DRIVE STRUCTURE FOR FLIGHT-TYPE ELEVATOR

Filed Aug. 21, 1968 2 Sheets-Sheet 1

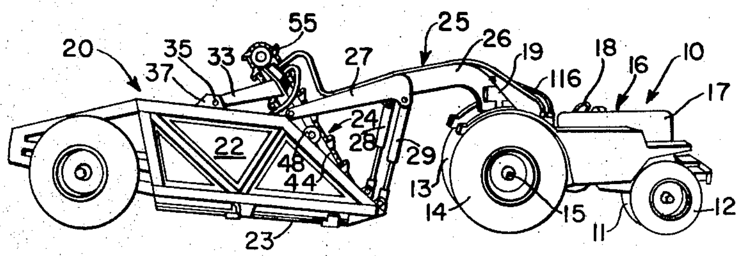


FIG. 1

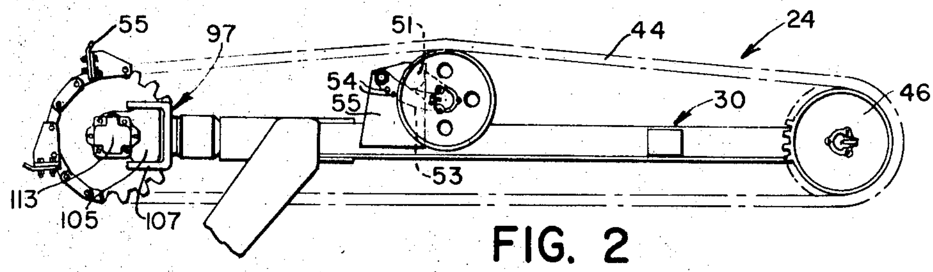


FIG. 2

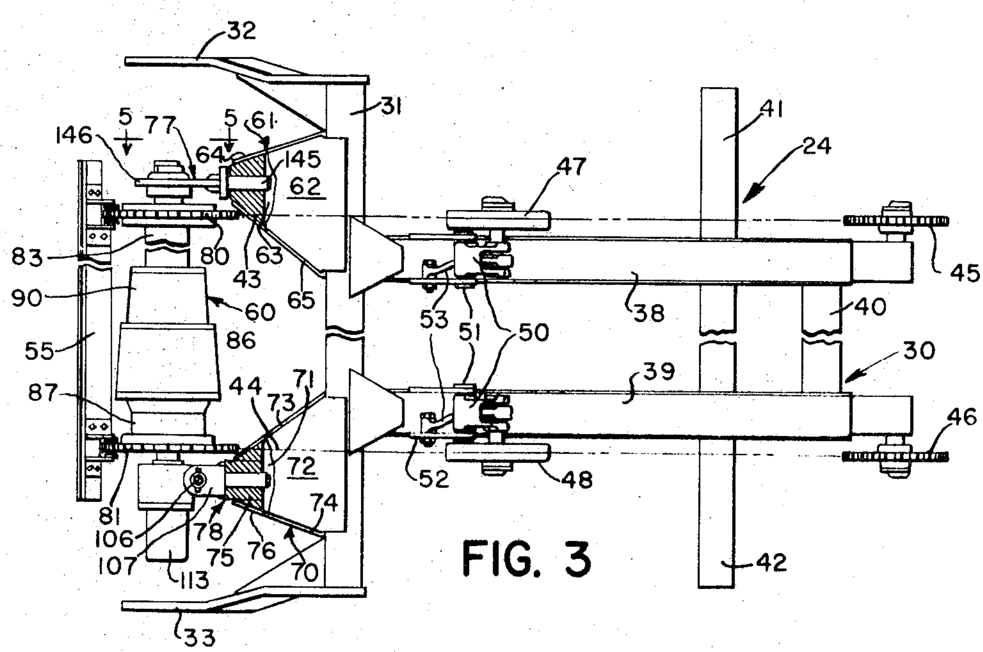


FIG. 3

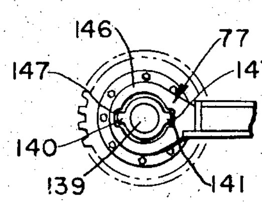


FIG. 5

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DRIVE STRUCTURE FOR FLIGHT-TYPE ELEVATOR

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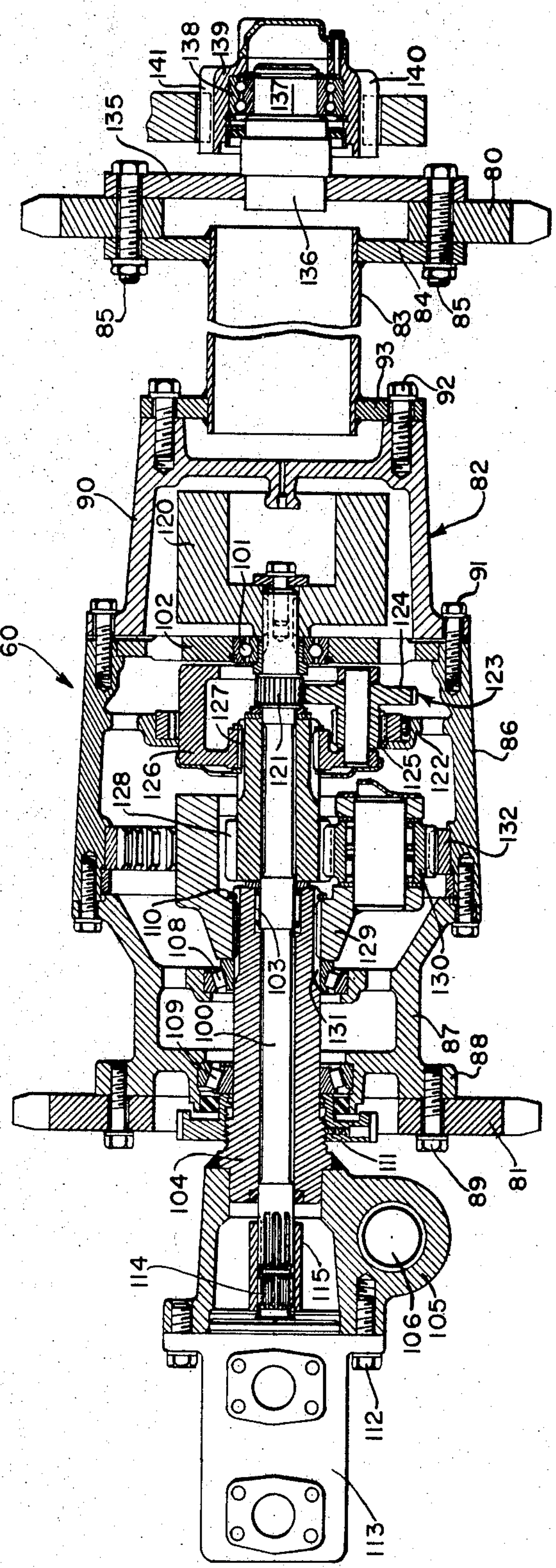


FIG. 4

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## 3,557,473
## DRIVE STRUCTURE FOR FLIGHT-TYPE ELEVATOR


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**Int. Cl. B60p** *1/36*
**U.S. Cl. 37—8** **13 Claims**



### ABSTRACT OF THE DISCLOSURE

Drive structure at the upper end of a flight-type elevator that includes transversely spaced sprockets rigidly interjoined by torsion-transmitting structure, a portion of which is a hollow casing. A hydraulic motor is supported outwardly of the end sprocket and has a drive shaft extending axially into the hollow portion. The torsion-transmitting structure is driven by a speed-reducing gear drive within the casing and extending between the drive shaft and the hollow casing portion.


### BACKGROUND OF THE INVENTION

This invention relates to the drive structure at the upper end of an elevator of the type mounted on the forward open end of a scraper bowl. Still more particularly the invention relates to a self-contained drive structure that includes a hollow torsion-transmitting means extending between transversely spaced drive sprockets and which has internal gear mechanism associated therewith for driving the torsion-transmitting structure.

It has heretofore been known to provide a flight-type elevator at the forward end of a scraper bowl and to drive the flights by means of hydraulic motor means that is drivingly connected to a drive shaft extending between a pair of transversely spaced drive sprockets at the upper end of an elevator. Such a drive is shown and described, for example, in U.S. Patent 3,143,814 which issued to F. M. Brinkmeyer et al. on Aug. 11, 1964. Also, it is known to provide a relatively high-speed rotary-type hydraulic motor for driving the upper drive shaft. However, in the latter drives there is required a speed-reducing drive that permits the elevator drive shaft to be driven at a relatively slow speed. The speed-reducing drive exists between the hydraulic motor and the drive shaft and is normally a gear drive contained in a suitable housing. The hydraulic motor and gear housing are supported on the elevator frame externally of one end of the drive shaft. A flywheel is also associated with the motor shaft and it also is supported at the end of the elevator drive shaft. Consequently there is considerable drive mechanism to one side of the elevator. This creates an unbalanced condition in the entire drive assembly. Since it is completely outwardly of the elevator, the structure or casings surrounding the various drive mechanism must be rather large and cumbersome. This gives a rather awkward appearance to the entire scraper. Also the additional weight on that side of the scraper makes a rather poor weight distribution for the entire elevator structure as well as the scraper itself.

### SUMMARY OF THE INVENTION

With the above in mind, it is the primary object of the present invention to provide a torsion-transmitting structure at the upper end of the elevator that includes a pair of end sprockets and rigid torsion-transmitting structure extending between the sprockets. The latter structures has an enlarged hollow section or casing disposed between the two sprockets. The hollow section has an outer periphery smaller than the sprockets so that the

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chain flights may pass around the enlarged portion. Contained within the enlarged portion is a speed-reducing gear drive and a flywheel, both of which are driven by a central drive shaft concentric to the casing. The drive shaft is drivingly connected to a motor supported just outwardly of one of the sprockets. The motor housing is carried on the elevator frame and is held against rotation. Consequently the entire structure and enlarged casing portion drive the sprockets.

It is also an object of the invention to provide in combination with the above a mounting for the upper drive structure that permits self-positioning of the sprockets and casing structure. This is done by providing articulate connections between opposite ends of the drive structure and the main frame which permits self-positioning of the drive structure. By such an arrangement there is alleviated the stresses that would occur if rigid connections were provided between the drive structure and frame. This is particularly important for the reason that the transverse torsion-transmitting structure that extends between the sprockets is in fact the main drive for the sprockets. Therefore, any prestressed condition in the structure plus the torsional forces that drive the structure, sprockets and elevator could cause premature or early failure.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side perspective view of a tractor and scraper utilizing the elevator structure which is the subject matter of the present invention.

FIG. 2 is a side view of the elevator structure.

FIG. 3 is a plan view of the elevator structure.

FIG. 4 is an enlarged sectional view taken substantially along the line 4—4 of FIG. 2.

FIG. 5 is a side view of a support between the drive sprocket structure and the main frame as taken substantially along the line 5—5 of FIG. 3.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

A tractor **10** has a pair of front steerable wheels **11**, **12** and a pair of rear traction wheels **13**, **14** carried on a transverse rear axle structure **15**. The tractor **10** includes an elongated tractor body **16** with a forwardly disposed engine or ain power source mounted under a hood **17**. To one side of the engine hood or housing **17** is an operator's station, indicated only partially by the steering wheel **18**. Supported by and formed above the tractor axle **15** is a structure defining a universal hitch **19** for connection to a trailing-type scraper implement indicated in its entirety by reference numeral **20**. The scraper is composed of a material container or bowl having upright sides **22** interconnected at their lower edges by a floor structure shown only partially in FIG. 1 at **23**. The bowl is open at its forward end and has an upwardly inclined elevator **24** extending across the open front of the bowl. As is conventional, there is a cutting edge along the front transverse edge of the bowl and the elevator operates in a manner so that the material passing over the edge is elevated or conveyed rearwardly into the rear setcion of the bowl. The scraper **20** is connected to the hitch device **19** so that the entire implement may move vertically as well as laterally. The hitch connection is in the form of a Y-shaped beam structure **25** having a gooseneck forward section **26** directly and articulately connected to the hitch **19** and a pair of leg portions, one being shown at **27**, extending rearwardly for connection to the upper edges of the sides **22**. The latter side beams and interconnected to the lower forward edges of the side walls **22** by means of hydraulic cylinders **28**, **29** which may be extended and retracted for purposes of raising and lowering the entire bowl.

The elevator **24** is composed of an elongated inclined main frame **30** including an upper horizontal transverse beam **31** and rigid and rearwardly projecting arms **32, 33** pivotally connected at **35** to upwardly projecting bracket lugs **37** on the upper edges of the sides **22** respectively. A pair of side beams **38, 39** extend downwardly to a lower elevator end.The side beams are connected at their lower ends to a lower transverse beam structure **40**. A pair of beams **41, 42** is rigid with and projects outwardly of the side beams **38, 39** adjacent their lower ends and contacts stops, not shown, on the sides **22** so as to limit downward movement of the frame **30**. As will be readily apparent from viewing FIG. 1, the entire elevator **24** has a floating relation to the bowl and will move both upwardly and longitudinally to accommodate the material passing into the bowl. The conveying mechanism on the elevator is composed of a pair of longitudinally extending continuous chains **43, 44** mounted over idler sprockets or chain guide means **45, 46** at the lower end of the elevator frame **30**. A second set of idler chain guides **47, 48** is provided on the respective side beams **38, 39**. The guides **47, 48** are carried on arms **50** pivotally connected at **51** on bracket structures **52**. The arms **50** are bifurcated at their connection to the respective guides **48** and receive links **53**. The bracket structures **52** are provided with a series of arcuately spaced openings **54** and the links **53** may be connected to any of the respective openings to thereby position the respective chain guides **47, 48** vertically. The chains **43, 44** are interconnected by rigid transverse flight elements **55**.

Supported on the upper end of the elevator frame **30** is a transversely extending sprocket drive structure, indicated in its entirety by the reference numeral **60**. The structure **60** is disposed above the transverse beam **31**. The beam **31** has at its left end and just inwardly of the arm **32** a rearwardly projecting channel structure **61** composed of upper and lower structural plates **62, 63** respectively that are triangular in shape and are interconnected by edge plates **64, 65**. The plates **64, 65** converge to an upper rear apex portion that has welded internally thereof a tubular socket **66** that opens upwardly and rearwardly toward the left outer end of the drive structure **60**.

The beam **31** has adjacent its right end and just inwardly of the arm **33** a rigid rearwardly projecting channel structure **70** composed of upper and lower plates **71, 72** respectively interconnected at their edges by structure plates **73, 74**. The plates **73, 74** converge rearwardly and all of the plates **71–74** have welded thereto a cast socket member **75** with an internally machine-finished pivot opening or socket **76**. The socket or pivot **76** extends upwardly and rearwardly and opens upwardly and rearwardly to the right outer end of the drive structure **60**. The left end socket member **66** swivelly carries therein a support **77** for the left end of the structure **60**. The right end pivot structure **75** carries therein a support **78** for supporting the right end of the drive structure **60**.

Referring now to FIG. 4, the drive structure **60** is composed of a pair of transversely spaced drive sprockets **80, 81** that receive the upper ends of the chains **43, 44** respectively. The sprockets **80, 81** are rigidly interjoined by a torque-transmitting structure **82**. The latter structure includes a transverse horizontal tubular section **83** that has an end adjacent the sprocket **80** and has fixed to that end a radial flange **84** lying inwardly of the sprocket **80** and bolted thereto at **85**. The structure **82** further includes an enlarged portion or casing **86** that is round in cross section and is formed about the axis of rotation of the two sprockets **80, 81**, it being understood that the sprockets **80, 81** are adapted to move about a common axis. The casing **86** has a right end extension **87** with a right end radial flange **88** lying inwardly of the right-hand sprocket **81** and bolted thereto



at **89**. A flywheel casing **90** is bolted at **91** to the left end of the enlarged portion or casing **86**. The flywheel casing **90** is bolted at **92** to a radial plate **93** that is welded to and extends outwardly from the right end of the structural tube **83**. A web **94** closes the left end of the flywheel casing **90**.

Extending axially in respect to the axis of rotation of the sprockets **80, 81** is drive shaft means in the form of an elongated axially extending shaft **100**. The shaft extends axially through the casings **86, 87** and into the flywheel casing **90**. The shaft **100** is journaled on its innermost end by a bearing **101** carried on a support **102** that is fixed to the casing **86**. The outer end of the shaft **100** is carried on bearings **103** which in turn are carried on an axially extending structure support member **104** that projects from an axial inner end inwardly of the casing **86** to an outer end outwardly of the sprocket **81**. The support **104** has a lug portion **105** thereon that is pinned at **106** to a bifurcated end **107** of the support **78** that connects that end of the drive structure to the transverse beam **31**. Journal means in the form of thrust bearings **108, 109** are carried internally of the casing extension **87** and permit rotation of the entire torque-transmitting structure **82** in respect to the supports **104, 78**. It should here be recognized that the supports **104, 78** are held against rotation by the pin **106**. A snap ring **110** is provided on the inner end of the support **104** and a nut **111** is threadedly mounted on the support **104** externally of the bearings **108, 109**. By tightening the nut **111** the bearings **108, 109** may be adjusted.

Fixed to the support **104** by bolts **112** is a main power source in the form of a hydraulic motor **113**. The motor **113** may be of any of many commercially sold. It has a drive shaft **114** extending in an axial alignment with the shaft **100**. The shafts **100, 114** are coupled by a coupling ring **115**. The hydraulic motor is controlled by suitable control means adjacent the operator's station on the tractor **10** and fluid is introduced into the motor by flexible hoses **116** so that the motor and drive shaft may be driven in either direction.

A flywheel **120** is supported to rotate with the inner end of the shaft **100**. Adjacent that end of the shaft **100** and fixed thereto is a sun gear **121**. The sun gear **121** is the initial drive connection to the entire speed-reducing drive means that is disposed in the casing **86**. The speed-reducing drive means includes a pair of axially spaced planetary gear drives with the first gear drive including the sun gear **121** fixed to rotate with the shaft means **100**, a ring gear **122** mounted on the casing **86**, and planet gears **123** that have one gear section **124** engaging the sun gear **121** and a second gear section **125** engaging the ring gear **122**. The ring gear **122** operates as a restriction against movement of the planet gear **123**. A carrier **126** for the planet gears **123** is fixed at **127** to the sun gear **128** of the second planetary gear arrangement. A carrier **129** for planet gears **130** of the second planetary gear arrangement is held against movement by a splined joint **131** with the support **104**. The ring gear **132** of the second planetry gear drive is fixed to the casing **86** and will cause rotation of that casing **86** upon rotation of the basic drive shaft **100**. Rotation of the casing **86** will, of course, cause the ring gear **122** to rotate. However, the direction of rotation is such that it will cause the carrier **126** to reduce the rate of rotation of the sun gear **128**. Consequently the two planetary gear arrangements will cause the entire casing **86**, the torsion-transmitting structure **82**, and the sprockets **80, 81** to rotate in unison.

Reviewing FIG. 4 in its entirety, it should be noted that there are many joints between the casings **83, 86, 87** and between the flanges **84, 80** and **88, 81** that may create misalignment of the bearings at the end of the drive sprocket structure. The bearing arrangement on the right-hand end has been previously described. On the left-hand end there is provided a rigid plate **135** that is bolted by bolts **85** to the outer surface of the sprocket **80**. Extending outwardly from the plate **135** is a bearing shaft **136** serving as a structure support at that end of the structure **60** having a reduced end **137** receiving a bearing **138** carried in a bearing housing **139**. The housing **139** has a pair of axially extending lugs **140, 141** projecting outwardly from its surface. The support **77** is provided with a pin end **145** that is received in the socket **66** and a ring end **146** that is loosely received around the housing **139**. The ring **146** has internal notches **147** therein that receive the lugs **140, 141**. The notches do not tightly grip the lugs and there is considerable free play between the housing **139** and the ring portion **146**. The ring portion **146** will therefore not retain the bearing housing **139** in a rigid or fixed position in respect to the frame **30**.

As mentioned previously, due to the various joints in the torsion-transmitting structure **82**, the bearings **138**, **103**, **101** could be slightly out of axial alignment. They could be slightly eccentric to one another. Should the entire torque-transmitting structure **82** be slightly out of axial alignment, unless the entire structure **60** is supported in a free or floating manner, there would be considerable stresses applied in the structure **82**. It is for this reason that the right-hand end of the structure is supported on pivot means that includes the pivot pin **106** and the pin portion **148** of the yoke **107** that fits into the socket **76**. Reviewing FIG. 3, it becomes apparent that the entire structure **60** may swivel longitudinally of the frame **30** by slight movement about the pin **106**. Similarly the structure **60** may swivel normal to the frame **30** by shifting about the socket joint **76, 148**. By having the support **77** loosely support the bearing housing **139**, any misalignment of the axial structure **60** will be compensated for by the articulate connections in the supports at opposite ends of the structure **60**. Thus, there will be no stress in the various parts of the torsion-transmitting structure **60** other than those created by the torque load created by the motor **113**. It should also be noted that the support adjacent the motor **113**, while articulate in nature, is nevertheless constructed of pivots that have close tolerances. Therefore, there will not be a jerky motion due to starting, stopping or reversing the direction of rotation of the motor. In other words, the end of the structure that supports the motor is firmly mounted on the frame **30**. Thus, the entire torque-transmitting structure **60** is free to self-position itself for any reason there is misalignment between one end and the other end of the structure.

We claim:

**1.** A drive structure for a flight-type elevator having a plurality of continuous chains interjoined by flight elements comprising: a plurality of drive sprockets for driving the chains spaced apart axially along a common axis of rotation; axially extending structure rigidly joining the sprockets and including an axially extending casing positioned between the sprockets with an opening at one end adjacent one of the sprockets; a power source outwardly of the one sprocket; a part adapted to be held against rotation extending axially through the one sprocket for penetration into the open end of the casing; external journal means between the part and the casing; a drive shaft partially retained in the casing and journaled internally of and on the part and projecting axially out of the respective sprocket and drivingly connected to the power source; and a speed-reducing drive between the shaft and casing for effecting rotation of the sprockets in response to rotation of the shaft means.

**2.** The structure as set forth in claim **1** in which the opening the casing is along the axis of rotation and the shaft extends axially along the axis of rotation.

**3.** The structure as set forth in claim **1** in which the chains move around the sprockets and the casing has its outer surface internally of the flights on the chains as they move with the chains around the sprockets.

**4.** The structure as set forth in claim **1** further characterized by a flywheel being supported on and to rotate with the shaft internally of the casing.

**5.** The structure as set forth in claim **1** in which the shaft extends axially in respect to the axis of rotation, casing journal means is at the opposite end of the casing from said opening, the speed-reducing means is positioned internally of the casing adjacent said opening, and further characterized by a flywheel mounted on the shaft adjacent the opposite end.

**6.** The structure as set forth in claim **1** in which the shaft is axially extending with respect to the axis of rotation, the power source is a rotary-type hydraulic motor having an output shaft axially coextensive with and connected to the shaft.

**7.** The structure as set forth in claim **1** in which the speed-reducing drive is a pair of planetary gear drives axially spaced along the shaft means and in which the first planetary gear drive has its sun gear fixed to rotate with the shaft, its ring gear fixed to the casing and effecting rotation of its planet gear around the sun gear, and the planet gear is connected to and drives the sun gear of the second planetary gear drive, and the second planetary gear drive has its planet gears fixed to the aforesaid part and against rotation with respect to its sun gear and its ring gear is fixed to the casing to effect rotation thereof.

**8.** A drive mechanism for a flight-type elevator having a pair of spaced apart continuous chains interjoined by flight elements comprising: an elongated rigid structure extending between the chains and having opposite ends adjacent the respective chains, the structure further having an elongated casing portion formed about an axis extending lengthwise of the structure and having an opening that opens to one end of the structure; a pair of drive sprockets fixed to the structure at the ends thereof such that the casing portion is between the sprockets and the sprockets are rotatable about a common axis; a pair of structure supports extending axially outwardly of the sprockets for supporting opposite ends of the structure; a motor drive means mounted on one of the supports effecting rotation of a drive shaft aligned and internally journaled with respect to its respective support and penetrating into the casing via the opening; and a drive within the casing extending between the shaft and casing for effecting rotation of said structure in response to rotation of the shaft.

**9.** The structure as set forth in claim **8** in which the support on which the motor drive means is mounted is fixed against rotation, and the structure at its end adjacent the latter support is supported for rotation on the support about the axis of rotation.

**10.** The structure as set forth in claim **8** in which the opening in the casing is an axial opening, the shaft extends axially along the axis of rotation, and said motor effects rotation of the shaft means by a motor shaft axially aligned with and coupled to the shaft.

**11.** The structure as set forth in claim **8** in which the elevator has a main frame and the supports are articulately mounted on the frame to automatically accommodate minor shifting and movement of the structure.

**12.** A drive structure for a flight-type elevator having a plurality of continuous chains interjoined by flight elements comprising: a plurality of sprockets for receiving the chains spaced axially along a common axis of rotation; an axially extending rigid structure extending between and rigid with the sprockets for rotation therewith, said structure having a hollow axially extending gear casing between the sprockets with an axial opening at one end; a drive source offset outwardly of one of the sprockets; a part adapted to be held against rotation extending axially through the one sprocket for penetration into the open end of the casing; external journal means between the part and the casing; a drive shaft partially retained in the casing and journaled internally of and on the part and projecting axially out of the respective sprocket and drivingly connected to the power source; and gear means on the shaft within the casing adapted to rotatably drive the sprockets in response to rotation of the shaft.

**13.** In an elevator for use with an earth scraper having a material bowl with opposite fore-and-aft extending side walls and a forward horizontally disposed cutting blade and in which the elevator includes an inclined main frame extending from a lower end adjacent the blade to an upper rear end and further having opposite fore-and-aft extending sides, transversely spaced rotary chain carriers supported on the lower end of the frame, and a flight-type conveyor including a plurality of transversely spaced chains interjoined by transverse flight elements and extending between the upper and lower ends of the frame, the improvement residing in drive means for the elevator comprising a rigid transverse structure having transversely spaced drive sprockets rigid therewith and supported on the upper end of the frame, the structure further having a hollow axially extending casing disposed between the sprockets; an axially extending drive shaft means extending from internally of the casing through and beyond the outer side of one of the sprockets; a power-transmitting device with rotary output means drivingly connected to the drive shaft means; a drive structure internally of the casing between the casing and drive shaft means for rotating the casing and sprockets in response to rotation of the shaft means; supports adjacent the respective sprockets and between the frame and said tranverse structure for journaling the rigid transverse structure for rotation, with one of said supports nonrotatable carrying the power-transmitting device externally of said casing; and means articulately mounting the supports on the frame to automatically accommodate minor shifting and movement of the structure with respect to the frame.


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U.S. Cl. X. R.

74—802; 198—203

# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,557,473 Dated 26 January 1971

Inventor(s) Ronald P. Grossklaus and John L. Clingerman

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

Column 5, line 67, after "opening" insert -- in --.

Column 6, line 52, cancel "means".

Signed and sealed this 18th day of May 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, J
Commissioner of Patent

FORM PO-1050 (10-69)