Sept. 20, 1971 J. L. PETERSON ET AL 3,606,037

CENTRAL DRAG LINE SYSTEM FOR NON-CYLINDRICAL PARTICLE STORAGE FACILITIES

Filed July 22, 1969 4 Sheets-Sheet 1

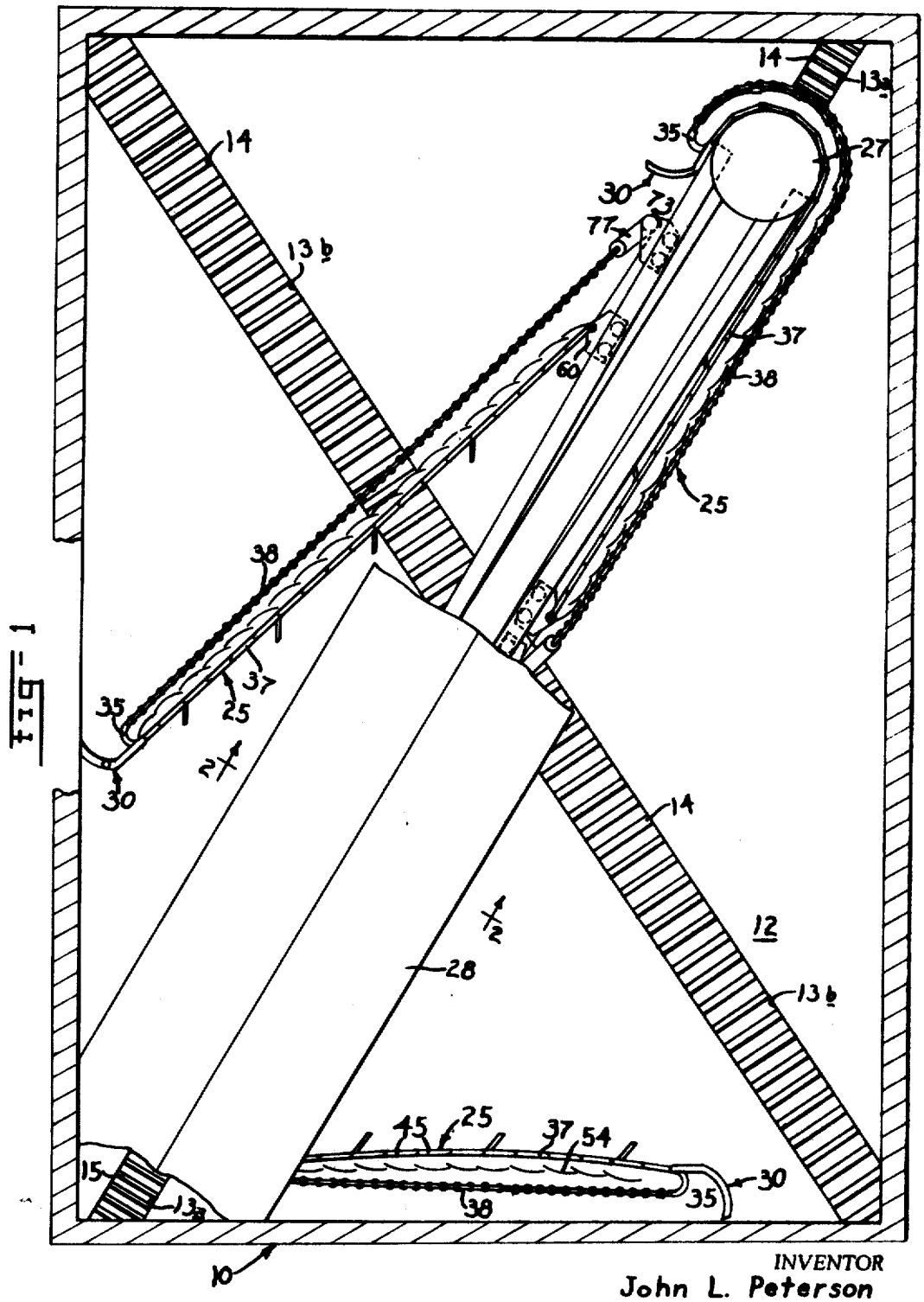


Fig. 1

INVENTOR
John L. Peterson
BY George H. Pettis
Wells & St. John
Attys

Sept. 20, 1971 J. L. PETERSON ET AL 3,606,037

CENTRAL DRAG LINE SYSTEM FOR NON-CYLINDRICAL PARTICLE STORAGE FACILITIES

Filed July 22, 1969 4 Sheets-Sheet 2

Fig - 2

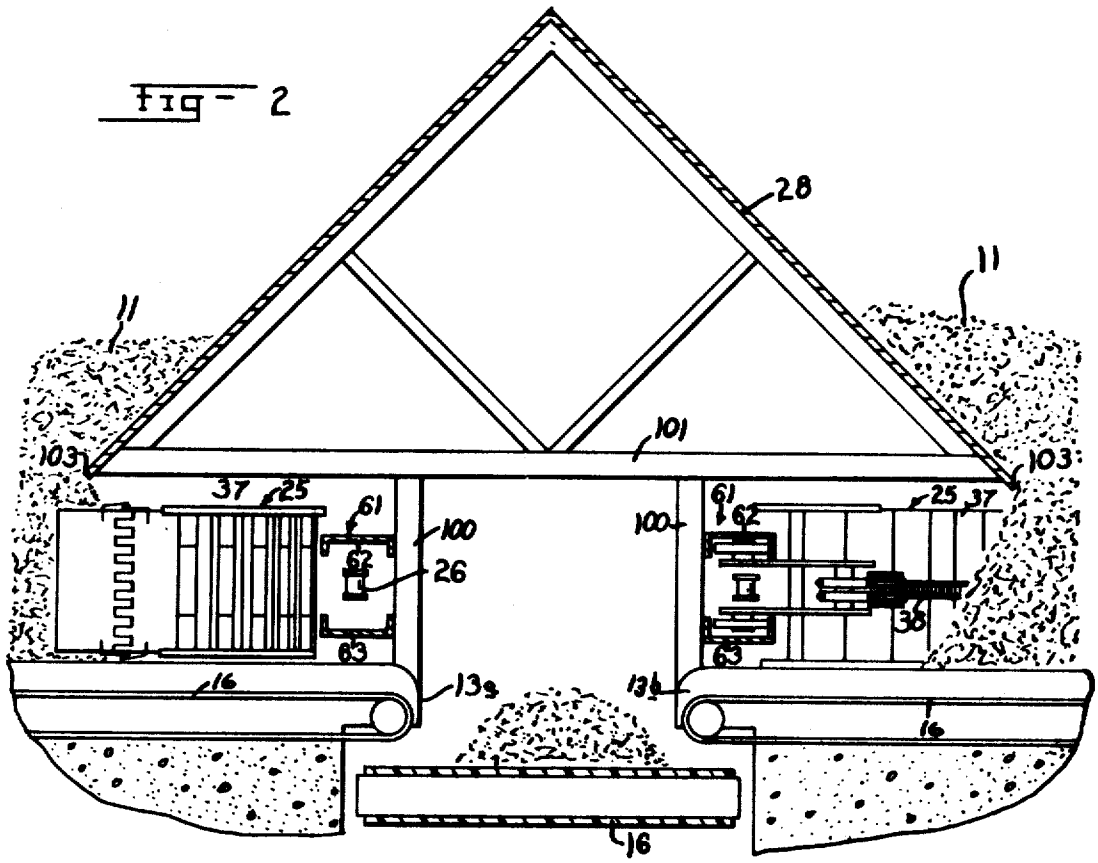
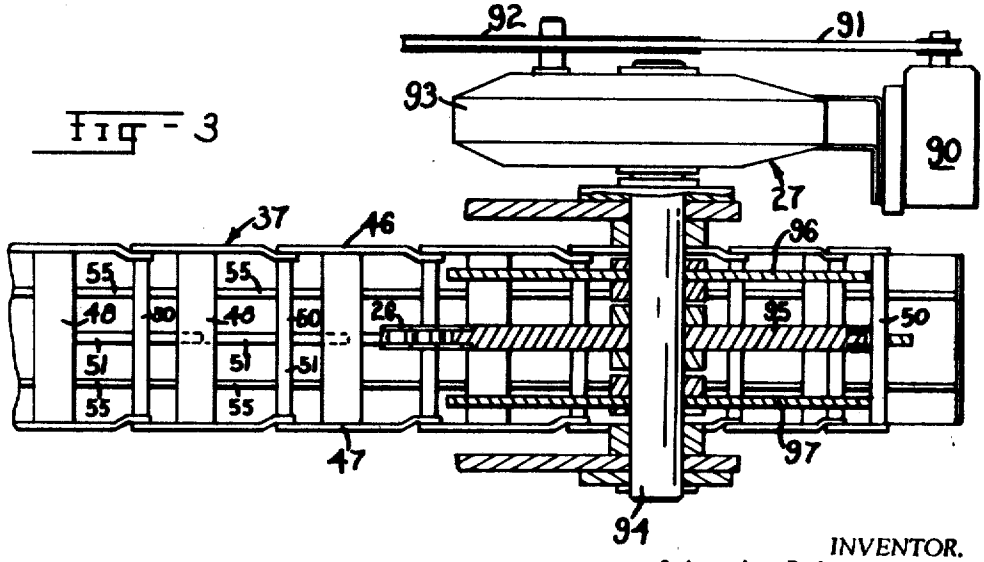


Fig - 3



INVENTOR.
John L. Peterson
BY George H. Pettis
Wells & St. John
Attys

Sept. 20, 1971 J. L. PETERSON ET AL 3,606,037

CENTRAL DRAG LINE SYSTEM FOR NON-CYLINDRICAL PARTICLE STORAGE FACILITIES

Filed July 22, 1969 4 Sheets-Sheet 3

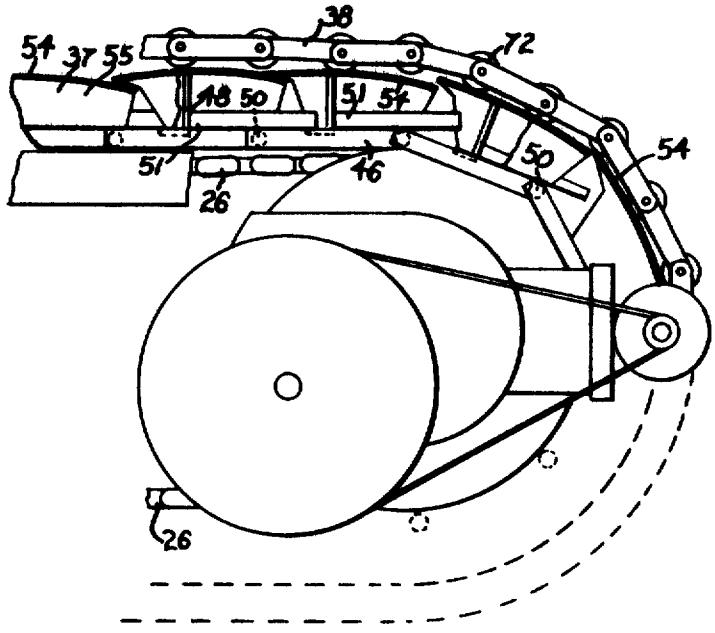


Fig - 4

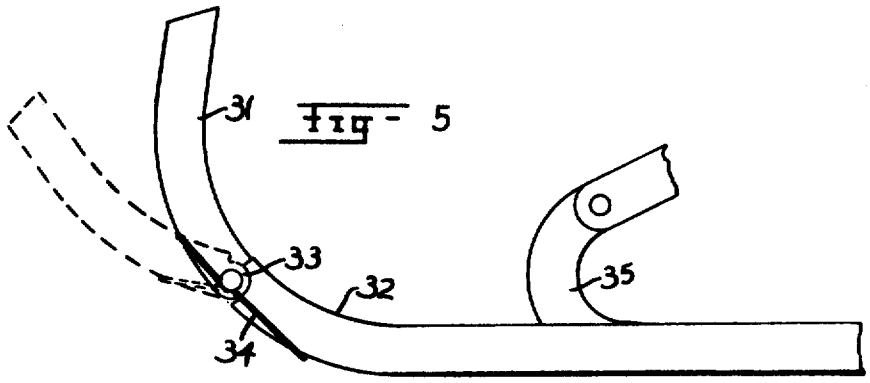
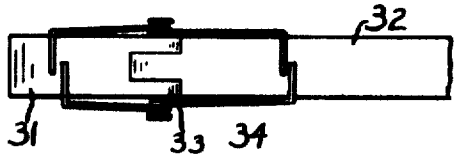


Fig - 5

Fig - 6



INVENTOR.
John L. Peterson
BY George H. Pettis
Wells & St. John
Attys

Sept. 20, 1971 J. L. PETERSON ET AL 3,606,037
CENTRAL DRAG LINE SYSTEM FOR NON-CYLINDRICAL PARTICLE STORAGE FACILITIES
Filed July 22, 1969 4 Sheets-Sheet 4

Fig-7

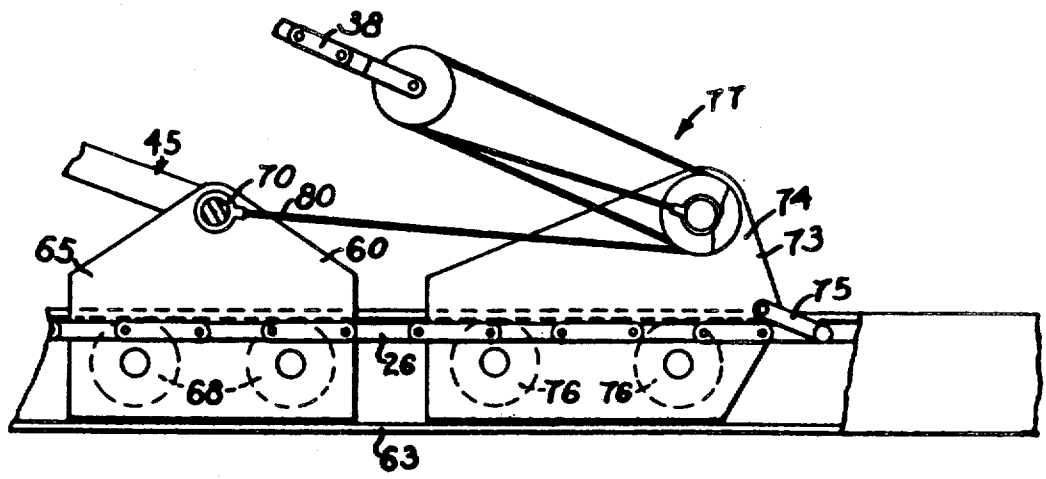
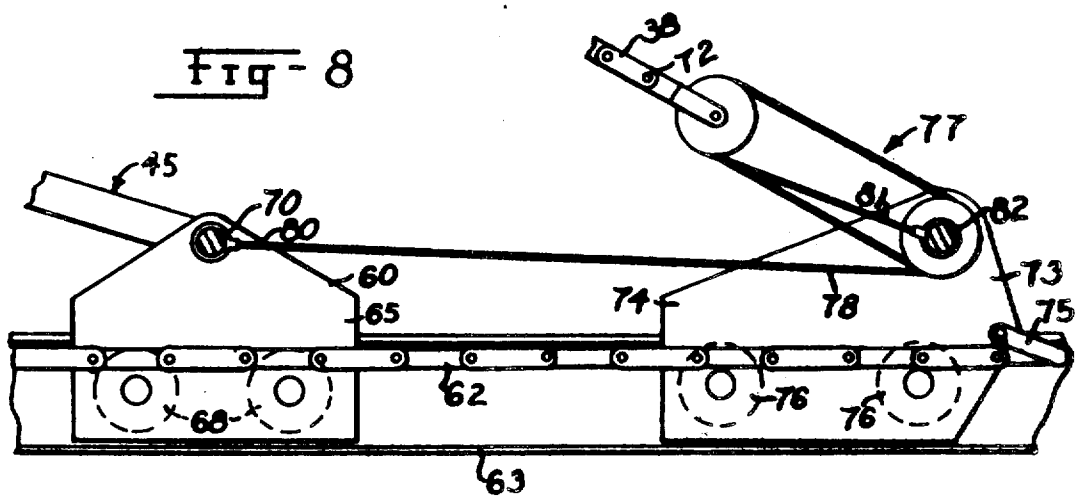


Fig-8



INVENTOR.
John L. Peterson
BY George H. Pettis
Wells & St. John
Attys

United States Patent Office 3,606,037
Patented Sept. 20, 1971

3,606,037

CENTRAL DRAG LINE SYSTEM FOR NON-CYLINDRICAL PARTICLE STORAGE FACILITIES

John L. Peterson and George H. Pettis, Spokane, Wash., assignors to Atlas Spokane, Inc.

Filed July 22, 1969, Ser. No. 843,702
Int. Cl. B65g 65/42
U.S. Cl. 214—10 8 Claims

ABSTRACT OF THE DISCLOSURE

A plurality of drag lines are attached to a continuous chain mounted above a flat floor over a floor aperture in the center of a non-cylindrical particle storage facility for digging granular material from a base of a pile and conveying the material to the floor aperture.

BACKGROUND OF THE INVENTION

This invention relates to particle storage facilities and more particularly to a non-cylindrical storage facility having a horizontal floor with central drag line systems for removing the granular material.

One of the principal objects of this invention is to provide a particle storage facility that has a non-cylindrical, cross section with the capability of removing the particles such as sawdust from the base of the pile in an efficient and continuous manner.

An additional object of this invention is to provide a dragline system for a storage facility that is mounted centrally within the facility with the free ends of the draglines being biased outwardly in proportion to the drag forces exerted on the draglines.

These and other objects and advantages of this invention will become apparent upon the reading of the following detailed description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of this invention is illustrated in the accompanying drawing, in which:

FIG. 1 is a horizontal, cross-sectional view of a rectangular storage facility for receiving and storing material in a pile on a horizontal floor with a material removal system shown in plan view for removing the material at the base of the pile;

FIG. 2 is a vertical cross-section view taken along lines 2—2 in FIG. 1 showing the material removal system in more detail with a continuous chain having a plurality of draglines connected thereto with the free end of the draglines being biased outwardly;

FIG. 3 is a fragmentary vertical cross-sectional view taken along lines 3—3 in FIG. 1 showing in detail the drive means for moving the continuous chain;

FIG. 4 is a fragmentary plan view of a section of the continuous chain and a section of the dragline means;

FIG. 5 is a fragmentary detail plan view of an end of one dragline;

FIG. 6 is a fragmentary side view of the end of the dragline shown in FIG. 5;

FIG. 7 is a fragmentary plan view of a force multiplying device for biasing the free end of the dragline outwardly into the base of the pile; and

FIG. 8 is a plan view similar to FIG. 7 except showing the effects of an increased drag force being exerted on the dragline causing the force multiplying device to exert a proportionately greater biasing force on the free end of the dragline.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to the drawings, there is shown

in plan view a walled storage facility, generally designated by arrow **10**, having a rectangular cross section for receiving and supporting particles **11** on a horizontal floor **12**. As shown in FIG. 1, the floor **12** has a rectangular-shaped perimeter. Two diagonal crisscrossing elongated apertures **13**(*a*) and **13**(*b*) are formed in the floor at diagonal angles to the walls. Grates **14** and **15** are positioned in the central apertures to permit material to flow through the apertures while providing supporting areas flush with the floor **12**. As shown in FIG. 2, belt conveyors are mounted beneath the aperture **13** for receiving the material and carrying the material from the particle storage facility to a boiler or the like.

The particle storage facility has a dragline means positioned immediately above the floor for removing the material from the center of the pile moving the material over the grates **14** and **15** to cause the material to flow through the apertures **13** and onto the conveyors **16** in a continuous manner. The dragline means includes a plurality of draglines **25** having one end of each dragline connected to an elongated horizontal continuous chain **26** centrally mounted in the facility immediately above the floor. The flights of the chain **26** are substantially parallel with the aperture **13**(*a*). The chain is supported off the floor a sufficient distance to enable material to pass unler the chain and into the aperture **13**(*a*). The continuous elongated chain **26** is driven by a drive sprocket mechanism **27** (FIG. 3).

A hood **28** is mounted in the storage facility covering the continuous chain **26** with the sides of the hood extending outward sufficiently to provide escape spaces to house the draglines when cave-ins occur and to further prevent the sawdust in its natural angle of repose (FIG. 2) from clogging and interfering with the movement of the continuous chain and draglines.

Each of the draglines **25** has an end bucket **30** (FIGS. 5 and 6) formed on the free end for digging into the base of the sawdust as the dragline is moved over the floor. The bucket **30** has a base **32** with a hinge joint **33** formed thereon for pivotally supporting a curved tip **31**. A spring **34** is mounted on each hinge joint for biasing the curved tip to an extended position shown in solid line (FIG. 5). The springs **34** enable the curved tip **31** to flex backward as shown in dotted line (FIG. 5) should the bucket engage an obstruction. A curved bracket **35** is formed on the base **32** of the bucket.

Each dragline **25** has a main line **37** and an end biasing line **38**. The main line **37** includes a plurality of interconnected link frames **45** (FIG. 3) that extend from the bucket to a carriage **60**. Each of the lengths of frames **45** (FIGS. 2, 3 and 4) has an upper link connecting member **46** and a lower link connecting member **47**. An upright channel member **48** is welded between the two members **46** and **47**. A pin **50** interconnects the ends of the lower and upper connecting members **46** and **47** to adjacent link frames. A collar **51** surrounds each pin **50**. A horizontal locking bar **52** is welded between the side of the channel **48** and the collar **51** with an end projecting into the adjacent link frame for engaging the side surface of the adjacent channel **48** (see FIGS. 3 and 4). The locking bars **52** limit the degree of pivotal freedom of the link frames so that the frames can pivot only in one direction from a substantially straight line. The locking bars **50** give the link frames a knee action to provide a substantially rigid pull line when forces are exerted on the free end tending to swing the free end outward from the carriage **60** while at the same time enabling the dragline to flex around the ends of the elongated continuous chain as the draglines move from one side of the floor to the other.

Each of the link frames **45** has a shield plate **54** fixed to one side of the frame by horizontal gusset plates **55**. The first link frame of the pull line is connected to a carriage **60** that is movably supported in tracks **61** that run

along the flights of the continuous chain **26**. The tracks have an upper channel member **62** and a lower channel member **63** that vertically straddle the continous chain **26**. Carriage **60** has a main frame **65** supported by wheels **68** riding in the channels **62** and **63**. The carriage **60** has a vertical pin **70** that fastens the first link frame to the carriage.

The end biasing line **38** has a roller chain **72** fastened to the bracket **35** and extending to a second or forward carriage **73**. When the dragline rounds the corners the roller chain **72** biases against and is supported by the shield plates **54** as shown in FIG. 4. The carriage **73** is quite similar to the carriage **60** having a main frame **74** with wheels **76** riding in the channels **62** and **63** forward of the carriage **60**. A link **75** (FIGS. 7 and 8) interconnects the carriage **73** to the continuous chain **26** for pulling the dragline over the floor.

A force multiplying device **77** is mounted on the carriage **73** interconnecting the end biasing line **38** in proportion to the drag forces exerted on the main line **37**. The greater the drag forces exerted on the dragline, the greater the tension on the end biasing line **38** tending to swing the free end outward from the continuous chain **26**. The force multiplying device **77** is in the form of a block and tackle having a cable **78** connected at one end **80** to the pin **70** and wound around pulleys mounted on the end of the chain **72** and the carriage **73**. The other end **81** of the cable is attached to a pin **82** fixed on the carriage **73**. In this embodiment the block and tackle has a force ratio of 4. FIG. 8 shows the effect of increased drag forces being exerted on the dragline to lengthen the distance between the carriages **60** and **73** and decrease the distance between the forward end of the end biasing line **38** and the carriage **73** causing an increased tension on the end biasing line **38** to pivot the free end of the draw line outward to maintain the main line **37** straigh texcept while rounding a corner. In this manner the free end is always biased outward into the base of the pile. The spacing between the carriages **60** and **73** provides a moment arm for pivoting the free end outward.

The drive sprocket mechanism for supporting and driving the continuous chain **26** includes a motor **90** (FIG. 3) mounted under the hood adjacent one end of the continuous chain **26**. The motor **90** drives a belt **91** to rotate a pulley **93** that is affixed to a shaft of a speed reducer **93**. The speed reducer rotates a main shaft **94**. A sprocket **95** is affixed to the shaft for moving and supporting the continuous chain **26**. Freely rotatable idler wheels **96** and **97** are mounted on the shaft above and below the sprocket **94** respectively for supporting the draglines around the end of the chain path. The wheels **96** and **97** engage the pins **50** as shown in FIGS. 3 and 4.

The hood **28** is supported above the continuous chain **26** on vertical support members **100** (FIG. 2). The hood has a hip-shaped roof with outside edges **103** that extend outward sufficiently to prevent the natural flow of sawdust into the chain.

It should be noted that the removal system removes the sawdust from the center bottom of the pile first and then moves outward toward the sides. In this manner the oldest material in the facility is removed first.

We claim:

1. A particle storage facility for receiving and storing granular particle material such as sawdust, comprising:

(a) a horizontal support floor having a non-circular perimeter for supporting the granular particle material in a pile, said floor having at least one elongated centrally located aperture formed therein;

(b) an elongated continuous chain mounted centrally in the facility above the support floor;

(c) a plurality of elongated draglines slidably mounted on the horizontal floor with one end of each dragline operatively connected to the chain and the other end free to move over the floor and aperture;

(d) a hood mounted centrally in the facility above the continuous chain with sides that extend outwardly a sufficient distance to prevent the particles in repose from covering the continuous chain;

(e) biasing means operatively connected between the free ends and the chain for biasing the free ends outward from beneath the hood toward the floor perimeter toengage the base of the pile; and

(f) drive means operatively connected to the continuous chain for moving the draglines over the floor and against the base of the pile to remove the particles and move the particles to the floor aperture.

2. The particle storage facility as defined in claim **1** wherein the biasing means exerts a force on the free end of the drag means tending to move the free end outward from the continuous chain that is proportional to the drag forces exerted on the draglines.

3. The particle storage facility as defined in claim **1** wherein each of the drag means includes a bucket mounted on the free end thereof that has a flexible tip that will deflect if an obstruction is encountered.

4. The particle storage facility as defined in claim **1** further comprising a second aperture formed in the floor intersecting the first aperture and wherein the chain is mounted parallel with and straddling the second floor aperture at a distance above the floor sufficient to permit the particles to flow underneath the chain and into apertures without clogging the chain.

5. The particle storage facility as defined in claim **1** wherein each elongated dragline comprises a plurality of pivotally interconnected link frames in which each link frame is freely pivotable inward and has a stop means to limit outward pivotal movement of the succeeding link frame to interlock the link frames together to form an inflexible dragline when the free end of the dragline is moved outward toward the floor perimeter and a flexible dragline when the free end is moved inward from the floor perimeter.

6. The particle storage facility as defined in claim **5** wherein the biasing means includes a cable means under tension having one end connected to the free end of the dragline and the other end operatively connected to the continuous chain forward of the dragline for swinging the free end of the dragline outward toward the floor perimeter.

7. The particle storage facility as defined in claim **1** further comprising:

tracks centrally mounted in the facility along the flights of the continued chain;

a front carriage mounted for movement along the tracks, said first carriage being connected to the continuous chain for movement therewith;

a rear carriage mounted for movement in the tracks spaced rearward of the front carriage, in which said one end of the dragline is connected thereto; and

said biasing means having a pulley and cable means operatively interconnecting the dragline free end, the front carriage and the rear carriage for pulling the rear carriage behind the front carriage and for swinging the free end of the dragline outward with a force proportional to the drag resistance encountered by the dragline.

8. The particle storage facility as defined in claim **1** wherein the biasing means has a force means for biasing the free end of the dragline outward with the force proportional to the drag resistance encountered by the dragline.

References Cited

UNITED STATES PATENTS

3,407,943	10/1968	Douglass	214—17.82
3,424,295	1/1969	Wahl	214—17.82X
3,469,720	9/1969	Peterson	214—17.8

ROBERT G. SHERIDAN, Primary Examiner

U.S. Cl. X.R.

198—170, 171; 214—17DB