted for use both in through barns and dead end barns. In through barns, those having exit doors or openings at both ends of the center aisle, cleaning of the troughs or gutters to both sides of the aisles, at the rear of both rows of stalls or stanchions is readily effected by starting at one end of the barn to clean one gutter, driving to the outside of the barn after one gutter has been cleaned, and driving back through the barn in the opposite direction to accommodate cleaning of the other gutter. In dead end barns, those having a door or opening only at one end of the center aisle, turning the tractor around after one gutter has been cleaned cannot be effected. In these barns, the apparatus of the invention lends itself to two methods of cleaning; the first by backing into the barn in one direction to clean one gutter substantially to the blank wall of the barn, transporting the cleaner to the opposite side of the manure spreader, and driving frontward out of the barn to clean the other gutter. This first method results in a single-pass cleaning of each gutter, i.e. the cleaning head cleans one gutter in an inward direction while the machine is traveling inwardly toward the dead end of the barn, whereupon the entire cleaner is transposed or reversed so that the cleaning head cleans the other gutter in an outward direction while the machine is traveling outwardly away from the dead end of the barn. Thus, in this first method, each gutter receives only one cleaning pass. In the second method, each gutter of the dead end barn receives two cleaning passes, one inward and one outward. That is to say, one gutter receives a cleaning pass as the machine travels inwardly toward the dead end of the barn, whereupon the cleaning head is rendered operable to clean that same gutter as the machine travels outwardly away from the dead end. This same operation is repeated for the gutter at the other side of the barn, from which it will be seen that each gutter receives two cleaning passes. In the performance of the second method, the entire cleaner is preferably transposed from one side of the machine to the other when transferring the cleaning operation from one gutter to the other, so that the tractor does not have to precede the cleaner in cleaning either gutter, but this is not essential if there is enough linear space at the dead end of the barn to accommodate the tractor and still complete the cleaning of each gutter. According to the second method, the cleaning operation is rendered more efficient, by accommodating cleaning of each gutter in both directions of tractor movement, by the provision of a cleaner head that will alternately provide an inlet opening in reverse directions—a reversible head.

In achieving the foregoing objects, one embodiment of

my invention comprises a carriage, a conveyor and tube mounted on the carriage, a generally rectangular box-like head into which the conveyor extends, and a scraper attachment on the conveyor within the head to be moved by the conveyor to scrape the gutter, the box-like head having an open end constituting an inlet and being pivotally mounted on the conveyor tube to dispose the inlet opening thereof in reverse directions.

Another object of the invention is to provide an improved barn cleaner of the above type which can be pulled along each gutter by a towing or traction cable instead of by a tractor, this cable being wound on a power driven winch at one end of the barn. This type of apparatus lends itself particularly well to barns provided with cleaning equipment using a system of tracks extending alongside each manure gutter for accommodating a small wheeled hopper type of car into which the manure is ordinarily shoveled from the gutter. My improved cleaner can be coupled to such car and the two propelled together by the traction cable, the cleaner lifting the manure from the gutter and dumping it into the car. In this embodiment of the invention, the manure lifting conveyor of my improved cleaner is driven by a small gasoline engine mounted on the cleaner, or by an electric motor supplied through an extension cord.

Other objects and advantages of the present invention will become apparent in the following detailed description of two of the above described embodiments of the invention.

Now, in order to acquaint those skilled in the art with certain preferred manners of making and using the apparatus of my invention, I shall describe, in connection with the accompanying drawings, the different embodiments of the invention above referred to.

In the drawings; wherein like reference numerals indicate like parts:

FIGURE 1 is a somewhat diagrammatic side elevational view of a tractor, a manure spreader and the first embodiment of the cleaning apparatus of the present invention associated therewith, the head of the cleaner being movable in a barn trough or gutter;

FIGURE 2 is a front elevation, on an enlarged scale, of the first embodiment of the cleaner and the manure spreader, the view showing the cleaner in its in-use position in solid lines and in its position for transportation in dotted lines, the in-use position corresponding approximately to views taken on the section planes 2—2 of FIGURES 3 and 5;

FIGURES 3 and 4 are plan views, respectively, and FIGURES 5 and 6 are side elevational views, respectively, of the head and a portion of the tube of the first embodiment of the cleaning apparatus as disposed for movement in reverse directions in a trough or gutter; and

FIGURE 7 is a diagrammatic view of the cable pulled embodiment of my invention.

Referring now to FIGURES 1 and 2, the customary floor plan or configuration of a barn is shown as comprising a floor level or center aisle portion **10**, a manure trough or gutter **12**, one being located to each side of the center aisle and running the length of the barn, and a stall or stanchion level **14**, also one on each side of the aisle, upon which the cows or other farm animals stand. The aisle **10** is of a width to accommodate passage through the barn of a tractor **16**, and a manure spreader **18** drawn by the tractor by means of a draw bar **20**. The cleaning apparatus of the present invention is indicated generally at **22** and comprises a conveyor tube **24** associated with the manure spreader **18** and a head **26** movable in the gutter **12**, the apparatus being adapted to be drawn by the tractor **16** by means of a draw bar assembly or connection **28** associated with the spreader draw bar **20**. That corner or edge of the gutter **12** which is adjacent to the stall or stanchion level **14** will be hereinafter referred to as the outer or far corner, designated **12***a* (FIG. 2), and the opposite corner or edge of the gutter adjacent to the center aisle **10** will be hereinafter referred to as the inner or near corner of the gutter, designated **12***b*. As will be hereinafter described in detail, my improved barn cleaning apparatus is operative to remove manure from the entire span of the gutter **12**, from the outer corner **12***a* to the inner corner **12***b*.

As shown in greater detail in FIGURE 2, the conveyor tube **24** of the cleaning apparatus is adapted for the reception and rotatable support of a screw conveyor **30** which is adapted to be driven through suitable drive means **32** mounted by a swivel connector **34** on the upper end of the tube **24**. The drive means **32** is adapted to be actuated by any suitable or conventional means, such as, an electric motor, a mechanical drive connection from the power take off of the tractor as is indicated at **36** in FIGURE 1, a hydraulic motor actuated from the hydraulic system of the tractor, and so on. Immediately below the swivel connector **34**, the upper end of the tube **24** is provided with an outlet or discharge spout **38** disposed to discharge into the manure spreader **18**. As will be appreciated, the lower end of the tube is the inlet or feed end thereof and the same communicates with the gutter through the head **26** of the cleaning apparatus. The tube **24** and conveyor **30** are supported at an inclination, preferably at an angle of 45°, by means of a wheeled carriage **40** which includes a base **42** supported by a plurality of the swivel casters **44**, a framework **46**, and a semi-cylindrical support **48** carried by the frame work. This caster-wheel supported carriage **40** is provided at opposite ends with duplicate hitches so that either end of the carriage can be coupled to the tractor, this enabling the carriage to be either pulled or pushed along either side of the manure spreader by the tractor, with the conveyor tube discharging over either side of the spreader body. The conveyor tube **24** is slidably supported by the support member **48** and is retained on the support **48** by means of detachable semi-cylindrical straps **50** secured to the support. As will be appreciated, the wheeled carriage **40** so supports the tube **24** and head **26** as to accommodate movement of the head longitudinally of the gutter. To associate the cleaning apparatus with the draw bar assembly **28**, a bifurcated boss or stud **52** is provided on the surface of the tube **24** adjacent the lower end thereof.

The tube **24** is slidable within the support **48** and the straps **50** and, due to its weight, normally tends to slide downwardly on the support **48** into the gutter **12** so that the body of the head **26** rides along the bottom of the gutter or trough **12**, as is indicated in solid lines in FIGURE 2. To remove the head **26** from the gutter **12** to accommodate transportation of the cleaning apparatus, and to accommodate any desired disposition of the head **26** with respect to the floor **10**, any one of a variety of elevating devices may be provided between the support **48** and the tube **24**. A suitable arrangement is shown in FIGURE 2, wherein a chain or other flexible connector **54** is secured to the lower end of the tube **24** and is wound upon a shaft **56** journalled in the framework **46**, the shaft **56** being provided with a crank **58** adapted to be operated manually to wind the chain **54** on the shaft **56**, thus to elevate the tube **24** and head **26** to the position shown in dotted lines in FIGURE 2, the shaft being then latched in this position.

The head **26** of the cleaning apparatus comprises a generally rectangular box-like member open at one end thereof to define an inlet **60** through which waste matter in the gutter or trough **12** is introduced to the feed end of the conveyor **30**. The head **26** can be fixedly secured to the conveyor **30** for use in through barns and for single-pass cleaning in closed end barns. However, I have illustrated a reversible type of head **26** because of its greater versatility, particularly for two-pass cleaning of closed end barns. In this construction the closed end of the head, opposite the inlet **60**, is somewhat of ellipsoidal configuration for a purpose to be described. To accom-

modate this reversing of the head 26 to dispose the inlet 60 in opposite or reverse directions, the head 26 is pivotally mounted on the lower end of the conveyor tube 24 by means of a swivel joint 62. Due to the fact that the tube 24 is disposed at a 45° angle, swivelling movement of the head 26 with respect to the tube 24 at the connector swivel 62 through an arc of 180° will result in rotation of the head 26 180° around the transverse axis thereof, that is, around the axis lying in the same vertical plane as the axis of the tube 24. At the same time, the head 26 will be rotated 90° about its own longitudinal axis. This relationship is particularly desirable since the portions of the head 26 disposed in and operating upon the waste matter in the gutter will be different in any two direction movement of the cleaning apparatus to equalize wear upon all parts of the head 26. As will be appreciated, the box-like head 26 includes four side wall portions 26*a*, 26*b*, 26*c* and 26*d*. The relative dispositions of these various side walls of the head are shown in FIGURES 3 to 6, wherein FIGURES 3 and 5 are plan and side elevational views, respectively, of the head as disposed for movement in one direction, to the left as shown by the arrow L in FIGURES 3 and 5; and FIGURES 4 and 6 are plan and side elevational views, respectively, of the head as disposed for movement in the opposite direction, to the right as shown by the arrow R in FIGURES 4 and 6. In FIGURES 2, 3 and 5, the side wall 26*a* of the head 26 is rested upon the bottom of the gutter or trough 12. It is preferred that the leading edge of the wall 26*a* be capable of scraping the bottom of the gutter to remove waste material therefrom and, to this end, the wall preferably does not present a straight edge, but is provided with an elliptical cutout 64*a*. When the head 26 is rotated with respect to the tube 24 through an arc of 180° at the swivel connector 62, the motion is such as to dispose the wall 26*a* at the outer side of the head with respect to the tube 24, as is shown in FIGURE 6. As will be appreciated, the side walls, that is the walls other than the bottom wall, should be complete or closed walls to insure proper feeding of waste materials to the screw conveyor 30. In view of this fact, a detachable closure plate 66 is adapted to be fitted into the elliptical cutout 64*a* in the wall 26*a*, when that wall is disposed as shown in FIGURE 6. In transposition of the cleaning head, the side wall 26*b* of the head is rested upon the bottom of the trough 12 and this wall, like the wall 26*a*, is preferably provided with an elliptical cutout 64*b* for the purpose described. When the head is returned to the position shown in FIGURES 2, 3 and 5, the wall 26*b* is disposed at the outer side of the head with respect to the tube 24 and in this position is adapted to be closed by the detachable plate 66, which is removed from the cutout 64*a* in the wall 26*a* upon reversal of the head and is then inserted in the cutout 64*b*. It will be seen from the above description, and from FIGURES 3, 4, 5 and 6, that the four-sided housing or head 26, together with the ellipsoidal configuration at its rear end, envelops or surrounds considerably more than one-half of the perimeter of cutting of the crescent shaped attachment 72 (see particularly FIGURES 5 and 6). It will be seen from the latter figures, that this box shaped housing, together with its ellipsoidal rear end, embraces or surrounds approximately 270° of the 360° of rotation of the crescent shaped attachment 72; and this is true irrespective of whether the pick-up head or housing 26 faces toward the left or toward the right. This large circumferential or arcuate span of the housing around the crescent shaped attachment insures that the waste material will be confined where the crescent shaped attachment can cut it up and can start feeding it up into the conveyor 30.

In operating the cleaning apparatus of the invention, it is preferred that means be provided for scraping the surfaces of the gutter or trough 12 to insure thorough cleaning of the trough. To this end, the closure plate 66 is preferably formed of a relatively springy or resilient sheet of metal and is provided with a forwardly extending portion turned slightly outwardly of the associated side wall of the head 26 so that the free outer end or leading edge of the plate 66 will act as a scraper to scrape waste matter from the wall of the gutter adjacent the animal stalls or stanchions. The elliptical cutouts 64*a* and 64*b* provided in the two walls 26*a* and 26*b* of the head 26 also present leading edges facing in the appropriate directions to engage the bottom of the trough for scraping means from the bottom of the trough. To accommodate scraping of the inner side and inner corners 12*b* of the trough or gutter adjacent the center aisle of the barn, I preferably provide a scraper plate 68 pivotally mounted on the head 26 adjacent the inlet thereto, the leading edge of the scraper blade 68 being continually biased into engagement with the wall of the gutter 12 by means of a spring hinge construction. Since both of the walls 26*c* and 26*d* of the head will be disposed next to the inner wall and inner corner 12*b* of the gutter adjacent the center aisle, it will be appreciated that scraper blades 68 should be provided on each of these walls of the head 26, as in indicated in FIGURES 3 to 6 at 68*c* and 68*d* respectively. Preferably, the spring hinge mounting of these two plates or blades is such that the plates will not be biased to a substantial angle with respect to the associated side wall, but will be biased to such extent as necessary to press their leading edges forcibly against the inner wall 12*b* of the gutter 12 adjacent the center aisle of the barn. At the same time, manure is also being scraped from the outer wall and corner 12*a* by one of the cutouts 64*a*—64*b*, and is also being scraped from the bottom of the gutter by the other of these cutouts.

From the foregoing, it will be appreciated that the feed end head 26 of the apparatus of the invention, and the association thereof with the conveyor tube 24, assures efficient and thorough cleaning of the trough or gutter and that the reversability of the head 26 accommodates use of the cleaning apparatus for either through barns or dead end barns and eliminates any concern or problem with respect to which side of the manure spreader 18 the apparatus should be disposed. Regardless of the side of the manure spreader to which disposed, the head of the apparatus can always be manipulated to dispose the inlet 60 thereof in the direction of tractor and spreader movement. Also, the drive means 32 can be disposed in any desired or required direction due to the provision of the swivel connector 34. For example, for mechanical drive of the drive means 32 when the apparatus is disposed to one side of the spreader, the drive means would be disposed with the shaft thereof extending upwardly out of the plane of the paper as the same is viewed in FIGURE 2, and when the apparatus is transposed in its entirety on the wheeled carriage 40 to the opposite side of the spreader, the drive means shaft would extend downwardly out of the plane of the paper. In use, the tractor, spreader and cleaner can be moved into the barn and the cleaning head fitted into the gutter by lowering the tube and head upon proper operation of the elevating means, i.e. the crank 58 and chain 54. The drive means 32 for the screw conveyor 30 may then be set into operation and the tractor driven through the barn to effect cleaning of the gutter within which the head 26 is disposed. If the barn is a dead end type, either of two alternative methods may be employed. In the first method, the tractor is preferably backed into the barn with the manure spreader being backed ahead of it, the cleaner traveling alongside with the receiving end of the head 26 pointed inwardly to clean the gutter on this side during such inward travel. Thereupon the cleaning apparatus is detached from that side of the spreader and is transposed on its wheeled carriage 40 around to the other side of the spreader to point the receiving end of the head 26 outwardly, the coupling with the tractor being transposed from the hitch at one end of the carriage to the hitch at the other end of the

carriage so that the tractor now pulls instead of pushes the carriage 40. In this transposed position the proper disposition of the drive means 32 is accommodated by the swivel connector 34. The tractor is then driven frontwardly out of the barn to effect cleaning of the other gutter. In the second method, after backing to the dead end of the barn, the head 26 of the apparatus is rotated bodily about the axis of the tube 24 to dispose the inlet opening 60 thereof in the opposite direction, namely toward the front of the manure spreader or toward the open end of the barn, and the plate 66 is detached from the side of the head which will now be disposed upon the bottom of the trough and attached to that side-wall of the head which was originally rested upon the bottom wall of the trough. Then, the tractor is driven forwardly so that the gutter or trough 12 is given a second-pass cleaning in the reverse direction.

At the end of the trough, the head 26 is lifted out of the gutter 12, by suitable operation of the crank 58. The cleaning apparatus is then detached from one side of the spreader and transposed around on the wheeled carriage 40 for association with the other side of the spreader, at which time the head of the cleaning apparatus will be disposed adjacent the other barn gutter, with the inlet opening thereof facing toward the rear of the manure spreader. The head is then lowered into the gutter, the screw conveyor is set into operation and the tractor is backed toward the dead end of the barn. When the manure spreader reaches the dead end of the barn, the head 26 of the cleaning apparatus is again reversed, in the manner described, and the tractor is run forwardly toward the open end of the barn to effect a second cleaning operation on the second gutter. At the open end of the barn, the cleaning head is removed from the trough or gutter and the tractor, manure spreader and cleaner are driven to the exterior of the barn. Thereafter, the cleaner may be detached from the tractor and spreader, upon disconnection of the draw bar assembly 28, and the tractor may be driven into the field to spread the manure deposited in the spreader 18 by the cleaning apparatus of the invention.

In the case of through barns, the necessity for backing the tractor, spreader and cleaner into the barn is eliminated, since the three units may be driven directly through the barn, turned around exteriorly of the barn at the end thereof opposite the original entry, and returned through the barn in the forward drive direction of tractor movement. Also, in the case of through barns, there is no necessity for reversing the direction of the cleaning head if the cleaning operation is carried out in the manner described. Otherwise, the operation is the same as that described for a dead end barn.

To guide the cleaning apparatus of the invention with respect to the manure spreader 18, it is preferred to provide a guide 70 on the conveyor tube 24 adapted to engage the side wall of the spreader 18. As shown in FIGURES 1 and 2, the spreader 18 may be provided with an inclined lip at the top thereof, in which case the guide 70 may extend parallel to the wall of the lip to engage flatly against the same. The guide 70 may, if desired, be detachably secured to the body of the manure spreader, but it is preferred that the same merely rest against the spreader so that the head 26 of the cleaning apparatus may have complete freedom for movement within the trough or gutter 12 regardless of the disposition of the manure spreader with respect to the gutter. Regardless of the disposition of the cleaning apparatus of the present invention with respect to the spreader body, the spreading mechanism within the spreader body will operate in its usual manner to move the waste materials to the rearward end and into the mechanical broadcaster of the spreader.

While the cleaning apparatus of the present invention may be constructed and operated in the manner thus far described with successful results, I have found that the bottom wall of the head 26, even when cut out as at 26*a* and 26*b*, and even as weighted down by the full mass of the head, the conveyor tube, the screw conveyor and the drive means, is not always 100% efficient in removing waste materials from gutters or troughs when such matter has caked to a very hard degree and adheres very firmly to the bottom of the gutter. To render the apparatus thoroughly efficient irrespective of the consistency and degree of caking of the waste materials to be removed from the gutters, I provide means actuated with the screw conveyor to exert an active or motive scraping or scouring effect on the bottom of the troughs. In the embodiment of the invention shown in FIGURES 1 to 6, the screw conveyor extends through the conveyor tube 24 and directly into and diagonally through the box-like head 26. Within the head 26, I secure a scraper attachment 72 to the blade of the screw, the attachment 72 being in the form substantially of a crescent and being secured to the screw to describe a path of movement wherein the attachment 72 is moved across the bottom of the gutter, the elliptical cutouts 26*a* and 26*b* accommodating such engagement, to insure positive removal of materials caked and adhering to the bottom of the gutter. Attention is directed to the fact that the crescent-shaped attachment 72 has a maximum radius reaching out considerably beyond the radius of the screw conveyor 30 (FIG. 2), which is effective for removing manure located adjacent to the inner corner 12*b* of the gutter. Thus, while the outer end of the screw conveyor 30 can operate effectively on manure located adjacent to the outer corner 12*a* of the gutter, it cannot operate effectively on manure located adjacent to the inner corner 12*b* of the gutter. It is here at this inner corner 12*b* that the greatly increased radius of the crescent-shaped attachment 72 is particularly effective for removing manure. To accommodate passage of the attachment 72 in that portion of the path of movement thereof entirely within the head 26, the head 26 is formed of generally ellipsoidal configuration at the end thereof opposite the inlet, as was pointed out herein before. The crescent-shaped scraper attachment 72 has a relatively sharp outer peripheral edge 72', which is either purposely sharpened or which is the naturally sharp edge which inherently results from the forming operation of blanking the scraper attachment 72 out of flat sheet metal stock by a shearing or punching operation. This sharp outer cutting edge 72' moves with a progressive shearing or cutting action spirally across the bottom wall, outer and inner side walls, top wall, and ellipsoidal back wall of the head 26, either in extremely close proximity to or in actual contact with these walls. When the head 26 is facing for the direction of travel shown in FIGURES 3 and 4, which corresponds to the direction shown in FIGURE 2, the bottom wall is identified as 26*a*, the outer and inner side walls as 26*b* and 26*d* and the top wall as 26*c* (FIGURE 2). The spiral motion of this cutting edge 72', inherent in the spiral formation of the crescent-shaped attachment 72, also aids in producing a very effective shearing action against the inner wall surfaces of the head 26, so as to shear through any thick cornstalks or ensilage material which may fall into the gutter, and which, in the absence of this shearing operation, might tend to clog the apparatus.

In view of the foregoing, it will be appreciated that the present invention provides improved barn cleaning apparatus of a highly economical nature, that is very practical and efficient in operation and that insures thorough cleaning of the gutters or troughs. Since no hand operations are involved, and the waste material is enclosed entirely within the conveyor tube 24 during its transfer to the manure spreader, very high standards of sanitation are maintained.

In FIGURE 7 I have illustrated another arrangement or embodiment in which my improved barn cleaning apparatus is adapted to be pulled along the gutter 12 by a

towing or traction cable **210** which is adapted to be wound upon a power driven winch or winding drum located at the end of the barn, or outside of the barn. Such winch might be of the type mounted on a tractor or other like vehicle. It will be seen that the wheeled carriage **40** is provided with duplicate draw bar or hitch connections **28**, **28'** at opposite ends, either one of which is effective to transmit either pushing or pulling propelling force from the tractor to the wheeled carriage **40**, and either one of which is also effective to transmit pulling propelling force from the tow cable **210** to the wheeled carriage. The tow cable **210** might also pull a manure spreader or other manure receiving vehicle through the barn alongside the cleaning unit **22**. As illustrative of one particular utility of this cable towed embodiment, I have illustrated it as used in cooperation with barn cleaning equipment employing pairs of tracks **212** on which roll one or more wheeled cars **214** generally of the hopper type. Ordinarily, the manure is shoveled from the gutter **12** into these hand cars **214**. However, my barn cleaning unit **22** may be coupled up to such a car substantially as shown, and the two wheeled vehicles pulled side by side through the divergent hitch connections **211** leading from the cabe **210**. In such embodiment, the conveyor is power driven either by a small gasoline engine or an electric motor mounted directly on the unit, as indicated at **216**, the latter being coupled to the driving connection **32**. This cable pulled embodiment may be of the construction shown in FIGURES 2–6. Also, due to the provision of the wheeled carriage and reversible cleaning head as described hereinbefore, the cable pulled embodiment is adapted to be moved to the opposite sides of the receptacle or car **214** and to have the head thereof reversed for the reasons and purposes described in conjunction with the other embodiments of the invention.

From the foregoing, it will be appreciated that the present invention provides improved barn cleaning apparatus of a highly economical nature that is practical and that performs a thoroughly efficient cleaning function. All of the objects enumerated hereinbefore are achieved in all embodiments of the invention, particularly the novel objects of the provision of a feed end head for the inclined flight screw conveyor and tube, the provision of means motivated in conjunction with the screw conveyor for effecting scraping of the gutter, the provision of apparatus that affords a truly sanitary method of manure removal, the provision of apparatus that is adapted for use in both through and dead end barns, and the achievement of these objects and advantages in the form of highly economical embodiments.

While I have described what I regard to be preferred embodiments of my invention, it will be appreciated that various changes, rearrangements and modifications may be made therein without departing from the scope of the invention, as defined by the appended claims.

I claim:

1. In barn cleaning apparatus of the class described for cleaning manure from a manure gutter which is formed to extend lengthwise of the barn floor between the aisle floor level and the stanchion floor level, said barn cleaning apparatus comprising a conveyor tube adapted to be propelled in an inclined operating position which lies in a plane extending substantially transversely of said gutter with the lower inlet end of said tube being disposed adjacent to said gutter and its upper outlet end being disposed over the aisle floor level for discharging into a receptacle which also travels along said aisle floor level, a screw conveyor rotatably mounted in said conveyor tube, a cleaning head mounted on the lower end of said conveyor tube for traveling along within the bottom of the gutter and having a manure receiving opening therein facing forwardly substantially at right angles to the transverse plane of said conveyor tube and screw conveyor, said cleaning head being of generally rectangular formation comprising substantially vertical side walls and a substantially horizontal bottom wall which define said manure receiving opening, said side and bottom walls having leading edges which scrape the manure from the side and bottom surfaces of said gutter and direct it into the interior of said cleaning head for transfer into said conveyor tube, and rotating scraper blade means within said cleaning head driven by said screw conveyor, said scraper blade means comprising a crescent shaped portion having a spiral cutting edge which moves with a progressive cutting action spirally across the inner walls of said cleaning head, whereby said spiral cutting edge and the interior walls of said cleaning head cooperate to cause relatively large cornstalks, heavy straw, long grass and the like to be sheared or broken up between said spiral cutting edge and the interior walls of said cleaning head into a mass which can be fed up said inclined conveyor tube by said screw conveyor, said crescent shaped portion being of substantially larger diameter than said screw conveyor so that in its rotation said crescent shaped portion can reach down into the inner or near corner area of the cleaning head traveling in the inner or near corner area of the gutter adjacent to said aisle floor level, which inner corner area cannot be reached by said screw conveyor because of the angle of inclination of the screw conveyor transversely of the gutter and because of the depressed position of the gutter below the floor level.

2. In barn cleaning apparatus of the class described for cleaning manure from a manure gutter which extends lengthwise of the barn floor between the aisle floor level and the stanchion floor level, said barn cleaning apparatus comprising a conveyor tube adapted to be propelled in an inclined operating position which lies in a plane extending substantially transversely of said gutter with the lower inlet end of said tube disposed adjacent to said gutter and its upper outlet end disposed over the aisle floor level for discharging into a receptacle which also travels along said aisle floor level, a screw conveyor rotatably mounted in said conveyor tube, a cleaning head mounted at the lower end of said conveyor tube for traveling along within the bottom of the gutter and having a manure receiving opening therein facing forwardly substantially at right angles to the transverse plane of said conveyor tube and screw conveyor, said cleaning head being of generally rectangular formation comprising substantially vertical side walls, said side walls having leading edges which scrape the manure from the side surfaces of said gutter and direct it into the interior of said cleaning head for transfer into said conveyor tube, and rotating scraper blade means within said cleaning head driven by said screw conveyor, said scraper blade means comprising a crescent shaped portion of substantially larger radius than said screw conveyor and having a spiral cutting edge which moves with a progressive cutting action spirally across the inner surfaces of said cleaning head, whereby said spiral cutting edge and the walls of said cleaning head cooperate to shear or break up therebetween any large cornstalks or the like for rendering the same conveyable up said conveyor tube by said screw conveyor.

3. In barn cleaning apparatus of the class described for cleaning manure from a manure gutter which is formed to extend lengthwise between the aisle floor level and the stanchion floor level of the barn floor, said barn cleaning apparatus comprising an inclined conveyor tube having its lower manure receiving end adapted to travel in said gutter or in proximity thereto and having its upper manure discharging end sloping diagonally upwardly over said aisle floor level in a transversely extending direction, a wheeled vehicle for transporting said conveyor tube in a direction along the length of said gutter, said vehicle comprising supporting wheels having rolling planes of rotation normally positioned to roll parallel to said gutter and at right angles to the longitudinal dimension of the conveyor tube, so that in its normally forward rolling motion the vehicle will carry the conveyor tube in a crosswise position of transport relatively to said gutter, a screw conveyor

rotatably mounted in said conveyor tube, a cleaning head mounted on the lower end of said conveyor tube for traveling along within the bottom of the gutter and having a forwardly facing manure receiving opening therein, said cleaning head comprising substantially vertical side walls which define the sides of said manure receiving openings, said side walls having leading edges which scrape the manure from the side surfaces of said gutter and direct it into the interior of said cleaning head for transfer into said conveyor tube, and rotating scraper blade means within said cleaning head driven by said screw conveyor, said rotating scraper blade means comprising a crescent shaped portion of substantially larger radius than said screw conveyor, said crescent shaped portion having a spiral cutting edge which moves with a progressive cutting action spirally across the inner walls of said cleaning head.

4. In barn cleaning apparatus of the class described for cleaning manure from a manure gutter extending lengthwise between the aisle floor level and the stanchion floor level of the barn floor, said barn cleaning apparatus comprising an inclined conveyor tube having its lower manure receiving end adapted to travel in said gutter or in proximity thereto and having its upper manure discharging end sloping diagonally upwardly over said aisle floor level in a transversely extending direction, a wheeled vehicle for transporting said conveyor tube in a direction along the length of said gutter, said vehicle comprising supporting wheels having rolling planes of rotation normally positioned to roll parallel to the length of said gutter and at right angles to the longitudinal dimension of the conveyor tube, so that in its normal forward rolling motion the vehicle will carry the conveyor tube in a crosswise position of transport relatively to said gutter, a conveyor in said conveyor tube, and a cleaning head mounted at the lower end of said conveyor tube for traveling motion within the bottom of the gutter and having a forwardly facing manure receiving opening therein facing at right angles to the transverse plane of the conveyor tube and in the direction of travel of said cleaning head along the length of the gutter, said cleaning head comprising substantially vertical side walls which define the sides of said manure receiving opening, said side walls having leading edges which scrape the manure from the side surfaces of said gutter and direct it into the interior of said cleaning head for transfer into said conveyor tube.

5. The combination of claim 1 wherein said cleaning head envelops substantially more than one-half of the circle of rotation of said rotating scraper blade means.

6. The combination of claim 4 wherein the discharge end of said conveyor tube discharges into a moving receptacle, and wherein said moving receptacle travels along track rails extending substantially parallel to said gutter.

7. The combination of claim 2 wherein the cleaning head is rotatably journaled on the lower end of said conveyor tube for rotating the cleaning head so as to present the manure receiving opening therein in the appropriate direction for either direction of travel of the cleaning head along the length of the gutter.

References Cited in the file of this patent

UNITED STATES PATENTS

1,271,627	Stuart	July 9, 1918
2,529,954	McCann	Nov. 14, 1950
2,558,424	Dretzke	June 26, 1951

FOREIGN PATENTS

300,391	Germany	Sept. 8, 1917
108,382	Great Britain	Aug. 9, 1917