# United States Patent [19]

**Grau**

[11] **3,897,888**

[45] **Aug. 5, 1975**


[54] **METERING APPARATUS FOR PARTICULATE MATERIAL**


[75] Inventor: **Theodore H. Grau**, Sioux Rapids, Iowa

[73] Assignee: **Toledo Stamping & Manufacturing Co.**, Toledo, Ohio



[22] Filed: **Mar. 11, 1974**

[21] Appl. No.: **449,902**

[52] **U.S. Cl.** ..... **222/38**

[51] **Int. Cl.** ..... **B67d 5/22**

[58] **Field of Search** ..... 222/185, 333, 36, 559, 222/561, 76, 38; 251/129, 133



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,770,396 | 11/1956 | Vernig | 222/185 X |
| 3,363,536 | 1/1968 | Dean, Jr. | 251/133 |
| 3,812,843 | 5/1974 | Wootten et al. | 222/76 |



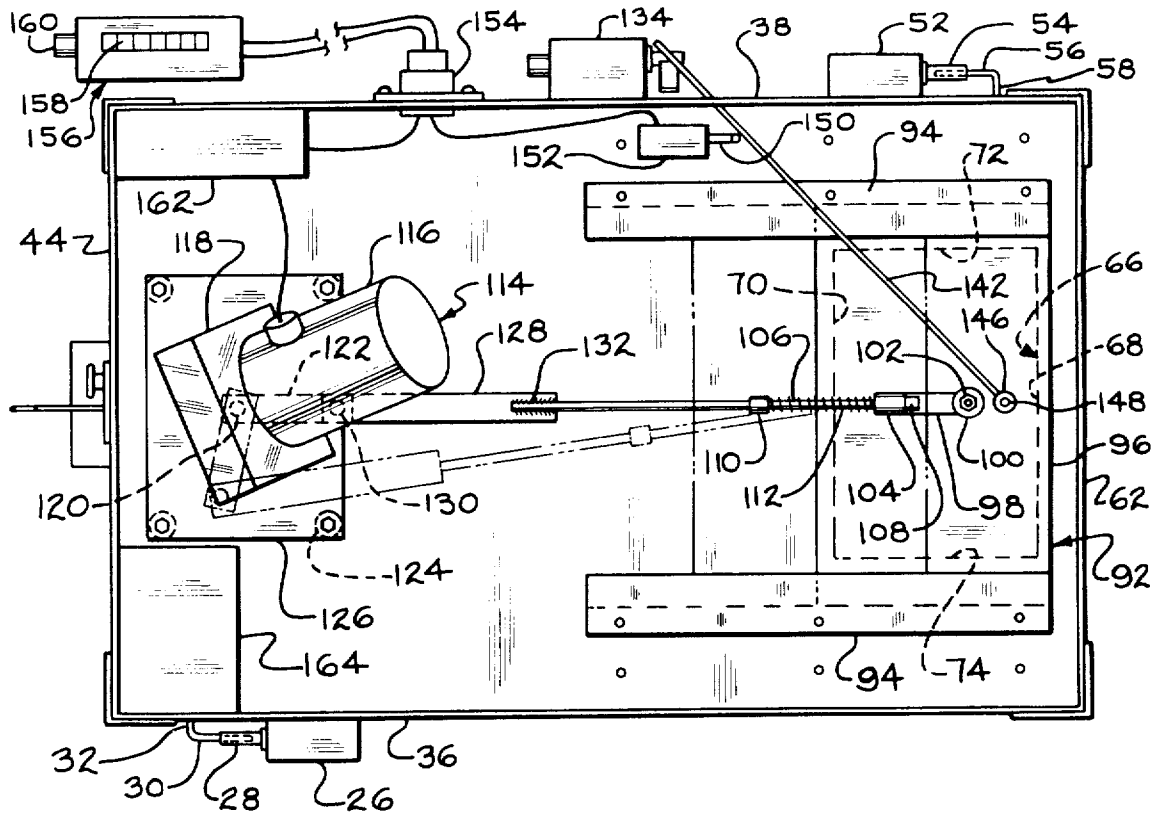
*Primary Examiner*—Stanley H. Tollberg
*Attorney, Agent, or Firm*—Allen D. Gutchess, Jr.



[57] **ABSTRACT**

Metering apparatus for metering feed from a source to another location is provided. The metering apparatus is primarily designed to meter a quantity of a supplement or supplemental components supplied to animal feed for accurate control of the quantity and uniform distribution of the feed. The apparatus includes a bin with a reciprocating gate of a constant stroke movable across a variable discharge opening. The reciprocating gate is driven by a 12-volt DC windshield wiper motor which can be operated off a tractor battery in the field, if desired. The unit preferably is used with 110-volt AC power, in which case a drive motor of an auger supplying feed to the bin of the metering apparatus can be controlled by a sensing paddle in the bin of the apparatus. The reciprocation of the gate through its motor can be controlled by a subtraction counter to determine the number of reciprocations and also by a second sensing paddle in the bin which shuts off the gate motor if the bin becomes empty.


**13 Claims, 6 Drawing Figures**



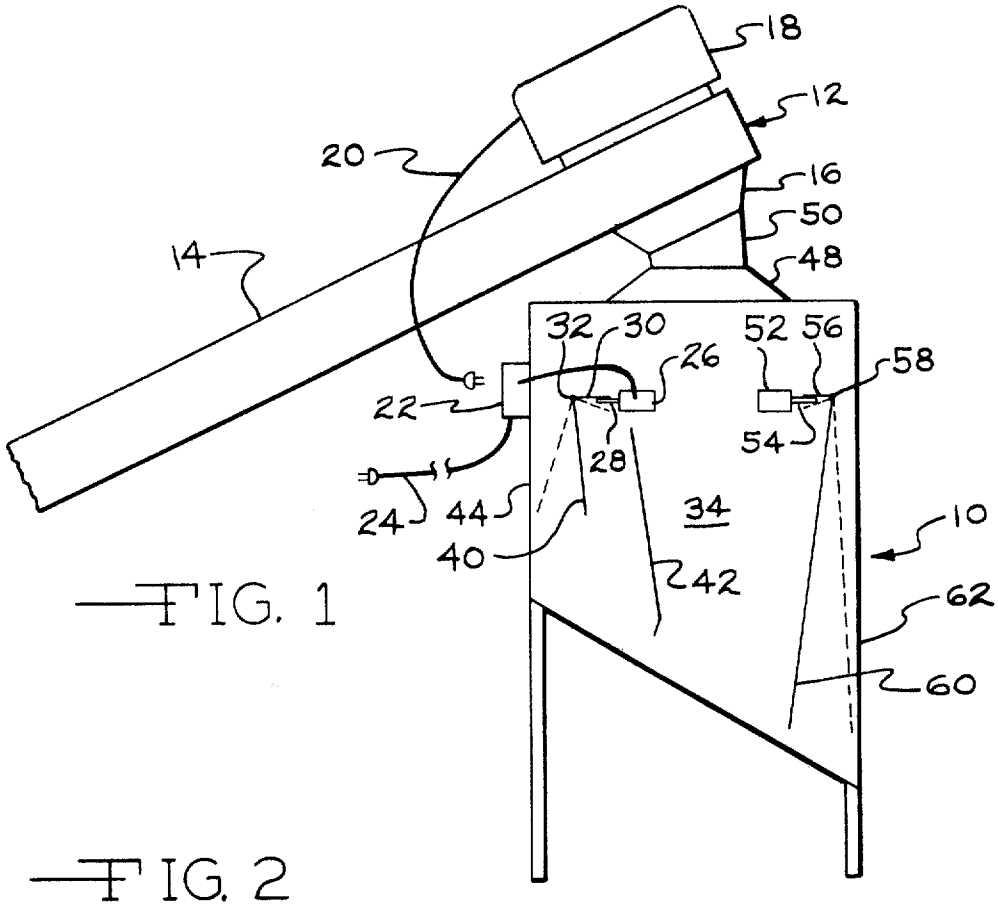
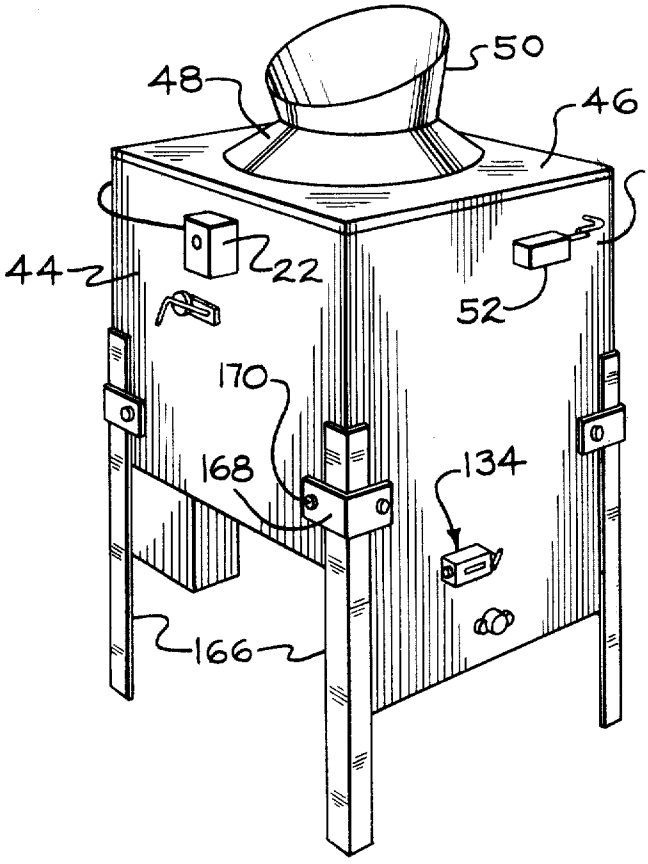



FIG. 1

FIG. 2



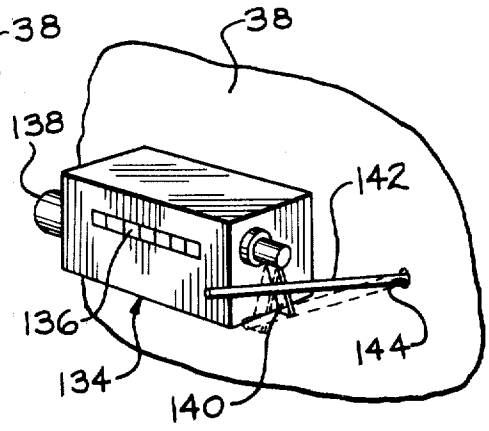




FIG. 5

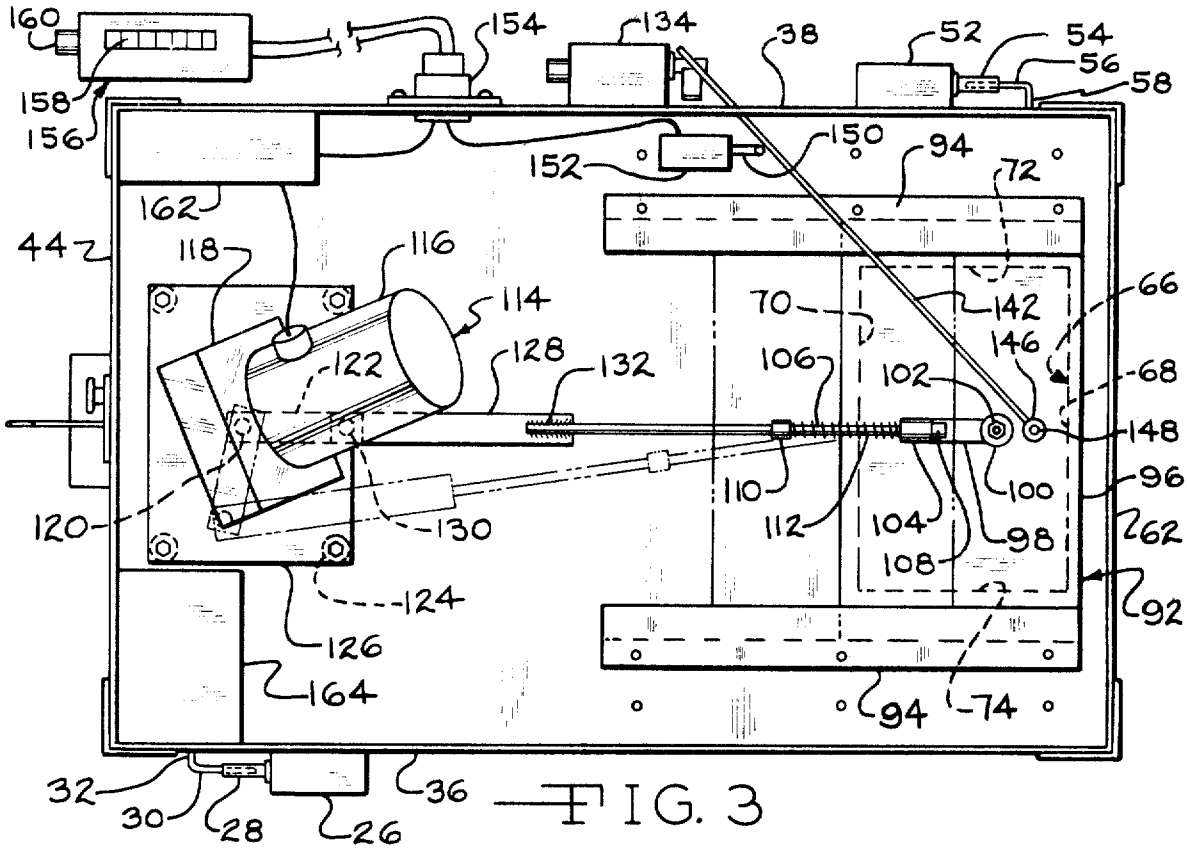



FIG. 3

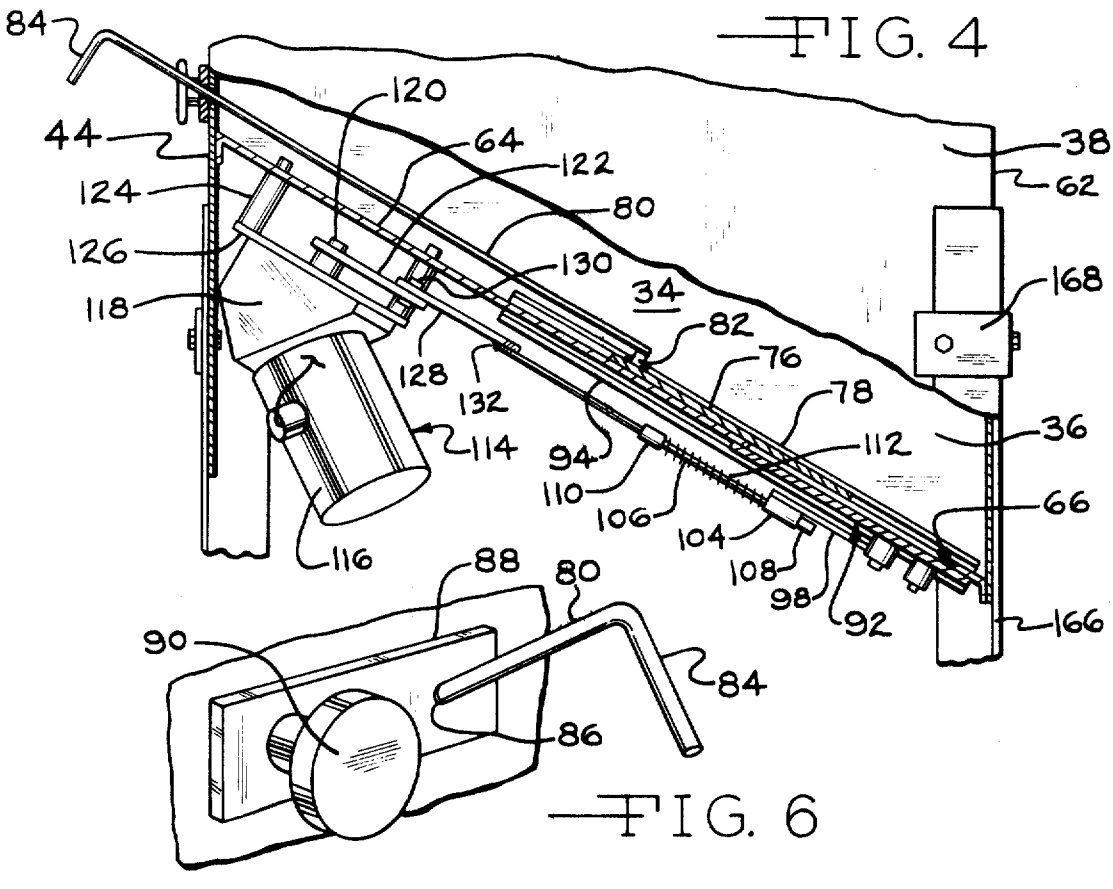



FIG. 4

FIG. 6

# METERING APPARATUS FOR PARTICULATE MATERIAL

This invention relates to metering apparatus for controlling a supplement or supplemental components added to animal feed.

In more recent years, the addition of a supplement or supplemental components of one type or another to forage has become more and more common. Such supplement usually has been added by hand with the result that it is neither uniformly distributed over the forage nor is the quantity added known with any degree of accuracy.

Metering devices have heretofore been known to a limited extent for metering supplement to forage. Some of these have been quite expensive and/or required considerable maintenance, while others have been quite effective. A common way of metering the supplement has been by reciprocating a gate under an opening of a bin containing the supplement, with the degree of reciprocation, or length of stroke, determining the amount of supplement metered or discharged from the bin. A meter of this type is shown in my U.S. Pat. No. **3,184,108.** To obtain proper reciprocation of the gate in such an instance, relatively complex means have been required to achieve a reasonably wide range of adjustment.

The present invention provides metering apparatus for a supplement which utilizes a bin with an opening in the bottom across which a gate is reciprocated with a fixed length stroke. The metering is achieved by a sliding valve plate which controls the area of the bin openings to thereby control the amount of supplement discharged with each stroke of the gate. The gate in this instance is driven by a commercially available, relatively inexpensive, **12**-volt DC windshield wiper motor which also has the advantage of automatically moving the gate to the closed position whenever the motor is shut off. The motor can be driven directly by the **12**-volt system of a tractor battery when in the field. Preferably, however, the new metering apparatus is provided with a transformer or converter which can employ **110**-volt AC power and converts this to **12**-volt DC for the motor. When **110**-volt power is used, an electrical outlet on the meter can supply power for an auger motor for feeding the supplement to the bin. The bin has a sensing paddle which controls the operation of the auger motor thereby to control the supply of feed to the bin. The new metering apparatus also can employ a subtraction counter which shuts off the gate motor when reaching zero from a pre-selected number, and the bin can have a second sensing paddle which shuts off the gate motor if the bin is empty. In addition to the subtraction counter, a cumulative counter can also be operated to provide the farmer or other operator with an overall indication of the quantity dispensed. Both counters can be operated by a single member which is movable with the reciprocating gate.

It is, therefore, a principal object of the invention to provide improved metering apparatus for controlling the addition of a supplement to forage.

Another object of the invention is to provide metering apparatus of the type described which can employ either **12**-volt DC or **110**-volt AC power.

A further object of the invention is to provide metering apparatus which has a bin with an opening, the area of which can be controlled, with a gate of fixed stroke reciprocated across the opening.



Still another object of the invention is to provide metering apparatus having a sensing paddle in a bin which is effective to turn on and off a supply motor which supplies particulate material to the bin.

Still a further object of the invention is to provide metering apparatus employing a reciprocating gate with a drive motor controlled by a subtraction counter and a sensing paddle in a bin thereof.

Yet another object of the invention is to provide metering apparatus with a reciprocating gate driven by a windshield wiper motor.

Many other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings in which:

FIG. **1** is a schematic side view in elevation of metering apparatus in accordance with the invention, and means for supplying supplement thereto;

FIG. **2** is a view in perspective of the apparatus of FIG. **1**;

FIG. **3** is a somewhat schematic, bottom view of the metering apparatus of FIG. **2**;

FIG. **4** is a fragmentary view in vertical cross section taken centrally through the bottom of the apparatus of FIG. **3**;

FIG. **5** is a detailed view in perspective of a counter and control rod of the apparatus of FIG. **3**; and

FIG. **6** is a detailed view in perspective of a valve plate control handle.

Referring particularly to FIG. **1**, supplement metering apparatus according to the invention is indicated at **10** and receives supplement from supply means indicated at **12**, discharging the supplement at another location, such as onto forage carried along a conveyor below the apparatus **10.** The apparatus **10** thereby can supply a metered, known amount of the supplement uniformly to the forage. Thus, the amount of supplement, which is usually relatively expensive compared to the forage supplied thereto can be accurately determined. The supplement is also uniformly distributed so that each animal receives a substantially constant ratio of supplement to feed. In addition, the supplement can be readily adjusted to provide different amounts under different conditions, as desired.

The supply means **12** include a trough **14** containing an auger (not shown), which carries feed up the trough **14** to a discharge spout **16,** when driven by a motor **18.** The motor requires a **110**-volt AC electrical supply and has a power supply line **20** which can be connected to an electrical outlet box **22** on the metering apparatus. The apparatus can be connected to a **110**-volt AC supply through a line **24** connected to an extension cord or other suitable source. As used herein, the term "**110** volt AC" is intended to denote common household current, which can vary from about **105** volts to **125** volts.

A limit switch **26** is mounted on the side of the metering apparatus **10** and is connected in series with the supply line **24** and the outlet box **22** to control power to the outlet box. The switch **26** has an operating lever **28** which is positioned to be engaged by an arm **30** affixed to a pivot rod **32** extending across a bin **34** of the metering apparatus **10,** between opposite side walls **36** and **38** thereof. A load-sensing plate or paddle **40** extends a substantial distance across the bin **34** between the side walls **36** and **38,** being pivotally supported by the rod **32.** The paddle **40** is located between a baffle **42** and a front wall **44** of the bin **34.** With sufficient par-

ticulate material, such as supplement, between the baffle **42** and the paddle **40**, the paddle is moved to the dotted line position of FIG. **1**, causing the arm **30** to depress the lever **28** and shut off the switch **26**. This terminates power to the motor **18** and stops the auger.

As the bin **34** subsequently empties to a level below the lower end of the paddle **40**, it swings back to the solid line position, raising the arm **30** and closing the switch **26** again to turn on the motor **18**. The lever **28** of the switch can be spring-loaded internally within the switch to urge the paddle **40** to the solid line position, or a supplemental spring can be employed for this purpose. With the paddle **40**, the amount of supplement in the bin **34** can be controlled within a desired range of levels to keep a relatively constant "head" of the supplement in the bin. A more consistent discharge of the supplement is thereby achieved.

When the supply means **12** is employed, the apparatus **10** can be provided with a top cap **46** (FIG. **2**) which covers the entire top of the bin **34** and has an upwardly extending sheet metal spout **48** terminating in a flexible skirt **50** which fits closely with the spout **16** of the auger trough **14**. This assures that no dirt or debris will be accidentally supplied to the top of the bin **34** and also assures that the supplement will not be blown away under windy conditions.

To control the discharge arrangement for the bin **34**, a second limit switch **52** having an operating lever **54** is mounted outside the bin, on the side wall **38**. The switch lever **54** is engaged by an arm **56** of a pivot rod **58** which extends across the bin **34** between the side walls **36** and **38**, being pivotally supported thereby. A second load-sensing plate or paddle **60** is affixed to the pivot rod **58** and is pivotally supported thereby within the bin **34**. The paddle **60** is located on the side of the baffle **42** opposite the paddle **40**, adjacent a rear wall **62** of the apparatus **10**. Under normal operating conditions, the supplement in the bin **34** moves the paddle **60** to the dotted line position, closing the switch **52**, in this instance. If the level falls below the lower end of the paddle **60**, the internal switch spring for the lever **54**, or an external spring, if used, urges the paddle **60** back to the solid line position of FIG. **1** and opens the switch **52**. This shuts off the discharge arrangement for the bin **34** to prevent a false indication of the amount of supplement dispensed.

Referring now more particularly to FIGS. **3** and **4**, the discharge arrangement for the bin **34** will be discussed. The bin **34** includes a bottom wall **64** which extends diagonally between the front wall **44** and the rear wall **62** on approximately a 30° angle, as shown. The bottom wall **64** has an opening **66** of a fixed size and shape near the lower end thereof, the opening being formed by lower and upper edges **68** and **70** and sides edges **72** and **74**, the edge **68** being close to the rear wall **62** of the apparatus.

A valve plate **76** is located on the upper surface of the bottom wall **64** and is slidably mounted in ways or guides **78** located parallel to the edges **72** and **74** of the opening **66**. The adjusting rod or member **80** is affixed to a projection **82** on the valve plate **76** and extends beyond the front wall **44** to a handle **84**. The adjusting rod **80** extends through an opening **86** (FIG. **6**) in a locking plate **88** which is held adjacent the front wall **44** by a locking screw **90**. When the screw **90** is loosened, the locking plate **88** is loosened and the rod **80** can be moved longitudinally to adjust the position of the valve plate **76** relative to the opening **66**. When the rod **80** is pushed in, the plate **76** moves toward the lower edge **68** of the opening to reduce the area of the opening. When the rod **80** is pulled out, the plate **78** is moved up the bottom wall **64** toward the front wall **44**, to increase the area of the opening defined between the lower edge **68** thereof, portions of the side edges **72** and **74** thereof, and the forward edge of the plate **76**. When the locking screw **90** is tightened, the locking plate **88** tends to assume a true vertical position adjacent the front wall **44** and causes edges of the opening **86** to bite against the rod **80** and hold it securely in place.

A reciprocable discharge gate **92** is located adjacent the lower surface of the bottom wall **64** and is slidably mounted in ways **94** located parallel to the side edges **72** and **74** of the opening **66**, below the ways **78** of the valve plate **76**. The reciprocable gate **92** is reciprocated through strokes of fixed length such that a forward edge **96** of the gate extends beyond the lower edge **68** of the opening **66** when at one end of the stroke and with the edge **96** being near or back of the upper edge **70** of the opening **66** at the other end of the stroke.

To reciprocate the gate **92**, a bar **98** has an ear **100** pivotally connected to the gate **92** by a suitable fastener **102**. The opposite end of the bar **98** terminates in a tubular projection **104** which slidably receives a link **106** extending therethrough to a collar **108** beyond the tubular projection **104**. The link **106** has a second collar **110** spaced from the tubular projection **104** with a spring **112** located therebetween. When the link **106** is moved forwardly or toward the right as viewed in FIGS. **3** and **4**, the spring **112** engages the tubular projection **104** and pushes the bar **98** along with the gate **92** toward the closed position, as shown in FIGS. **3** and **4**. When the link **106** is moved in the opposite direction or toward the left, the collar **108** directly engages the tubular projection **104** to move the gate **92** to the left to clear the opening **66**, with the forward edge **96** of the gate being beyond the edge **70** of the opening. This connecting arrangement for the gate enables the spring **112** to be compressed as the gate moves toward the closed position in the event that some obstruction, such as debris, should be caught in the opening **66**, between the forward edge **96** of the gate **92** and the lower edge **68** of the opening.

The link **106** and the gate **92** can be reciprocated by a drive unit or windshield wiper drive **114** which includes an electric 12-volt DC motor **116** and a suitable gear and control unit **118** forming a part thereof. A drive shaft **120** extends from the gear unit **118** perpendicular to the bottom wall **64**, as shown in FIG. **4**. A crank arm **122** is affixed to the drive shaft **120** and rotates therewith, clearing posts **124** which support and space a mounting plate **126** for the unit **118** from the bottom wall **64**. A link extension **128** is pivotally connected to an end of the crank arm **122** by a pin **130** and the opposite end of the link extension is affixed to the link **106** by a weld **132**.

When the motor **116** is driven, the drive shaft **120** is rotated to rotate the crank arm **122** to reciprocate the link extension **128** and the link **106** and correspondingly move the gate **92**, the length of the stroke of the gate **92** being equal to twice the distance between the pivot pin **130** and the drive shaft **120**. The commercially available unit **114** provides a relatively low cost and maintenance free drive for the gate **92** and further

has the built-in feature that whenever the motor **116** is shut off, the gate **92** is moved back to the closed position of FIG. **3**. Thus, there is no possibility of the opening **66** in the bottom wall **64** being left partially open upon the termination of operation, which could, of course, undesirably empty any remaining contents from the bin **34**.

The amount of supplement discharged from the bin **34** upon each complete reciprocatory cycle of the gate **92** depends upon the position of the valve plate **76**. Suitable lines or other indicia can be inscribed on the outer end portion of the adjusting rod **80** so that the operator knows that when a certain line on the rod is aligned with the locking plate **88**, a particular amount of feed will be discharged for each complete cycle of the gate **92**. If the operator then knows the number of reciprocations made, he will know the total amount of supplement supplied to the forage for any particular situation.

For this purpose, the metering apparatus **10** is equipped with a cumulative counter **134** mounted on the side wall **38** of the apparatus. As shown in FIG. **5**, the counter **134** has a window **136** through which suitable dials indicate the number of cycles made by the gate **92**. The counter has a reset knob **138** and a depending arm **140** which advances the counter one digit upon each movement thereof from the dotted line position to the solid line position and back again.

To operate the arm **140**, a counter operating rod or elongate member **142** extends through an opening **144** in the side wall **38**. The rod **142** is pivotally attached to the gate **92** by an enlargement **146** and a fastener **148**. As the gate **92** reciprocates, the rod **142** pivots about the fastener **148** and also pivots at the opening **144** in the side wall **38** to move substantially as shown between the solid and dotted line positions in FIG. **5**. In the dotted line position of the rod **142**, the counter arm **140** moves to the dotted position, being internally spring loaded. The counter can be reset to zero by means of the knob **138** after any predetermined period of time, and after the amount of supplement used in that period of time is determined.

The counter rod **142** also is engageable with a feeler arm **150** (FIG. **3**) of a limit switch **152** and is positioned to close the switch **152** briefly upon each reciprocatory motion of the gate **92**. The switch **152** is electrically connected through a plug **154** to a remotely located, commercially available counter **156** of the subtraction type. The number of cycles desired for the gate **92** is set on dials showing through a window **158** of the counter by means of a knob **160** or other suitable manual means. The counter contains a solenoid operated upon each pulse of the switch **152** to reduce the counter number by one. When the number reaches zero, a switch in the counter is opened, the switch being connected to the motor **116** through a junction box **162** and causing the motor to turn off at that time. The motor is connected to the **110**-volt AC power source through a converter **164** which converts the power to **12**-volt DC, the conductors connecting the power supply, the transformer **164**, and the junction box **162** not being shown. The motor **116** thus can be turned off automatically when the desired number of cycles of the gate **92** is reached or when the bin **34** becomes empty, as determined by the paddle **60** which controls the switch **52**. If the gate **92** is open at that time, it is automatically returned to the closed position by the drive unit **114**.

The meter **10**, as shown, is mounted on four legs **166** held by straps **168** and fasteners **170**. If desired, the legs can be arranged to extend above the top of the bin **34** to provide support for the auger trough **14**. Hence, the legs are adaptable to a wide variety of installations and applications.

Various modifications of the above-described embodiment of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if they are within the spirit and the tenor of the accompanying claims.

I claim:

**1**. Metering apparatus for feeding a quantity of particulate material from a source of supply to another location, said apparatus comprising a bin, a first plate, a first rod pivotally supporting said plate in said bin, a first switch outside said bin and mounted on said apparatus in communication with said first rod for said plate, an electrical outlet box mounted on said apparatus and connected to said switch, means for connecting a power supply to said outlet box and said switch for supplying power to said outlet box when said switch is closed and said plate is in a first position with the power to said outlet being off when said switch is open and said plate is in a second position, a second plate, a second rod pivotally supporting said second plate in said bin and spaced from said first plate, a second switch outside said bin and mounted on said apparatus in communication with said second rod, said second switch being closed when said second plate is in a first position, and said second switch being open when said second plate is in a second position, said bin having an opening in a bottom portion thereof, a gate mounted for reciprocation across said opening, a gate motor for reciprocating said gate, means connecting a second power supply to said motor and to said second switch, said motor being on when said second switch is closed, and said motor being off when said second switch is open.

**2**. Metering apparatus according to claim **1** characterized by a subtraction counter having a third switch electrically connected with said second switch and with said motor, said third switch being open when said counter is at a zero count.

**3**. Metering apparatus according to claim **2** characterized by means responsive to the reciprocation of said gate for actuating said counter.

**4**. Metering apparatus according to claim **1** characterized by means for supplying particulate material to said bin, a supply motor for operating said supply means, and means electrically connecting said supply motor to said electrical outlet box.

**5**. Metering apparatus according to claim **1** characterized by a generally upright baffle extending across said bin between said first plate and said second plate.

**6**. Metering apparatus for feeding a quantity of particulate material from a source of supply to another location, said metering apparatus comprising a bin, an outlet box mounted on said apparatus, said bin having an opening in a bottom wall thereof, a gate mounted for reciprocation across said opening, a **12**-volt DC motor mounted on said apparatus and connected to said gate for reciprocating said gate across said opening, means for converting **110**-volt AC power to **12**-volt DC

power, means connecting said converting means to said motor for supplying 12-volt DC power to said motor, means for supplying 110-volt AC power to said outlet box and to said converting means, a valve plate, and means for moving said valve plate to change the open area of said opening.

7. Metering apparatus according to claim 6 characterized by said valve plate being slidably mounted on one side of said bottom wall and said gate being mounted on the opposite side of said bottom wall.

8. Metering apparatus according to claim 6 characterized by said means for moving said valve plate comprises an elongate member extending to a handle located outside said bin, and a locking plate engageable with said elongate member for locking said member and said plate in predetermined positions.

9. Metering apparatus for feeding a quantity of particulate material from a source of supply to another location, said metering apparatus comprising a bin, an outlet box mounted on said apparatus, said bin having an opening in a bottom wall thereof, a gate mounted for reciprocation across said opening, a 12-volt DC motor mounted on said apparatus and connected to said gate for reciprocating said gate across said opening, means for converting 110-volt AC power to 12-volt DC power, means connecting said converting means to said motor for supplying 12-volt DC power to said motor, means for supplying 110-volt AC power to said outlet box and to said converting means, a subtraction counter electrically connected to said motor, and operating means including means pivotally connected to said gate for operating said subtraction counter.

10. Metering apparatus according to claim 9 characterized by said operating means comprises a limit switch mounted on said apparatus and engageable by said pivotally connected means.

11. Metering apparatus for metering a quantity of particulate material, said metering apparatus comprising a bin for receiving the particulate material, said bin having a bottom wall defining an opening therein, a gate slidably mounted on said bottom wall in a position for reciprocation across said opening, a windshield wiper drive mounted on said apparatus, said drive comprising a DC motor and a gear unit, said gear unit having a drive shaft extending therefrom, means connecting said drive shaft and said gate to cause said gate to reciprocate relative to said opening when said drive shaft is driven, with said gate returning to a closed position closing off said opening when power to said motor is shut off, a valve plate, means for slidably supporting said valve plate on said bottom wall, and means for moving said valve plate relative to said opening.

12. Metering apparatus for metering a quantity of particulate material, said metering apparatus comprising a bin for receiving the particulate material, said bin having a bottom wall defining an opening therein, a gate slidably mounted on said bottom wall in a position for reciprocation across said opening, a windshield wiper drive mounted on said apparatus, said drive comprising a DC motor and a gear unit, said gear unit having a drive shaft extending therefrom, means connecting said drive shaft and said gate to cause said gate to reciprocate relative to said opening when said drive shaft is driven, with said gate returning to a closed position closing off said opening when power to said motor is shut off, said connecting means comprising a crank arm connected to said drive shaft, link means having one end pivotally connected to said crank arm, and means pivotally connecting the other end of said link means to said gate.

13. Metering apparatus according to claim 12 characterized further by said last-named means comprises a tubular projection carried by said gate through which said link means extend, said link means having an enlargement on each side of said tubular projection, and resilient means located between said tubular projection and the enlargement closer to said motor.

* * * * *

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

PATENT NO. : 3,897,888

DATED : August 5, 1975

INVENTOR(S) : Theodore H. Grau

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 27, after "outlet" insert --box--.

Signed and Sealed this

*twenty-first* Day of *October 1975*

[SEAL]

*Attest:*

**RUTH C. MASON**
*Attesting Officer*

**C. MARSHALL DANN**
*Commissioner of Patents and Trademarks*