United States Patent

Okano et al.

[15] **3,656,609**

[45] **Apr. 18, 1972**

[54] RECIPROCATING CONVEYING APPARATUS

[72] Inventors: **Hideo Okano**, 12-10 Sanuke, 2-Chome, Kamakura-shi, Kanagawa-ken; **Zenjiro Suzuki**, 10-8 Sodegahama, Hiratsuka-shi, Kanagawa-ken, both of Japan

[22] Filed: **Apr. 20, 1970**

[21] Appl. No.: **30,166**

[30] **Foreign Application Priority Data**

Apr. 24, 1969 Japan 44/31394

[52] **U.S. Cl.** **198/224**

[51] **Int. Cl.** **B65g 25/08**

[58] **Field of Search** 198/224, 221, 171

[56] **References Cited**

UNITED STATES PATENTS

2,667,264	1/1959	Holloway	198/224
2,794,561	6/1957	Brahmsiepe	198/224 X
3,175,677	3/1965	Peras	198/224

FOREIGN PATENTS OR APPLICATIONS

1,196,198	11/1959	France	198/171

Primary Examiner—Richard E. Aegerter
Assistant Examiner—Douglas D. Watts
Attorney—Watson, Cole, Grindle & Watson

[57] **ABSTRACT**

The conveying apparatus has a plurality of reciprocating, rotatable scraper elements for successively pushing particles on a stationary support frame. Forward movement of a reciprocating driving element rotates the plurality of scraper elements into an operating position and carries them in a forward direction along the conveyor. Change of direction in the movement of the driving element rotates the scraper elements into a non-operative position and further rearward movement of the driving element carries the plurality of scraper elements to their original position whereupon the aforementioned cycle is repeated to move the particles along the conveyor.

6 Claims, 8 Drawing Figures

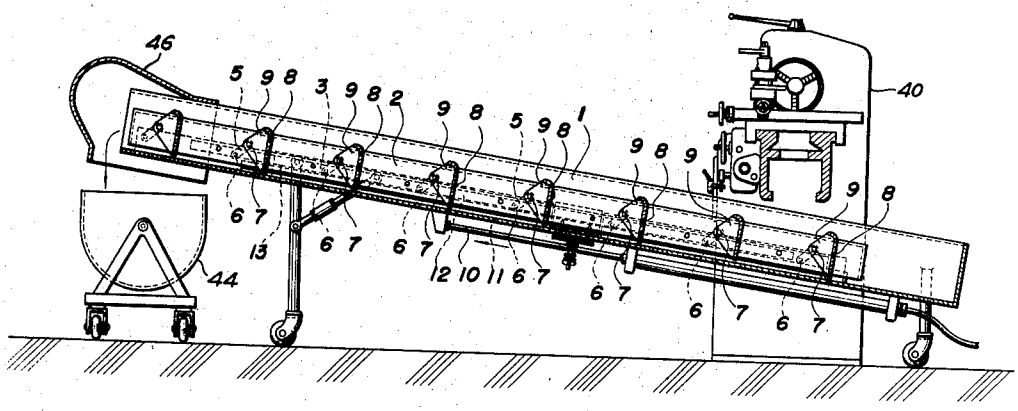


Fig. 1

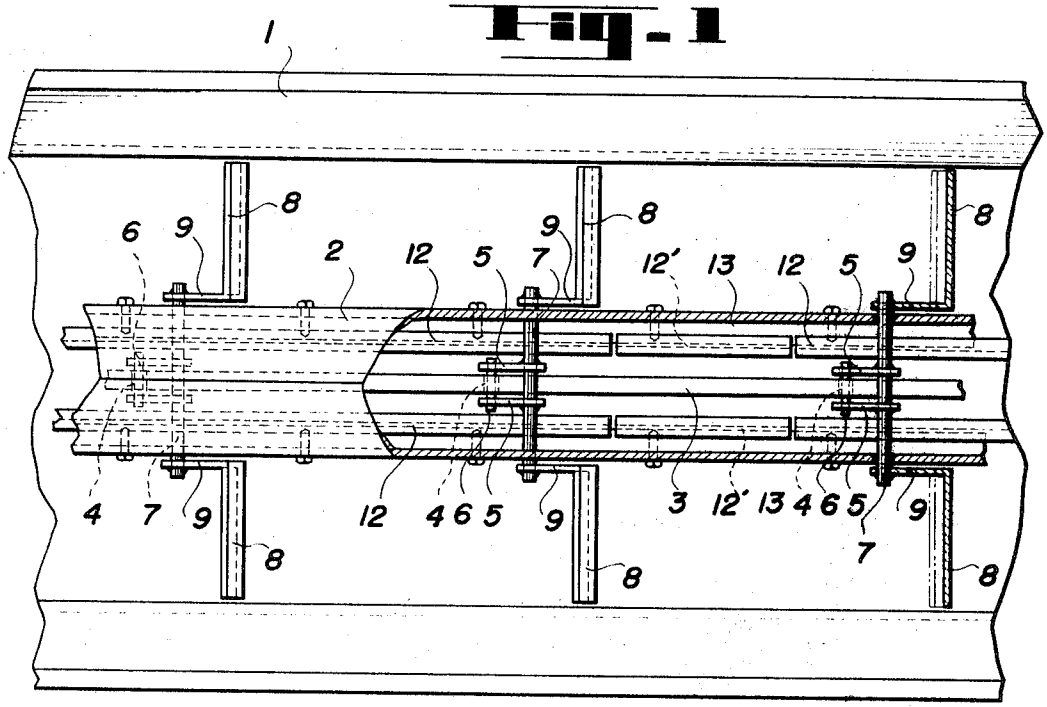
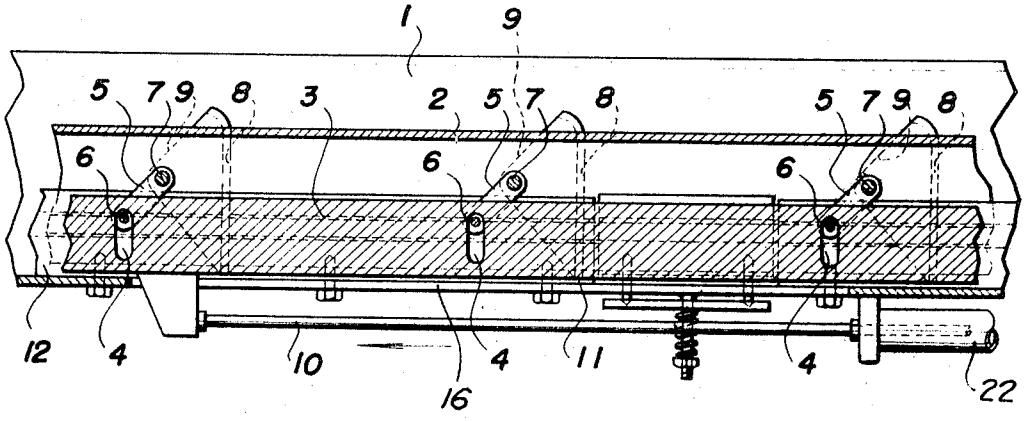


Fig. 2



INVENTOR

Kideo Okano
Zenjiro Segawaki

BY

Watson, Cole, Grindle & Watson

ATTORNEY

Fig. 3

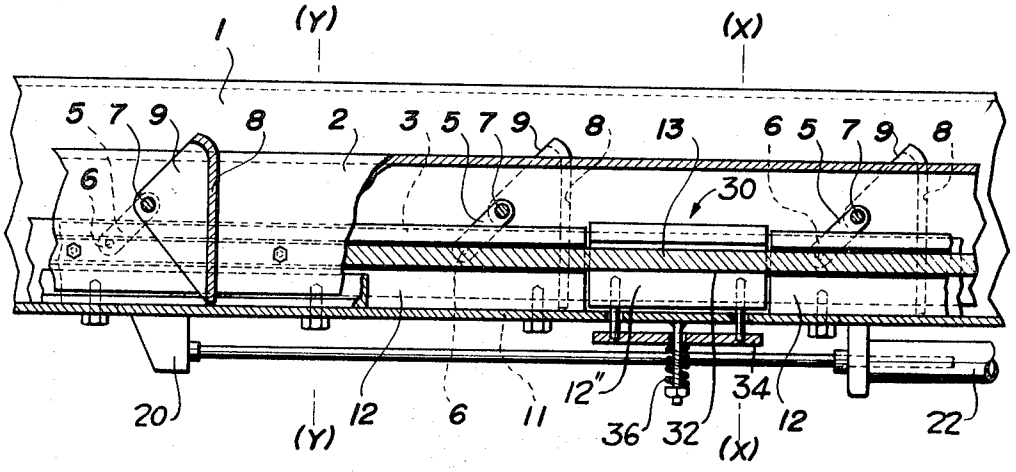
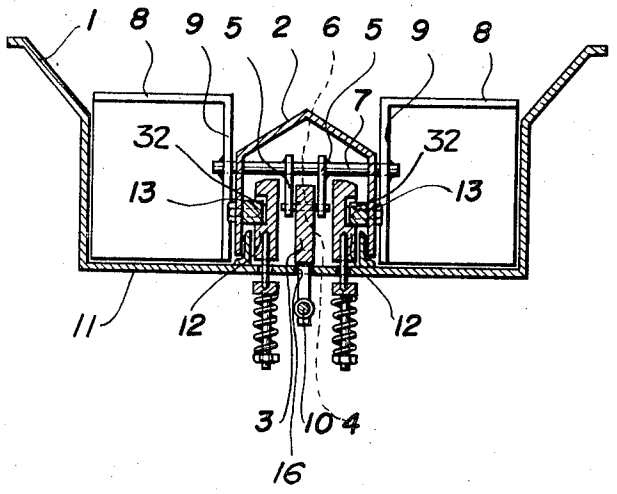


Fig. 4



INVENTOR

Kudo Okano
Zenjiro Suzuki

BY
Watson, Cole, Grindle & Watson
ATTORNEY

Fig. 5

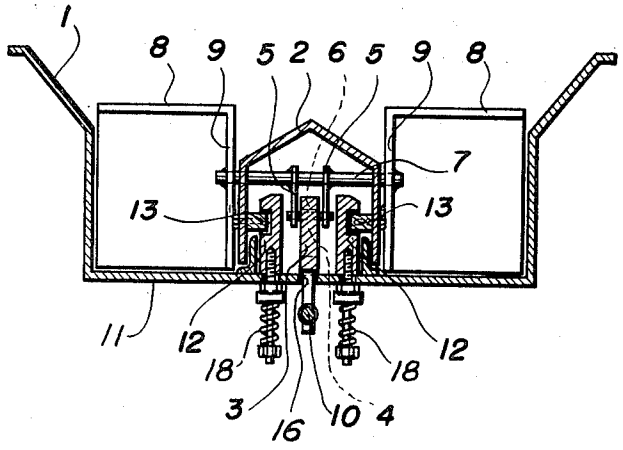
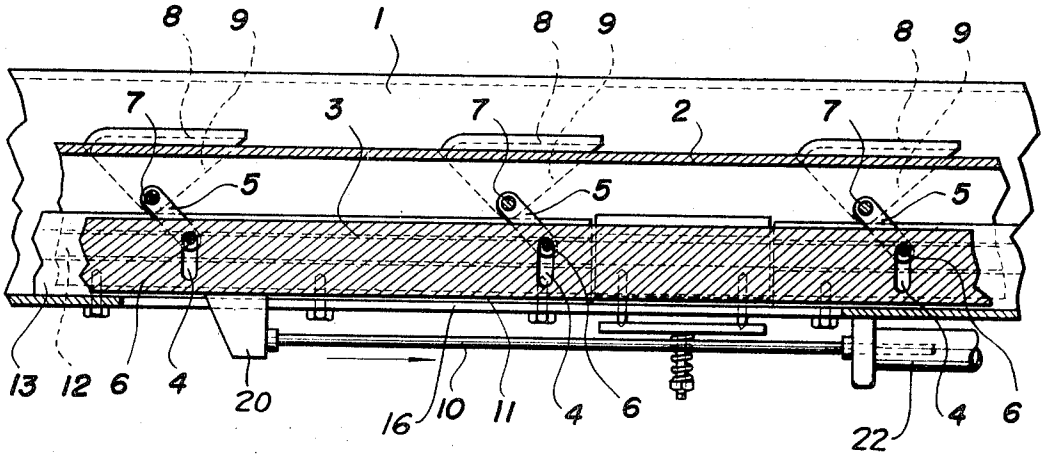


Fig. 6



INVENTOR

Hideo Okano
Zenjiro Suzuki

BY
Watson, Cole, Grindle & Watson
ATTORNEY

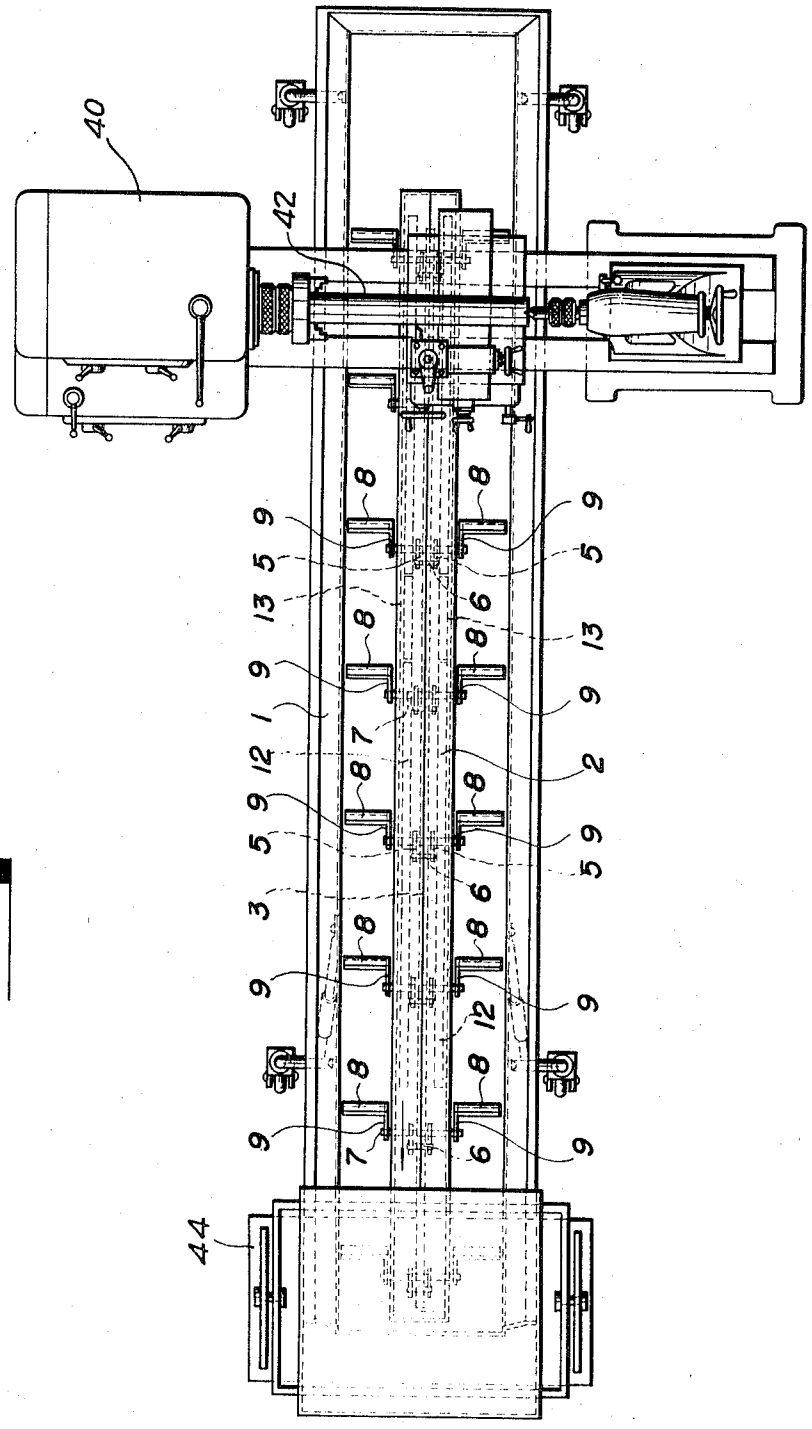


FIG. 7

Inventors
Hideo Okano
Zenjiro Suzuki
By
Watson, Cole, Grindle & Watson
Attorneys

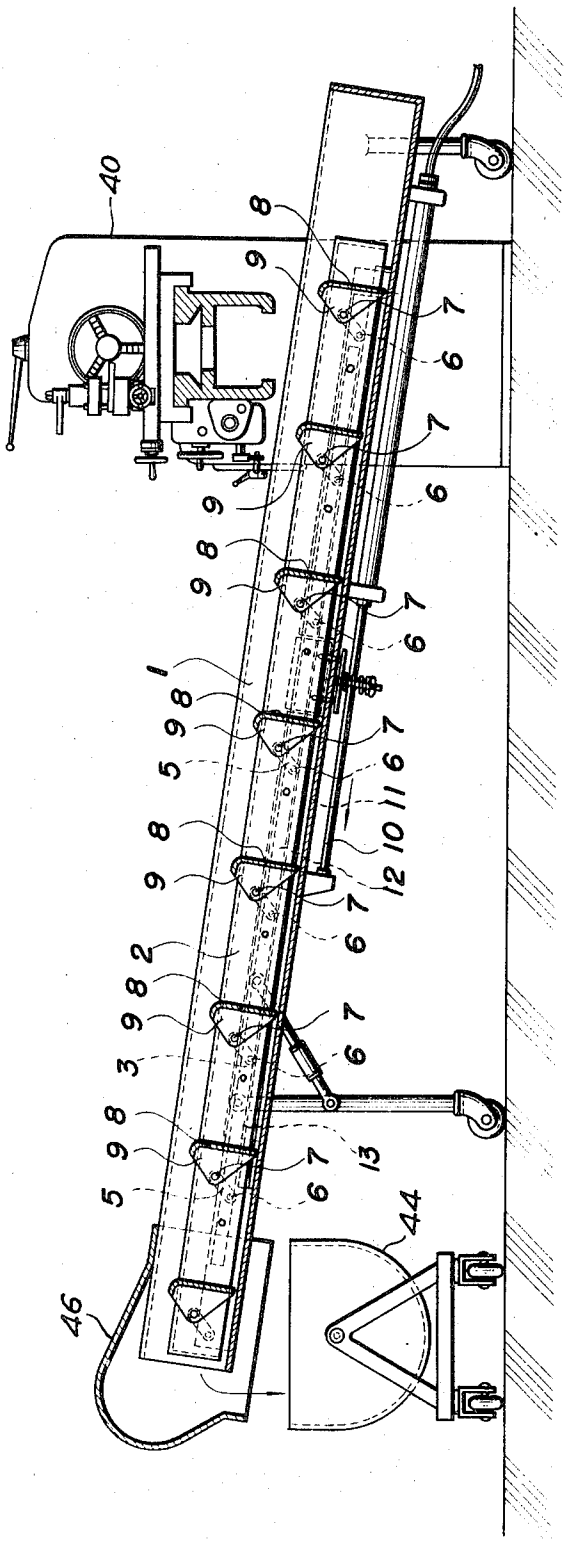


Fig. 8

Inventors
Kuniaki Okano
Shinjiro Suzuki
By Watson, Cole, Grindle & Watson
Attorneys

RECIPROCATING CONVEYING APPARATUS

This invention relates to conveying apparatus and, in particular, to such apparatus which combines a reciprocating member of an in-line arrangement of a plurality of scraper elements with as associated rotation of the scraper elements into operative and inoperative positions to push particulate material on a stationary conveyor housing to a collecting station.

A primary feature on the invention resides in the structure whereby the aforementioned dual operation of the scraper elements is effected. The means connecting the scraper elements to the reciprocating driving element cause the scraping elements to be rotated to an operative position from an inoperative position at the beginning of the forward movement of the driving element and to be carried forward with the driving element after the aforementioned re-positioning of the scraper elements. In the operative position, the scraper elements push the particulate material along the stationary bottom of the conveyor a distance determined by the forward stroke of the driving element. At the end of the forward movement of the driving element, and during an initial portion of its rearward movement, the connecting means cause the scraper elements to be rotated into an inoperative position and to be carried backwardly, by rearward movement of the driving element, to their initial position. In their inoperative position the scraper elements do not contact the particulate material.

Repetition of the aforementioned cyclic operation pushes or pulls the particulate material within the conveyor frame housing along the conveyor by successive in-line scraper elements to a collecting station at the end of the conveyor.

It is a primary object of the invention to provide an improved conveyor apparatus having reciprocating scraper elements.

It is a further object of the invention to provide an improved conveyor apparatus of the type specified which is inexpensive and less complex than known prior art apparatus.

The conveyor apparatus of this invention will be understood by those having ordinary skill and knowledge of conveying apparatus by the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a plan view of a section of the conveyor apparatus which shows the successive in-line arrangement of the scraper elements in their operative position;

FIG. 2 is a side elevational view of the section illustrated in FIG. 1 wherein the driving element is at its forwardmost position;

FIG. 3 is another side elevational view of the apparatus illustrated in FIG. 1 which shows the conveyor guide mechanism and the mounting of a friction reducer to the conveyor apparatus;

FIG. 4 is a section taken along lines X—X in FIG. 3;

FIG. 5 is another sectional view taken along lines Y—Y in FIG. 3;

FIG. 6 is a side elevation of the apparatus similar to that shown in FIG. 2 wherein the drive element has completed an initial portion of its rearward motion and showing the inoperative position of the scraper elements during the rearward motion of the driving element;

FIG. 7 is a plan view illustrating a typical application of the conveyor apparatus of the invention wherein chips are conveyed from a working station to a collecting station; and

FIG. 8 is an elevation view of the system illustrated in FIG. 7.

DETAILED DESCRIPTION

Conveyor frame 1 is formed with the cross-sectional shape illustrated in FIG. 4; and the cross-sectional shape is not critical and other forms may be used. However, for reasons which will become apparent hereinafter, a simple cross-sectional shape is preferred since the shape of the scraper elements should conform to that of the internal surfaces of the conveyor frame. Bottom surface 11 of the conveyor frame has an elongated aperture 16 (as shown in FIGS. 2 and 4) which guides

drive plate 3. Spaced guide members 12 are suitably secured to conveyor frame 2, as shown in FIG. 3, and extend substantially along the length of the conveyor frame. Spaced guide members 12 each have guide channels 12' which slidably support strips 13 to which is mounted conveyor housing 2. Conveyor housing 2 forms an enclosure so that particles will be deflected by its sloping top surfaces and be deposited along bottom surface 11 in a position to be moved along the conveyor by elements to be more fully described below.

With particular reference to FIGS. 1, 2 and 4, the conveyor apparatus has a plurality of scraper elements 8 mounted in spaced in-line relationship along each side of conveyor housing 2 by mounting brackets 9 which are, in turn, fixed to rotatable shafts 7 supported by conveyor housing 2. The number of scraper elements and their respective in-line spacing is determined by the length of the conveyor and the distance each scraper is moved by structure to be described more completely below. A pair of spaced link arms 5 are rigidly fixed to rotatable shaft 33 (as illustrated in FIGS. 1 and 4) and are connected to drive plate 3 by means of pin 6 which passes through elongated opening 4 in the driving plate.

As best illustrated in FIG. 2, aperture 4 is elongated thereby allowing vertical movement of pin 6 and limited horizontal movement therein.

With reference to FIG. 2, the driving element 3 is driven by rod 10, which is connected at one end to the driving element by means of bracket 20, and which is attached at its other end to a hydraulic, pneumatic or other motive source, generally represented by numeral 22. Motive source 22 causes a cyclic, reciprocating movement of rod 10 which thereby reciprocates driving element 3 in guide aperture 16. During forward (leftward movement in FIG. 2) of driving element 3, scraper elements 8 are in a vertical position and are carried forwardly by engagement of pin 6 with the side surface of aperture 4. Rod 10 is in its forwardmost position as illustrated in FIG. 2 and all of the scraper elements have completed their forward motion.

With reference to FIG. 6, rearward movement of rod 10 (to the right in FIG. 6) causes pin 6 to move from a position forward of shaft 7 to a position behind shaft 7, thereby causing shaft 7 to rotate in a counterclockwise direction which, in turn, causes scraper elements 6, attached to the shaft, to rotate approximately 90°in a counterclockwise direction and assume the position illustrated in FIG. 6. Continuing rearward movement of rod 10 and driving element 3 carries the plurality of scraper elements 8 backward (to the right in FIG. 6) where they eventually come to rest at a position from which the aforementioned operation was initiated.

Subsequent forward movement of driving element 3 causes pin 6 to move from a rearward position to a forward position with respect to shaft 7, thereby causing shaft 7 to rotate in a clockwise direction and bringing scraper elements 8 into a vertical position whereby continuing forward movement of driving element 3 pushes or pulls particles from an area swept by the forward movement of a trailing scraper element into an area swept by the scraper element immediately preceding that scraper element. Successive repetition of the aforementioned cyclic, reciprocating movement of driving element 3 and the associated rotation and movement of scraper elements 8, causes particles on bottom surface 11 to be successively moved forwardly (to the left as illustrated in FIG. 6) within conveyor frame 10.

As illustrated in FIGS. 3 and 4, friction reducing assembly 30 raises strip 13 so that it rides only on the grooved surface 32 of section 12'' of guidemember 12. Section 12'' is supported by spring-loaded bracket 34 in such a manner that strip 13 does not abut against the upper and lower surfaces of groove 12'. This is accomplished by making the force exerted by spring 36 substantially equal to the counterforce produced by the weight of strip 13. The frictional drag of strip 13 is therefore considerably reduced as such sliding friction forces are proportional to the length of contact between the two sliding surfaces. A similar support is provided for the corresponding members on the other side of the conveyor apparatus.

A typical installation using the aforedescribed conveyor apparatus is illustrated in FIGS. 7 and 8. Corresponding elements have been given the same numeral designation as in the aforedescribed Figures. Work station 40 may comprise a lathe and the chips resulting from its operation on a workpiece 42 are conveyed by the conveyor apparatus to a collecting station 44 which may be a wheeled hopper. The conveyor apparatus may include a hood 46 mounted at the hopper end to direct particles to hopper 44 from the conveyor. As illustrated in FIG. 8, the conveyor may be used to move materials from work station 40 which may be at a lower elevation than hopper 44. It is apparent that the conveyor will operate in a strictly or generally horizontal position as well as one in which the particle receiving end is higher or lower than the particle depositing end.

What is claimed is:

1. Apparatus for conveying particulate material from a receiving station to a depositing station, comprising;

a frame for retaining said particulate material,

means mounted to said frame for reciprocating along the longitudinal axis of said frame,

a number of elements mounted within said frame to reciprocate with said reciprocating means for successively moving the material along said longitudinal axis, each of said elements is in a first position to contact said material during forward movement of said reciprocating means and in a second position out of contact with said material during backward movement of said reciprocating means,

means for driving said means for reciprocating,

a housing dividing said frame along its longitudinal axis for distributing said material to said elements,

means for connecting said reciprocating means to said housing and to each of said elements, said connecting means reciprocating along said longitudinal axis with said reciprocating means and moving said elements out of contact with said material as said reciprocating means changes from a forward to a rearward movement and moving said elements in contact with said material as said reciprocating means changes from a rearward to a forward movement,

said reciprocating means includes elongated apertures, said housing includes shafts rotatably mounted within said housing transversely to said longitudinal axis, and said means for connecting each of said elements to said means for reciprocating includes means slidable within a respective elongated aperture and fixed to a respective one of said shafts whereby said slidable means moves in said elongated aperture only during the change of direction of said reciprocating means to rotate said shaft to cause said movements of said scraper elements.

2. Apparatus as in claim 1 wherein each of said shafts protrude on either side of said housing and a scraper element is mounted to each end of each of said shafts.

3. Apparatus as in claim 2, wherein each of said elements has a shape substantially conforming to the inner surface of said frame to provide a narrow clearance between its surfaces adjacent said frame.

4. Apparatus as in claim 1 further comprising a pair of transversely spaced guide members extending along said longitudinal axis and each guide member having a longitudinally extending groove, and members fixed to said housing and movable within each of said grooves.

5. Apparatus as in claim 4, further comprising means for reducing the friction between each of said longitudinally extending grooves and said members fixed to said housing.

6. Apparatus as in claim 5, wherein said friction reducing means includes a pair of additional guide members each having an additional groove and each additional groove is positioned substantially in line with a respective groove of said guide members, and means for mounting each of said additional guide members so that said members fixed to said housing slide only along a surface of said additional groove, and the length of each of said additional grooves is substantially less than the length of each of said grooves.

* * * * *