

Feb. 25, 1930.

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1,748,301

CONVEYER SYSTEM FOR MINES AND OTHER PURPOSES

Filed Oct. 10, 1924

6 Sheets-Sheet 1

Fig. 1.

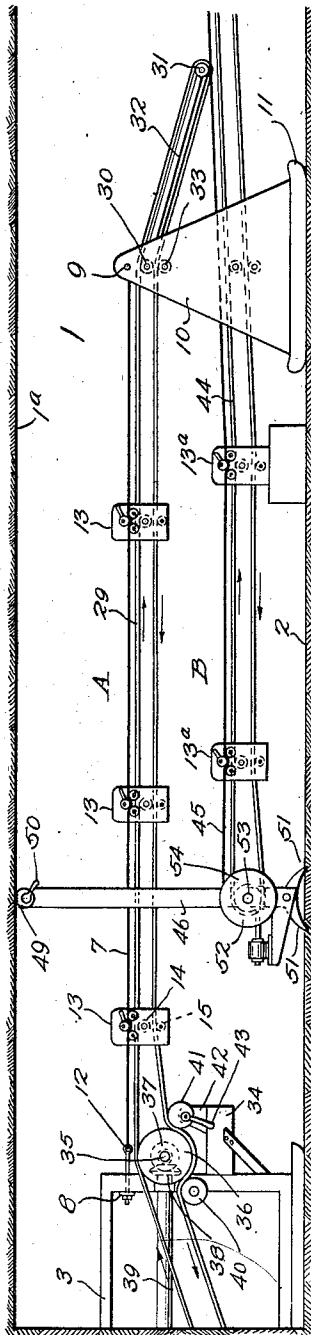


Fig. 26.

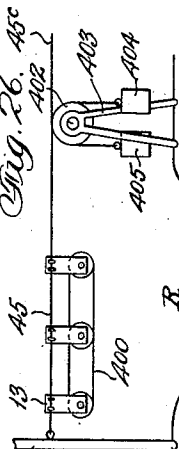


Fig. 10.

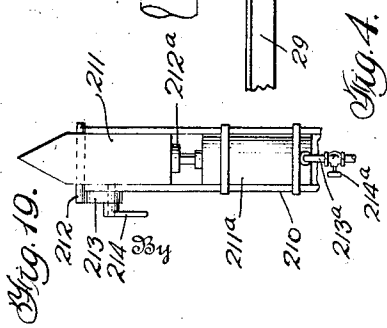


Fig. 4.

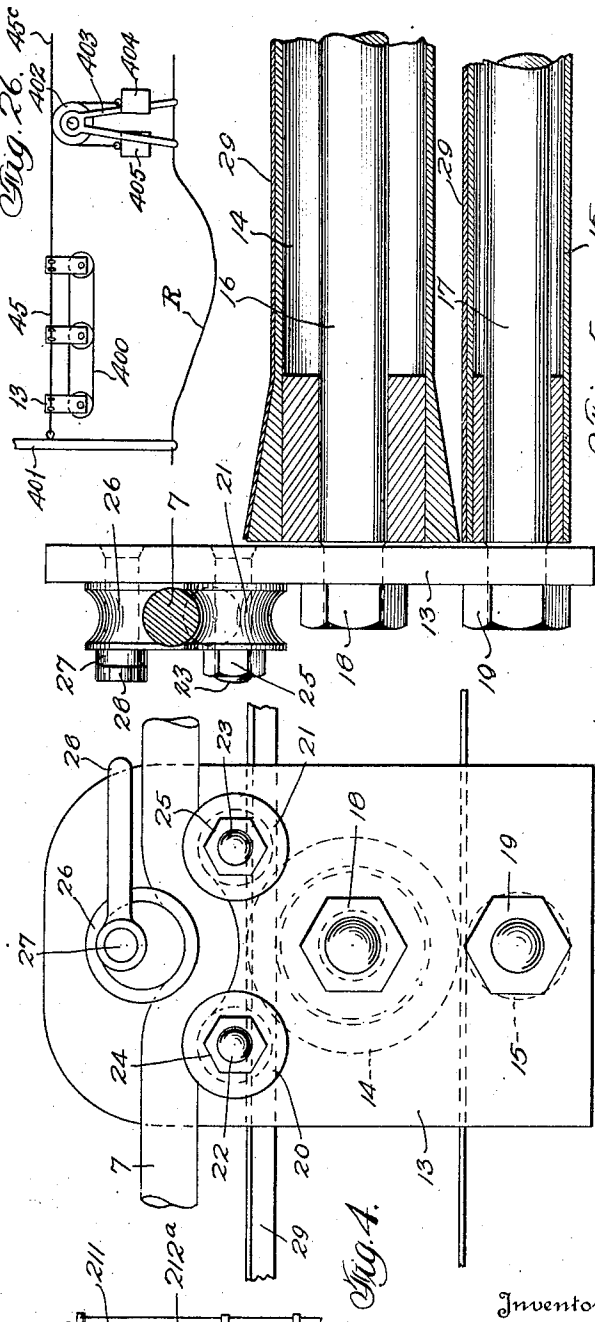


Fig. 5.

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6 Sheets-Sheet 2

Fig. 1.

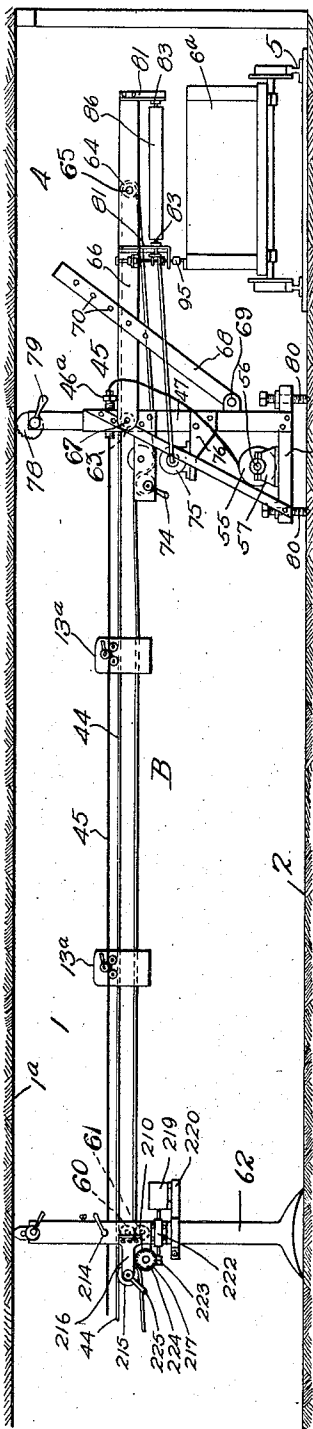


Fig. 2.

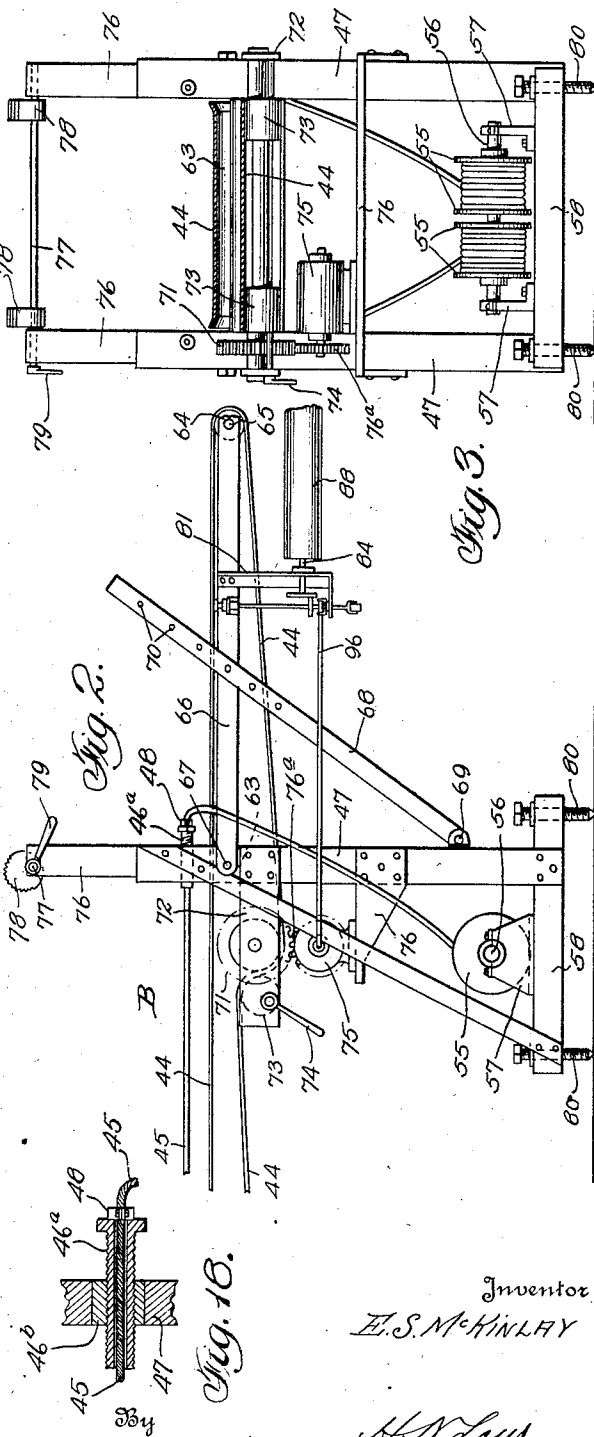


Fig. 1B.

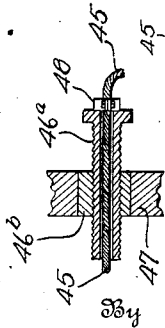
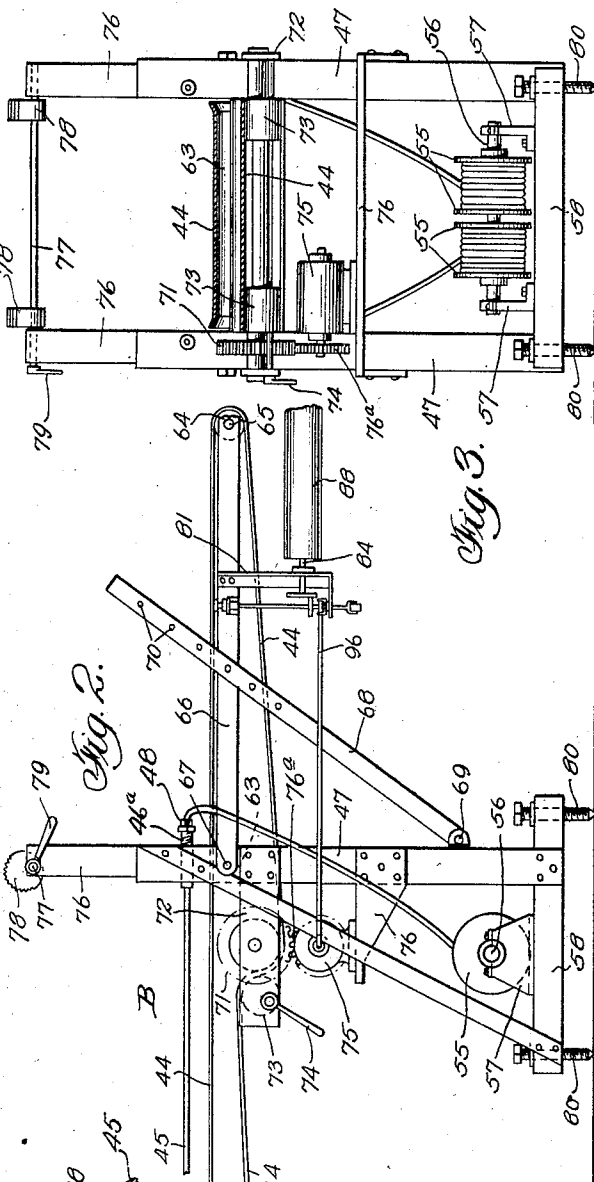


Fig. 3.



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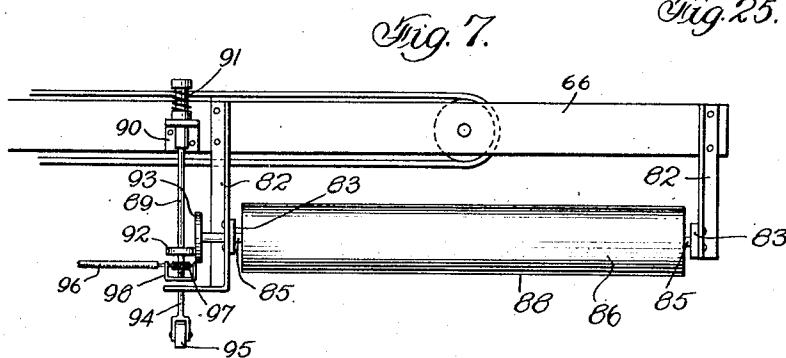
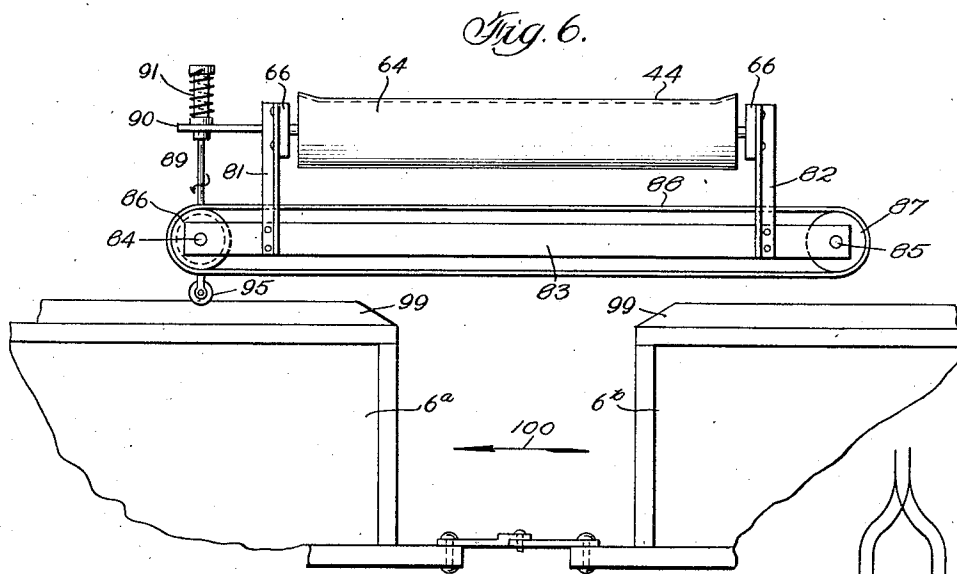


Fig. 25.

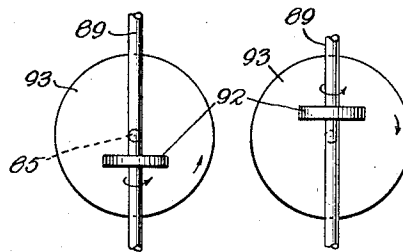
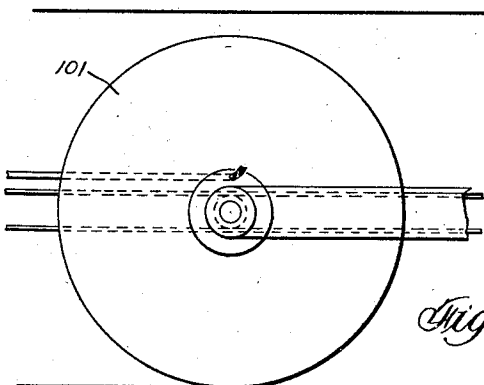
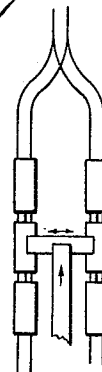


Fig. 8

Fig. 9.

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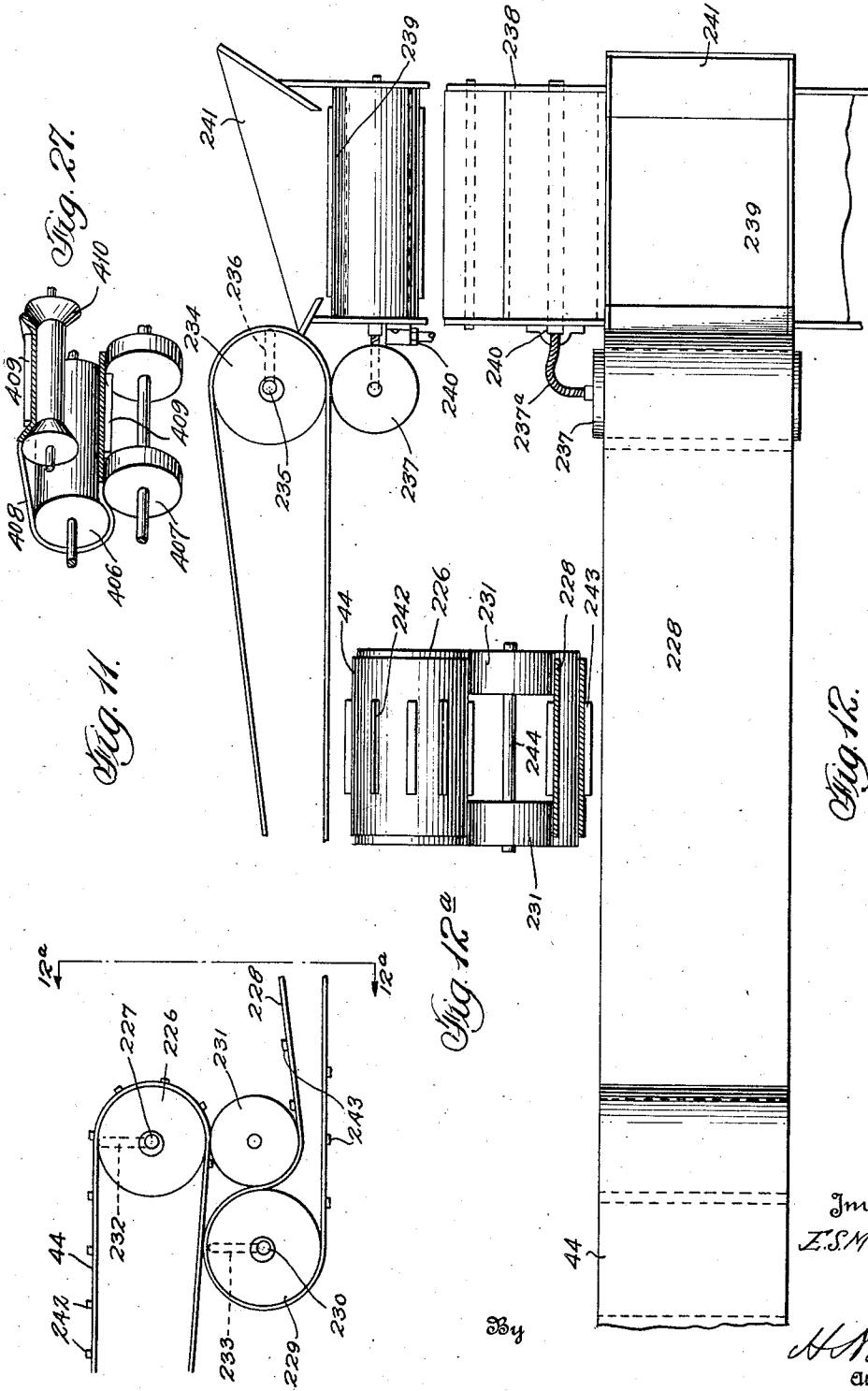
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CONVEYER SYSTEM FOR MINES AND OTHER PURPOSES

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6 Sheets-Sheet 5

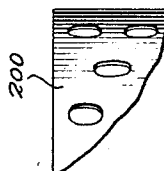
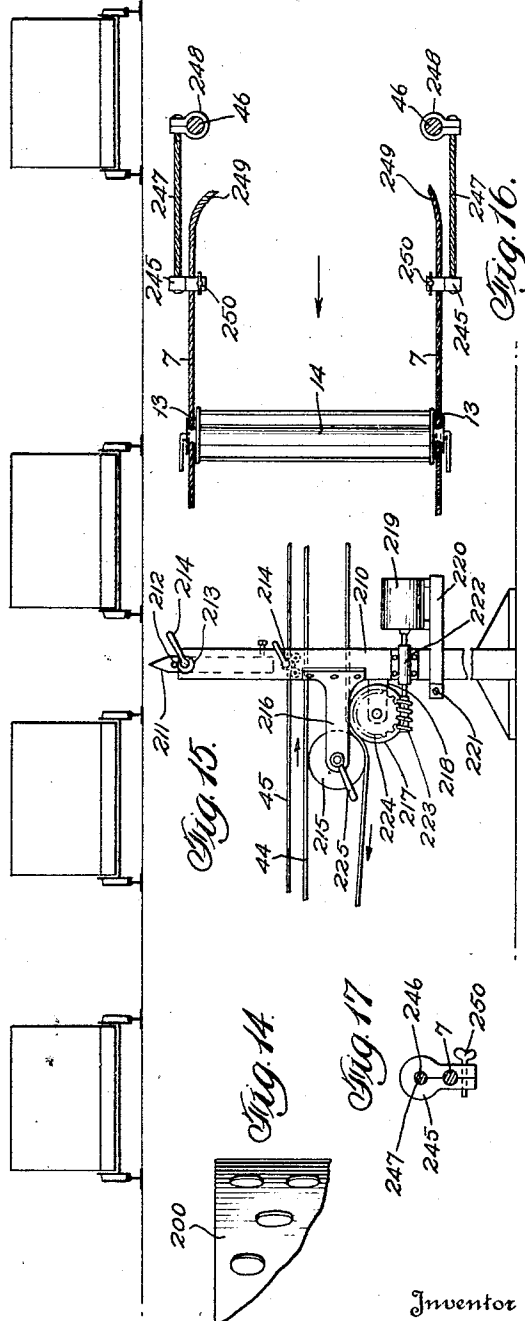
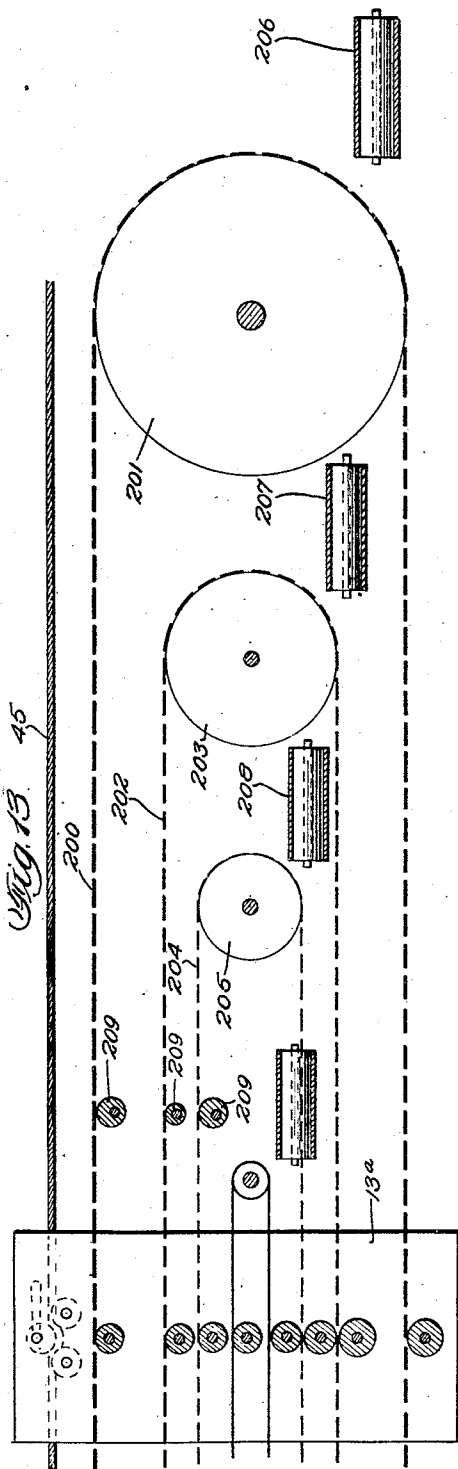


Fig. 14.

Fig. 17.

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CONVEYER SYSTEM FOR MINES AND OTHER PURPOSES

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Fig. 20.

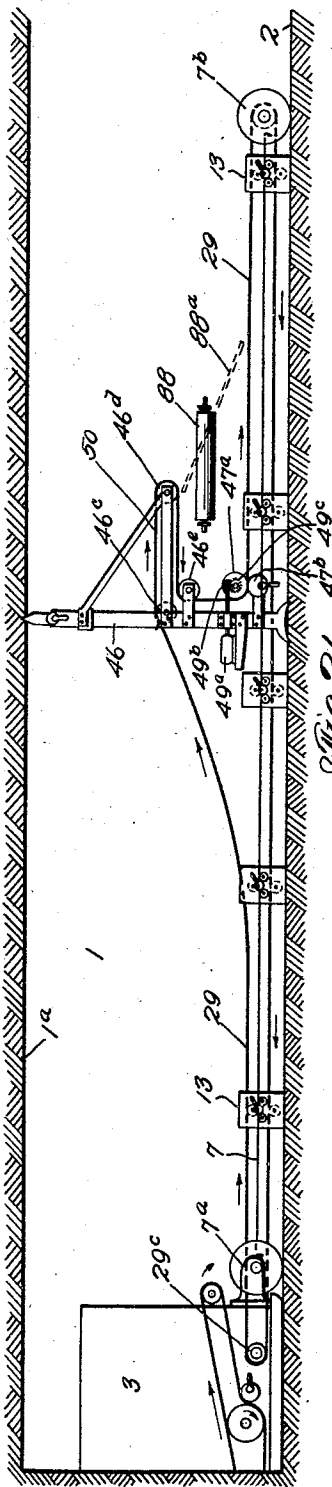


Fig. 21.

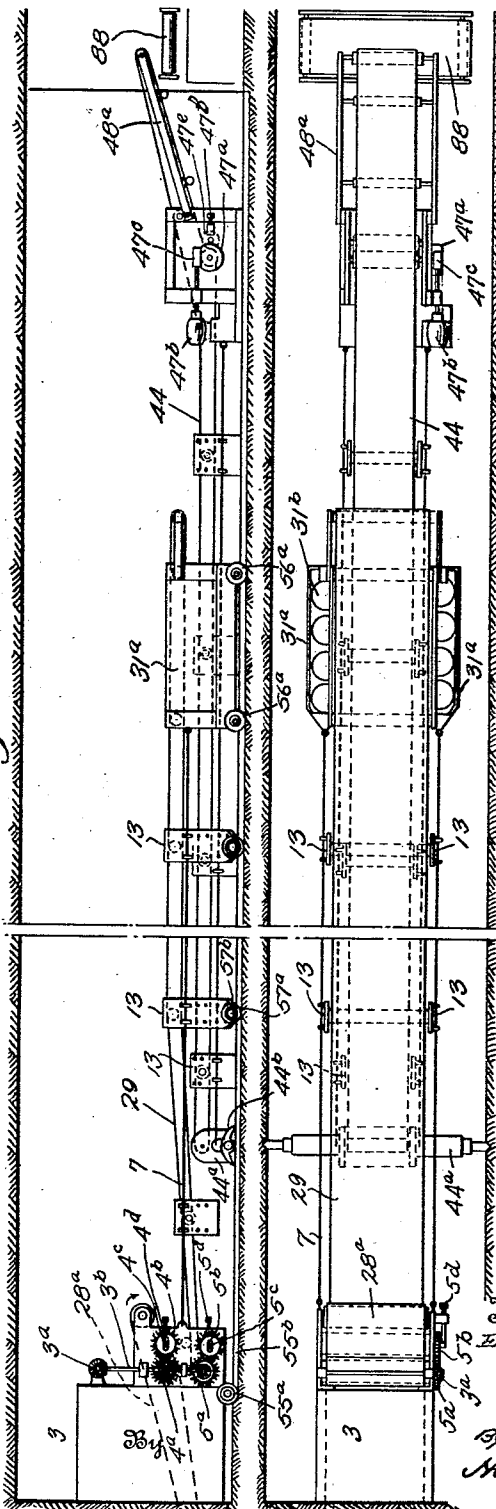
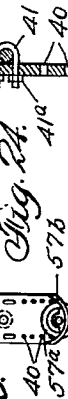


Fig. 22.

Fig. 23.



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UNITED STATES PATENT OFFICE

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CONVEYER SYSTEM FOR MINES AND OTHER PURPOSES

Application filed October 10, 1924. Serial No. 742,851.

The invention relates to flexible belt conveyers for mining machines, machines for breaking rock, and the like, and has for its objects to provide a flexible conveyer which may be readily installed in the mine or quarry in such manner as to cooperate with a mining machine, excavator or the like to continuously carry away to the desired point of discharge, the coal or rock as the latter is broken down and gathered up during the operation of the mining or other machine. The conveyer may be employed also, for the loading of railway cars and other handling and deposit of material.

An important object of the invention is the provision of a flexible conveyer of the character described which, after being placed in position in the rear of a mining or quarrying machine, is of such design as to permit of the machine being moved inwardly for a considerable distance as the coal or rock is broken down, without requiring continued adjustment of the conveyer to accommodate such inward movement of the machine.

A further object of the invention is to provide a flexible conveyer of such design that a minimum of rigid columns or supports are required, and the conveyer sections are adjustable and may be rigidly supported in any desired position with respect to the conveyer frame.

A further object of the invention is to provide a new and improved conveyer construction whereby the coal or rock is continuously carried rearwardly from the mining machine and deposited in mine cars provided for the purpose in such manner that the spilling of the broken down material between the cars while the same are being loaded, is effectually stopped.

A further object of the invention resides in the provision of a flexible belt conveyer mechanism of such character as to permit the conveyer belts to be positively driven when desired from the mining machine or from an auxiliary and independent source of power, such as a motor which may be mounted on the frame of the conveyer apparatus.

A further object of the invention is to pro-

vide a flexible conveyer mechanism which may be conveniently assembled and installed in the rear of a mining machine in such manner as to be rigidly clamped between the floor and the roof of the mine, and which is capable of being moved inwardly or outwardly along the entry when desired, as the material to be mined is broken down and carried rearwardly to the mine cars or other desired points of discharge.

While the improvements contemplated by the present invention are illustrated and hereinafter described as used in conjunction with an automatic mining machine it will be apparent that the same are capable of being used in conjunction with hand mining or other machine loaders as well as further and varied uses, such as the loading and unloading of vessels while in the vicinity of their docks, and for loading or storing materials in warehouses, and in general it will be apparent that the improvements are susceptible of many other useful purposes.

In the use of conveyers for general work or for loading and unloading vessels the ropes or cables which support the belt are suitably weighted and extend over pulleys located on towers, trestles, etc., and in the case of vessels the weights may be suspended in the water if desired.

With such objects in view, as well as other advantages which may be incident to the use of the improvements, the invention consists in the parts and combinations thereof hereinafter set forth and claimed, with the understanding that the several necessary elements constituting the same may be varied in proportions and arrangement without departing from the nature and scope of the invention.

In order to make the invention more clearly understood there are shown in the accompanying drawings means for carrying the same into practical effect, without limiting the improvements, in their useful applications, to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the said drawings:

Figs. 1—1A illustrate a vertical sectional view through a portion of a horizontal mine

passage and showing a portion of a mining machine designed to cut away and break down coal or other material in the mine, and illustrating a preferred embodiment of the present invention in position to be used in conjunction with said mining machine to carry away the mined material to the mine cars or other desired point of discharge.

Fig. 2 is an enlarged view of a portion of the flexible belt conveyer mechanism illustrated in Fig. 1A.

Fig. 3 is an end view of the structure illustrated in Fig. 2.

Fig. 4 is an enlarged side view of one of the adjustable steel plate clips adapted to support the conveyer belts and shown generally in Figs. 1—1A.

Fig. 5 is an enlarged transverse sectional view through a portion of one of the conveyer belts and supporting rollers, and showing in end elevation the steel plate clip illustrated in Fig. 4.

Fig. 6 is an enlarged end view of the structure illustrated at the right of Fig. 1A, and illustrating the construction of the reversible conveyer for preventing the mined material from falling between the cars while the latter are being loaded.

Fig. 7 is a similar view looking at right angles to Fig. 6.

Figs. 8 and 9 are enlarged detail views showing a portion of the mechanism for reversing the transverse conveyer illustrated in Figs. 6 and 7.

Fig. 10 is a detail view of a modified construction at one end of one of the conveyer belts.

Fig. 11 is a side elevation of a means for driving the conveyer sections at their ends.

Fig. 12 is a plan view of the same.

Fig. 12A is a section on line 12A—12A of Fig. 11.

Fig. 13 is a side elevation of the means for screening and sizing the coal.

Fig. 14 is an enlarged detail plan view of a portion of one of the perforated screen belt sections.

Fig. 15 is a view on a larger scale showing means for driving the suspended or other conveyer belt at a desired point between its supporting end rollers.

Fig. 16 is a fragmentary plan view of an alternative means for yieldably supporting the flexible cable near the machine end of the apparatus.

Fig. 17 is an enlarged detail view of one of the friction clamps illustrated in Fig. 16.

Fig. 18 is an enlarged detail sectional view of a portion of the structure illustrated in Fig. 2, and showing a preferred means for taking up the slack in the cables 45 when desired.

Fig. 19 is an enlarged detail view of an alternate construction of the top portion of the vertical frame supports 46, 47.

Fig. 20 is a view similar to Fig. 1 and showing the employment of a single belt to provide flexibility of operation.

Fig. 21 is a similar view and illustrating a somewhat modified use of the clip plates for supporting the flexible cable, and also illustrating their manner of relative movement with respect to one another as the machine advances into the cut.

Fig. 22 is a plan view of the same.

Fig. 23 is an enlarged view of one of the clip plates illustrated in Figs. 21 and 22.

Fig. 24 is an enlarged fragmentary vertical section through a portion of the same.

Fig. 25 is a detail diagrammatic plan view illustrating another application of the transverse discharge conveyer illustrated in Fig. 6.

Fig. 26 is a detail view illustrating another application of the invention.

Fig. 27 is a detail perspective view illustrating a manner of troughing the conveyer belt after its passage between the driving rollers.

Referring to the drawings, 1^a indicates the roof or ceiling of a horizontal mine entry or passage 1, and floor of which is represented by 2. At the inner end of the entry is shown a portion of a mining machine 3 which is adapted to break down and move rearwardly thereof the coal or material being mined. The mining machine 3 may be of any well known or desired construction and the cutters and means for breaking down the coal after the kerfs have been cut, are located on the forward end of the machine, and the same forming no part of the present invention, have therefore not been illustrated. At the outer end of the entry 1 is a transverse passage 4 which may have suitable rails 5 laid therein to provide tracks for the mine cars 6.

As illustrated in a preferred embodiment of the invention the improved flexible belt conveyer is composed of two sections generally designated by A and B. The inner section A comprises as a supporting medium, a pair of wire ropes or other flexible cables or chains 7 suitably secured at their inner ends as at 8 to opposite sides of the rear portion of the frame of the mining machine 3, and in one embodiment of the invention, are secured at their outer ends as at 9 to the upper portions of a pair of supporting weights 10 mounted upon suitable runners or skids 11 resting upon the floor 2 of the shaft. The weights 10 are of sufficient size to normally remain stationary within the shaft and serve as a supporting means for one end of the inner conveyer A, but are adapted to be moved inwardly with the skids 11 when the mining machine 3 advances a sufficient distance into the coal or other material being mined. A pair of turn-buckles 12 are provided on the cables 7 by means of which the desired tension of the latter may be conveniently effected. A plurality of plates or clips 13 of

any desired number are adjustably carried by the ropes or cables 7 and are provided with means whereby the same may be rigidly clamped in any desired position on the cables 7 as working operations may require. The plates or clips 13 are arranged in oppositely disposed pairs along the cables 7, each pair having extended therebetween a pair of conveyer belt supporting rollers 14 and 15 suitably journaled on transverse shafts 16 and 17 and which latter extend through the plates 13 and are secured at their outer ends as by nuts 18 and 19. The means carried by each plate 13 whereby the same may be adjustably clamped to the cables 7, comprise a pair of lower horizontally spaced grooved rollers 20 and 21 journaled on suitable studs 22 and 23 and rotatably retained thereon by means of nuts 24 and 25, which latter are threaded on to the ends of the studs. The cables 7 are adapted to pass over the rollers 20 and 21 and are retained thereon by means of a grooved roller 26 eccentrically journaled on the plate 13 by means of the stud 27. The eccentric roller 26 is provided with a hand lever 28 by means of which the turning of the roller causes it to grip and tightly engage the cable 7 (Fig. 4) and the kink thus formed in the cable effectually prevents movement of the plate 13 until the eccentric roller 26 has been again turned by means of the handle 28 to release the cable.

Other types of clips may be used, if desired, to fasten the ropes or cables 7 to the plates 13 carrying the rollers and the belt.

The rollers 16 and 17 journaled in the plates 13 serve to support intermediate of its ends the upper and lower flights of the traveling conveyer belt 29 of the section A. The belt 29 at its inner end passes over a pulley (not shown) at the forward end of the mining machine 3, and near its outer end the belt passes over a roller 30 journaled between the upright supporting weights 10. At its outer end the belt 29 passes over a roller 31 journaled between the outer ends of a swinging arm 32 which latter is pivoted at its inner end at 30. A guide roller 33 is journaled between the members 10 and between which latter and the roller 30 the lower flight of the belt 29 is passed. A bracket 34 is provided at the rear end of the mining machine 3, having suitably journaled thereupon a shaft 35 carrying a driving drum 36. The latter is or may be driven by means of a bevel pinion 37 meshing with a second pinion 38 keyed on the outer end of the horizontally disposed main power shaft 39. The inner end of the power shaft 39 is connected by suitable gearing to the power plant (not shown) at the front of the mining machine. If desired the drum 36 may be independently driven as by motor and suitable gearing carried by the bracket 34. A movable idler drum 40 is suitably journaled in the frame

of the machine 3 on one side of the driving drum 36, and a similar drum 41 is eccentrically journaled between bearings 42 carried by the bracket 34. The eccentric drum 41 is adapted to be turned by means of the lever or handle 43, toward the driving drum 36, to create a tension on the belt 29 and insure a positive driving connection between said belt and the drum 36. When the lever 43 is moved to the right the resulting tension on the conveyer belt 29 serves to draw the movable drum 41 toward the driving drum 36, thereby increasing the tension on the belt and augmenting its driving engagement with the drum 36.

The outer end of the inner conveyer A passes over the roller 31 as heretofore described and the latter is positioned directly over and intermediate the extremities of the upper flight of the belt 44, constituting the traveling element of the second conveyer B. The upper and lower flights of the second conveyer belt 44 are carried intermediate their ends by means of plates or clips 13^a, which are similar in construction to the plates 13 and which are supported in oppositely disposed pairs upon a pair of wire ropes or cables 45. The latter are similar to the cables 7 and are secured at their inner ends to a pair of columns or supports 46 and pass at their outer ends through a pair of tubular members or threaded pipe sections 46^a (Figs. 2 and 18) which are preferably threaded into a pair of bushings 46^b which latter are secured within the columns 47. Suitable clamps 48 are provided on the cables 45 which bear against the outer faces of the threaded pipes 46^a and prevent the cables from passing through the pipe sections after the cables have been adjusted. Adjustment of the cables is effected by applying a suitable wrench to the outer ends of the pipe sections 46^a and turning the same in the threaded bushings 46 to increase or diminish the tension on the cables 45.

The outer ends of the cables 45 pass downwardly and around a pair of winding drums 55 (Figs. 2 and 3) mounted upon a transverse shaft 56, journaled in suitable brackets 57 carried by the base portion 58 of the rear conveyer support. By means of the drums 55 any surplus of the cables 45 may be taken up as determined by operating conditions and the conveyer supporting portions of the cables 45 may be lengthened or diminished according to the extent of travel necessary between the mining machine and the loading cars.

The supports 46 may be formed of telescoping sections and are provided at their upper ends with a transverse shaft having one or more eccentrically mounted toothed rollers 49 (Fig. 1), which latter are adapted to be rotated by one or more handles 50 positioned on said shaft to rigidly maintain

the uprights 46 in position bearing at their upper ends against the roof 1^a and at their lower ends against the floor 2 of the mine passage. Suitable supporting and floor engaging portions 51 may be provided to insure a rigid engagement of the uprights 46 with the floor 2 when the apparatus is placed in position. A pair of drums 52 are journaled between the uprights 46 on a transverse shaft 53 and are adapted to accommodate any excess of wire cables 45 which may be taken up as the machine is advanced into the mine passage. A drum or idler roller 54 is also journaled on the shaft 53 around which the inner end of the second conveyer belt 44 is adapted to pass. The intermediate portion of the lower conveyer belt 44 inclines upwardly and passes over suitable rollers 60 and 61 journaled between a pair of intermediate columns 62 similar to and braced in the same manner as the columns 46. From the columns 62 the lower conveyer belt is extended outwardly supported by the cables 45 and plates 13^a, and the upper flight of the belt passes over a roller 63 journaled between the upright supports 47, passing thence over a similar roller or pulley 64 journaled on a shaft 65 carried by the forward end of a pair of swinging arms 66 pivoted on the shaft 67 to the supports 47. A pair of adjustable supporting members 68 are pivoted at 69 to the lower portion of the columns 47 and are provided with a plurality of apertures and pins 70 cooperating with corresponding apertures or pins in the swinging arms 66 by means of which the swinging arms 66 may be adjusted to any inclination according to the desired point of discharge.

From the outer roller 64 the lower flight of the belt passes rearwardly around a driving drum 71 journaled in a bracket 72 on the column 47 and thence the belt passes over an eccentrically mounted drum or roller 73 journaled in the bracket 72, and thence the lower flight of the conveyer belt 44 extends forwardly to be supported by the plates or clips 13^a. A lever 74 is provided whereby the eccentric drum 73 may be rotated to increase the tension of the belt 44 and insure its positive driving engagement with the driving drum 71. A motor 75 is mounted on a bracket 76 and is suitably geared as at 76^a with the drum 71 (Fig. 2) to provide an independent source of power for the second conveyer belt 44. The rear supports 47 are preferably provided with upper telescoping sections 76 adjustably secured in any desired manner to the lower sections 47, and at the upper ends of the sections 76 a transverse rock shaft 77 is provided having rigidly secured thereto one or more toothed eccentric wheels 78, similar to the eccentrics 49 at the forward end of the conveyer. A hand lever 79 is secured on the shaft 77 by means of which the eccentric toothed wheels may

be brought into tight binding engagement with the roof of the mine shaft. A pair of screw threaded members 80 are carried by the bars 58 by means of which a rigid engagement of the conveyer support with the floor may be effected.

The adjustable arm 66 has depending therefrom at each side thereof a pair of bracket arms 81 and 82 (Figs. 1A, 6 and 7), at the lower ends of which are secured a pair of transverse supporting members 83. The members 83 have journaled therein shafts 84 and 85 carrying rollers 86 and 87 supporting a transverse discharge conveyer belt 88. The transverse conveyer belt 88 is adapted to receive the mined material from the conveyer belt 44 and deliver the same to the mine cars 6 therebeneath. In order to prevent the coal or other material delivered to the belt 88 from being spilled between the cars 6 while the latter are being loaded, means are provided for automatically driving the discharge belt 88 in reverse directions. As best seen in Figs. 6 and 7 a shaft 89 is journaled for reciprocating movement and depends from a bracket 90 secured to the swinging arm 66. The reciprocating shaft 89 is normally maintained in depressed position by a tension spring 91 secured at its upper end to the enlarged upper end of the shaft 89 and bearing at its lower end against the bracket 90. The shaft 89 has secured thereto near its lower end a friction disk pinion 92 bearing against the outer face of a similar friction disk pinion 93 mounted upon the outer end of the transverse shaft 85, carrying one of the rollers 86 of the discharge conveyer 88. At its lower end the reciprocating shaft 89 is provided with an integral or suitably secured bifurcated portion 94 having journaled therein a roller 95. The shaft 89 may be driven from the motor 75 by means of the flexible shafting 96 terminating in a worm 97 journaled in a bracket 98 on the conveyer support and meshing with a worm wheel on the shaft 89 below the friction disk pinion 92.

As the mine cars pass along the tracks beneath the discharge conveyer 88, a rail 99 on the upper edge of the mine cars contacts with the rollers 95 on the lower end of the reciprocating shaft 89. This results in forcing the shaft upwardly against the tension of the spring 91 and the friction pinion 92 is moved upwardly along the face of the cooperating friction disk 93 from the position illustrated in Fig. 8 to the position illustrated in Fig. 9, thereby reversing the direction of travel of the discharge conveyer 88 and preventing any coal falling between the cars as the same are moved beneath the transverse conveyer while being loaded. Viewing Fig. 6, and assuming the cars 6 to be traveling toward the left in the direction of the arrow 100 and the car

6^a has been loaded from the discharge conveyor 88 which is also traveling toward the left, when the car 6^a passes from beneath the roller 95 the shaft 89 carrying the friction pinion 92 is forced downwardly by the spring 91 and the resulting engagement of the friction pinion 92 with the friction disk 93 below the center of the latter, causes a reversal of the conveyor 88 and causes it to travel toward the right to load the car 6^b until the rail 99 carried by the latter engages the roller 95 to raise the shaft and can effect a reversal of the conveyor belt 88 to the direction indicated in Fig. 6. Positive automatic means for preventing the discharge of coal between the cars is thereby provided by the mechanism above described.

Fig. 10 illustrates a roller or weight 101 which may be provided in place of the weights 10 carried by skids 11 illustrated in Fig. 1.

My invention further comprises, in a conveyor system for mines and other purposes, the combination of a series of endless conveying, screening and grading belts so arranged that each screening belt receives and conveys material and delivers the finer parts of it to a lower belt and so on successively to the extent desired, and combined with such screen belts cross belts which receive and take away from each screening belt material which is larger and which is not screened by the belt. Such cross belts may also be arranged to allow of the cleaning of the material. This arrangement is or may be such that each conveying belt serves as a cleaning belt, that is to say, it permits the picking out of slate or other undesired material from the contents of the belt as they are being conveyed. The result of such handling of coal or other material may be such as to enable a tippie or the expensive parts of it to be entirely done away with and the ultimate action of the system of belts referred to is or may be such as to deliver the coal or other material directly into railway cars, all suitably graded and ready for transportation, which is a very considerable economy. The belts which deliver the graded material to the cars may be made reversible in the direction of conveyance so that all cars on a single track may be quickly and conveniently loaded each with the desired grade of material. In Fig. 13 there is shown an arrangement and combination of belts such as are above described. 200 indicates an upper conveying and screening endless belt which receives material from the belt 44 heretofore described. The belt 200 is of a screening structure such as sheet metal having holes punched therein, or woven wire or other structures suitable for the purpose. This belt is mounted on rollers 201 and one or more of such rollers would be a driving roller for actuating the belt, and this driving roller may be operated by

a motor or any suitable system of sprockets and chains.

Arranged below and within the belt 200 is a second screening belt 202 having smaller holes or reticulations and mounted on rollers 203. I have further illustrated a third belt 204 arranged with and below the belt 202 and mounted on rollers 205. The belt 204 will have reticulations or holes still smaller than those of the belt 202. During the conveyance of the material the belt 200 may be used as a cleaning belt for the removal by hand of undesired material. The largest grade of material will pass from the belt 200 to a delivering belt 206 which may be suitably arranged for that purpose and also preferably for loading the material which it carries directly into cars. 207 is a crossbelt leading from within the belt 200 and so as to receive and take away the second grade of material which does not pass through the belt 202. 208 is a crossbelt arranged within the belt 202 and so as to receive and take away material delivered by the belt 204. The belt 204 will be a conveying and not a screening belt, and the belts 207 and 208 have no screening function and will be arranged by preference, to load the material conveyed by them directly into cars. It will be understood however that the delivering belts may deposit the material at any desired places of storage.

The screening belts are suitably agitated by eccentric elements 209 which are rotated beneath the upper limb of the belt and make this screening action efficient. Other suitable agitating means might be employed for this purpose.

The eccentric rollers and the power rollers between which the conveyor belts are pinched with the necessary tension to produce the desired driving engagement, are preferably constructed so as to grip the belts only at their side edges thereby leaving a sufficient clearance for the flights or slats with which the belts may be provided extending transversely across the belts in spaced relation and terminating before reaching the side edges of the belts. This construction is particularly advantageous when the material to be conveyed is directed upwardly or downwardly as required by operating conditions, and the transverse slats prevent the material slipping longitudinally off the plate during its movement toward the desired discharge point.

It will be understood that although wire ropes are illustrated and described as suitable for the flexible supports carrying the conveyers and conveying rollers, any desired flexible support may be employed for the purpose, such as chains or manila ropes.

The gripping pulley attachment of the clips is so arranged as to be adjustable, and put on and taken off quickly, in order to sup-

port any varying load being carried by the conveyer belt. Any desired number of clips may be used and the number will be determined, according to the particular weight and quantity of the material being carried. By loosening the eccentric pulley the entire clip can be readily pushed along the wire rope support to any desired position.

The apparatus as described is susceptible of having applied at any point along the flexible cables, rigid posts, on which are supported the driving means consisting of the cooperating power and eccentric rollers and interposed power roller (Fig. 15). Referring to Fig. 15, 210 represents an upright or column which may be square or cylindrical in cross section and having at its upper portion a telescoping section 211. The latter is transversely apertured to receive at the desired point a transverse pin 212 designed to be engaged by an eccentric 213 actuated by the handle 214 to securely clamp the column between the roof and floor of the mine passage. The cables 45 are suitably clamped or pinched to the column 210 by means of an eccentric 214 operated in a manner similar to the eccentric located on the plates 13 and 13^a. The upper limb of the conveyer belt 44 passes over the roller 215 eccentrically mounted in a bracket 216 secured to the column 210 and the lower limb of the conveyer plate 44 is pinched or clamped between the roller 215 and the power roller 217 carried by the bracket 218 secured to the column 210. Means for driving the power roller 217 are or may be provided in the form of the motor 219 carried by the vertically adjustable platform 220, the latter being clamped in position by means of the screw or other clamping means 221. The armature shaft of the motor passes through a bracket 222 secured to the column and the outer end of the armature shaft terminates in a worm 223 meshing with a worm wheel 224 on the end of the shaft carrying the power roller 217. By means of the eccentric handle 225 the proper tension of the driving engagement between the power roller 217 and belt supporting roller 215, may be conveniently affected in a manner readily understood. The construction just described is of particular utility where if the cables were continued in straight lines they would contact against depressed parts of the ceiling or upraised parts in the floor. The posts or columns 210 provide a means for deflecting the cables out of contact with the roof or ceiling as may be required at the necessary points in the mine passage.

Referring to Figs. 11, 12 and 12A there is illustrated a means for driving two superposed conveyer sections from a single power roller. The end of the conveyer section 44 passes over the roller 226 eccentrically mounted on the shaft 227. A lower conveyer section 228

passes over a roller 229 similar to the roller 226 and eccentrically mounted as at 230 as hereinabove described and preferably between two of the plates or clips which in turn are suspended from the flexible cables (not shown). The power roller is indicated at 231 and is driven by any desired means such as a motor (not shown). It will be apparent that by adjusting the eccentric handles 232 and 233 the rollers 226 and 229 may be brought into the proper driving engagement with the power roller 231 with a result that both conveyer sections 44 and 228 are driven from this single source. The outer end of the section 228 passes over a roller 234 eccentrically mounted as at 235 on a transverse shaft. By adjusting the eccentric lever 236 the proper driving engagement is affected for the transverse driven roller 237. This latter roller serves by means of the flexible shaft 237^a as a driving means for the roller 238 carrying one end of a transversely disposed discharge conveyer 239. The latter is pivotally mounted in any desired manner as at 240 to enable the discharge conveyer to be adjusted angularly with respect to the conveyer 228 according to the direction in which it is desired to discharge the material received by the discharge conveyer. A suitable hopper 241 is provided at the receiving end of the discharge conveyer to insure against the spilling of material received from the conveyer plate 228.

Referring more particularly to Fig. 12A it will be understood that the conveyer sections 44 and 228 are provided with flights or lugs 242 and 243 and the power roller 231 is composed of two sections fixed upon a transverse shaft 244. This construction permits the power roller 231 to impinge with a driving engagement upon the side edges of the conveyer sections 44 and 228 with a result that ample clearance is provided for the lugs or flights 242 and 243, during their passage around and adjacent the power roller 231.

Referring to Figs. 16 and 17 there is illustrated as modified means for supporting the section of the belt conveyer nearest the mining of excavating machine. As seen in Fig. 16 the flexible cables 7 extend from their point of securement to the mining machine (not shown) to a pair of suitable friction clamping members 245. The latter are apertured as at 246 for the reception of a pair of flexible or other supporting cables 247 the opposite ends of which latter are secured to clamping members 248 adjustably clamped to a pair of uprights or columns 46 which may be of the type illustrated in Fig. 1A of the drawings. The roller 14 for supporting the conveyer section is adjustably suspended from the cables 7 by the plates 13 in the manner heretofore described. The excess of the cables 7 passing through the friction clamps 245 and indicated at 249 is of preference suf-

sufficient to accommodate the inward longitudinal movement of the inner conveyer section with respect to the lower stationary conveyer section. The friction clamps 245 are adjusted by means of the clamping screws 250 to bear with the proper tension on the cables 7 to permit the latter to support the rollers 14 and inner conveyer section, and yet permit the cables 7 to move inwardly carrying the conveyer elements described as the machine advances into the mined material. In other words the tension of the clamping members 245 is adjusted to permit the cables 7 to perform their conveyer supporting function and yet allow them to draw inwardly through the friction clamps 245 as the machine advances, or in the direction of the arrow in Fig. 16.

The operation of the conveyer mechanism above described may be summed up as follows: The coal or material being mined is deposited upon a suitable apron (not shown) at the forward end of the mining machine 3 and deposited therefrom upon the conveyer belt 29 of the inner conveyer element A and carried rearwardly thereby until the same is deposited upon the belt 44 of the outer conveyer element B, from the belt 44 the mined material is deposited on the transverse discharge conveyer 88 and deposited therefrom into the mine car 6 in the manner above described.

It will be apparent from the construction above described that by superposing the inner conveyer element A above the outer and lower conveyer element B, there is provided an extensive flexibility of movement which enables the mining machine 3 to move inwardly a considerable distance into the mine shaft followed by the conveyer-supporting cables, the machine or element thereof to which the cables are attached being the means for moving the cables, the machine being translated by electric, hydraulic or other power, and the coal will be conveyed therefrom and delivered to the mine cars as the machine advances without requiring a repositioning of the conveyer mechanism until the upper conveyer element A has reached the extreme innermost end of the lower and outer conveyer element B. The conveyer elements may be made in sections and of any desired number and extent to enable the coal to be carried to any desired distance from the point where it is mined to the cars 6, and the number of conveyer sections required and amount of supporting wire cable to be employed will be determined by the extent of travel of the material being mined.

If desired the conveyer rollers illustrated in Fig. 5 for supporting the belt, may be dish or troughed to insure against spilling of the coal or mined material during its travel rearwardly to the cars.

By employing the wire cables and clip

plates for supporting the conveyer sections, extreme mobility and flexibility of operation of the conveyers is insured as well as the necessity for a minimum number of parts.

The mechanism described may be employed, if desired, to alternately load cars on parallel tracks extending longitudinally of and adjacent to the main conveyer. In such instance the arrangement is illustrated in Fig. 25. A car is positioned on one track and the cross conveyer is set in motion by the arrival of a second car on the other track and is driven in the proper direction to load the first car. After receiving its load the first car is moved away from contact with the belt control mechanism, which thereafter automatically operates to drive the transverse belt in the opposite direction to load the second car.

In Fig. 19 there is illustrated an alternate or modified construction whereby the top portions of the frame members 210 of the form shown in Fig. 15 are maintained in engagement with the roof of the mine passage. The pressure of the telescoping section 211 against the roof of the mine passage by means of the eccentric 213 being turned to engage with the pin 212, is supplemented by hydraulic pressure. To this end a pressure cylinder 211^a is mounted near the upper end of the frame members 210 and the piston 212^a thereof is adapted to bear upwardly against the lower face of the telescoping section 211 when oil or other fluid from the machine pump is admitted to the cylinder through the pipe 213^a. A suitable valve or cock 214^a may be operated to confine the fluid within the cylinder as long as it is desired to maintain the firm engagement of the telescoping section 211 with the roof of the mine passage.

Fig. 20 illustrates a form of apparatus in which a single conveyer belt is employed and designed to permit the flexibility of operation contemplated by the inventor. As illustrated, the inner end of the belt 29 passes around a roller 29^c journaled in the frame 3 of the machine. The flexible cables 7 are secured at their ends to a pair of weighted or heavy rollers 7^a, 7^b, the former of which is secured to the frame 3 at the rear of the machine. The intermediate clip plates 13 are of the construction previously described and are adjustably mounted along the flexible cables 7. The lower portions of the plates 13 are adapted to contact with the floor of the tunnel or be suspended on the cables 7, depending upon the varying weight of the material carried by the belt 29. The intermediate fixed support 46 is temporarily rigidly pressed between the floor and ceiling of the tunnel and is provided with idler rollers 46^c, 46^d and 46^e, which are so disposed as to rotatably carry the upper flight of the conveyer 29. The belt 29 is driven by a pinch

roller construction afforded by the drive roller 47^a and eccentric pinch roller 47^b. Power for driving the belt 29 may be supplied from a motor 49^a, worm 49^b and worm wheel 49^c. The portion 50^a of the traveling belt supported by the vertical support 46 is designed to discharge upon the heretofore described transverse discharge conveyer 88, or upon the inclined chute 88^a which is indicated in dotted lines and which may be employed, if desired, instead of the transverse belt 88. As the machine moves inwardly into the tunnel the traveling belt 29 driven by the motor 49^a is moved bodily inward by means of the weighted rollers 7^a and 7^b connected by the flexible cables 7, and continuous inward movement of the mining machine is insured until the weighted roller 7^b passes to the left of the standard 46 and conveyed material is continuously discharged by the portion 50 of the belt on to the transverse discharge conveyer 88 or chute 88^a. When this point is reached it is only necessary to reposition the standard 46 and discharge conveyer 88 at a point further in the tunnel and proceed as aforescribed. The weight of the rollers 7^b together with the clip plates 13 insure the proper support of the lower portion of the conveyer belt, prevent the same from undue sagging and permit the belt to be moved bodily and longitudinally inward as the machine advances.

If desired the arrangement may be such as illustrated in Figs. 21 and 22. In this arrangement the mining machine conveyer belt 28^a and the inner conveyer belt 29 are both driven from the mining machine. Power is supplied from the mining machine from the shaft 3^a having a beveled pinion connection with the vertical shaft 3^b journaled in the machine frame and which, through suitable gear and pinion connections, drives the pinch roller connection for the mining machine belt 28^a by means of the gears 4^a and 4^b. The lower end of the shaft 3^b drives the pinch roller connection for the belt 29 through similar gears 5^a and 5^b. The teeth of the inter-meshing gears 4^a, 4^b and 5^a, 5^b are of a length sufficient to permit the desired adjustment of the pinch for both belts without effecting the driving engagement between said gears. As illustrated, the upper and lower pinch rollers 4^b, 5^b are mounted for horizontal adjustment relative to the fixed rollers by means of slots 4^c, 5^c and set screws 4^d, 5^d. The support for the upper conveyer belt 29 is provided by the flexible cables 7 which are fixed at their inner ends to the machine frame and at their outer ends to weighted box like or skid members 31^a. The latter are preferably connected together as a unit and may be suitably weighted to provide the desired resistance and tension of the cables 7 by means of weights or spare car wheels 31^b. The intermediate clip plates 13 are of

the construction heretofore described with the exception that the same are so constructed that vertical adjustment of the same and the cables carried thereby may be effected by means of a plurality of sets of apertures 40 adapted to be engaged by U-shaped bolts or yokes 41 which are threaded at their ends and adapted to be engaged by nuts 41. In this manner the cables 7 may be clamped in varying positions to the clip plates 13 and support the conveyer belt 29 at the desired height above the ground, the lower portions of the clip plates 13 being preferably rounded and adapted to contact with the floor of the tunnel or suspend freely from the cable 7 according to the weight carried by the plate 29.

The inner end of the lower conveyer belt 44 passes over a roller carried by a horizontal jack 44^a adapted to have a threaded rigid and adjustable engagement with the side walls of the tunnel. The outer ends of the horizontal jack 44^a are preferably mounted as at 44^b to permit the lower portion of the clips 13 to ride over the machine as upper conveyer belt 29 passes into the tunnel. As will be observed from Fig. 22 the clip plates 13 supporting the upper conveyer 29 are spaced in pairs and are farther apart when viewed horizontally than the pair of plates 13 supporting the lower conveyer belt 44. This arrangement permits the pairs of horizontally movable plates 13 to straddle or pass by the more closely spaced and stationary clip plates supporting the lower stationary conveyer 44. The lower conveyer 44 may be driven by a motor 47^a having a worm 47^c meshing with a worm wheel 47^d and the proper driving engagement is effected by the pinch roller 47^e which is horizontally adjustable to bear against the horizontal roller 47^d by means of the set screw 47^f. The usual inclined and adjustable boom 48^a may be provided to effect the desired removal of the material discharged by the lower conveyer belt 44 to the transverse discharge conveyer 88.

As best illustrated in Fig. 21 the rear end of the mining machine is or may be provided with wedging rollers 55^a which, due to their wedge shape peripheral construction serve to cut a channel 55^b in the floor of the tunnel as the machine advances. The movable support or skid 31^a carrying the rear portion of the conveyer belt 29 is or may be provided with similar wedging rollers or wheels 56^a which follow in the path or track 55^b defined by the rollers 55^a, thereby maintaining the conveyer apparatus in alinement during its passage into the tunnel and obviating the necessity of providing tracks for the purpose. If desired the intermediate clip plates 13 may also be provided with similar wedge wheels or rollers 57^a journaled in the laterally extending lower portions 57^b of the clip plates which would further insure the passage of the

entire movable portion of the apparatus in a straight line. The weight of the machine and of the apparatus and material carried thereby is sufficient to define these grooves of sufficient depth to maintain the apparatus in alinement.

In Fig. 26 there is illustrated a modified arrangement in which the flexible conveyer apparatus may be employed for discharging its load into a ditch or ravine or any point intermediate its support. In the arrangement in Fig. 26 the conveyer belt section 400 of any desired length depending upon working conditions, is suspended by means or the rollers and clip plates 13 from the flexible support 45. The latter extends between a suitable stationary tower or support 401 on one side of the ravine, and the other end of the flexible conveyer passes over a pulley 402 journaled in any desired tower or support 403, and is weighted at its outer end as by the weight 404 sufficiently to provide the required tension of the cable 45. This tension is sufficient to support the conveyer section 400 and its working load. Any desired number of flexible cables may be employed and I have illustrated a second flexible cable 45', extending from the opposite direction and after passing over the roller 402 is suitably weighted as at 405 similar to the section 45. In this manner it will be apparent that by the arrangement described the apparatus may be employed for loading cars in the ravine intermediate the supports 401 and 403, or may be employed for filling such ravine, the latter being indicated by the letter R.

In Fig. 27 there is illustrated clearly the arrangement of the belt sections when flights of the belt are employed and it is desired to trough the belt for its passage through the pinch roller drive, to insure against material being spilled laterally from the belt during the travel of the latter. In Fig. 27 the driving roller is indicated at 406 and the adjustable pinching roller at 407, which serve to provide the proper driving engagement along the sides of the belt 408 outside of the flights 409. After its travel between the pinch rollers the belt passes over any desired number of troughing rollers 410, which are the usual idler rollers heretofore described and the troughed construction of which prevent material being spilled laterally from the moving belt.

What I claim is:

1. A conveyer apparatus, comprising a cable, a conveyer belt carried by said cable and longitudinally movable therewith, a second conveyer belt having a stationary support and maintained in operative relation to said first conveyer belt during the longitudinal movement of the latter, and means for driving said belts.

2. A conveyer apparatus, comprising a longitudinally movable cable, a conveyer belt

carried by said cable and longitudinally movable therewith, a fixed cable, a second conveyer belt carried thereby and adapted to receive the discharge of material from said first conveyer belt during the longitudinal movement of the latter, said first conveyer belt being longitudinally movable relative to said second conveyer belt, means for adjusting the tension on said belt, and means for driving said belts.

3. A flexible conveyer apparatus, comprising a cable, a conveyer belt carried by said cable and movable longitudinally therewith, a stationary cable, a second conveyer belt carried by said stationary cable and cooperating with said first conveyer belt to receive the discharge of material therefrom, said first conveyer belt being longitudinally movable relative to said second conveyer belt, means for adjustably mounting said belts on said cables, and means for driving said belts.

4. The combination of a flexible support, rollers adjustably carried by said flexible support, a plurality of endless conveyer belts arranged one over the other on said rollers, means for driving said conveyer belts, eccentric rollers adjacent said belt-supporting rollers and adapted to vary the tension of the driving engagement, yielding means controlling said driving means to permit the passage of conveyed material between said rollers and said belt-supporting rollers, a discharge conveyer belt carried by said flexible support and disposed transversely to the lower of said superposed conveyer belts, automatic means for driving said discharge conveyer belts in opposite directions to prevent the discharge of material between the series of mine cars.

5. The combination of a cable, means for drawing said cable endwise, rollers suspended from said cable, a conveyer belt on said rollers, and means for actuating said conveyer belt.

6. The combination of a cable, means for drawing said cable endwise, brackets suspended on said cable, rollers journaled in said brackets, a conveyer belt on said rollers, and means for actuating said conveyer belt.

7. The combination of a cable, means for drawing said cable endwise, brackets adjustable along said cable, said brackets having guides through which said cable passes, rollers journaled in said brackets, a conveyer belt on said rollers, and means for actuating said conveyer belt.

8. The combination of a cable, means for adjusting said cable, rollers suspended from said cable, a conveyer belt on said rollers, a power roller for driving said belt, and a tension roller adjacent said power roller and adapted to be brought into driving engagement with said power roller.

9. The combination of a cable, brackets adjustable along said cable, clamping rollers

for adjustably securing said brackets in adjusted position on said cable, a conveyer belt carried by said brackets, and means for actuating said conveyer belt.

5 10. The combination of a cable, brackets suspended on said cable, adjustable means for bending said cable to hold said brackets in place, a conveyer belt carried by said brackets, and means for actuating said conveyer belt.

10 11. The combination of an endless conveyer belt, supporting rollers at the ends thereof, a driving roller below the lower part of said belt, an idler roller between the parts of said belt, an eccentric mounting for said idler roller, devices for turning the eccentric mounting to cause said belt to be grasped between said rollers and the belt to be actuated, and a spring acting on one of said rollers to allow the passage of obstacles between said rollers.

15 12. The combination of an upper conveyer belt, a roller carrying the same and having an eccentric mounting, a lower conveyer belt, a roller carrying the same and having an eccentric mounting, and a driving roller interposed between said rollers for driving said belts, the eccentric mountings of said upper and lower rollers being adapted to vary the tension of said belts against said driving roller.

20 13. The combination of suspending cables, a conveyer supported thereon, fixed supports and friction means connecting the suspending cables with the fixed supports, whereby the suspending cables will be maintained in position to support the conveyer and its load, the advancing adjustment of the cables and conveyer being permitted by said friction means, the friction being sufficient to hold the cables stationary under a load and being overcome by said adjustment.

25 14. In a conveying apparatus, in combination: flexible cables secured at their ends to movable supports, conveyer belts supported by said cables, means for moving said cables and their supported belts during the operation of said belts, and clamping means for effecting the firm engagement of said movable supports with the roof of a mine passage.

30 15. In a conveying apparatus, in combination: flexible cables secured at their ends to movable supports, conveyer belts supported by said cables and adapted to be adjusted longitudinally relative to one another, and hydraulic pressure means for effecting the firm engagement of said movable supports with the roof of a mine passage.

35 16. In a conveying apparatus, in combination: flexible cables secured at their ends to movable supports, conveyer belts supported by said cables, means for moving said cables and their supported belts during the operation of said belts, clamping means carried by said movable supports for removably en-

gaging the same with the roof of a mine passage, and hydraulic pressure means co-operating with said clamping means to effect a firm engagement of said supports with said roof.

7 17. A conveyer apparatus, comprising a movable cable support, a conveyer belt carried by said support and longitudinally movable therewith, a fixed support, a second conveyer belt carried thereby and adapted to receive the discharge of material from said movable conveyer belt during the longitudinal movement of the latter, means for adjusting the tension on said belt, and means for driving said belts.

18. A conveyer apparatus, comprising a pair of movable supports, a conveyer belt carried by said supports and longitudinally movable therewith, a fixed support intermediate said movable supports and carrying a portion of said conveyer belt, whereby said movable supports and said conveyer belt are adapted to be moved longitudinally relative to said fixed support to insure flexibility of movement of said conveyer belt.

19. A conveyer apparatus, comprising a pair of movable supports, flexible cables extending between said supports, rollers carried by said cables and adjustable thereon, a conveyer belt carried by said rollers and extending between said movable supports, an adjustable and normally stationary support between said movable supports and carrying a portion of said conveyer belt, whereby said movable supports, said cables and said conveyer belt are adapted to be moved longitudinally relative to said stationary support to insure flexibility of movement of said conveyer belt, means adjacent said stationary support to receive the discharge from said conveyer belt, and means for driving said belt.

20. A conveyer apparatus comprising movable supports, flexible cables extending between said supports, clip plates adjustably mounted on said cables and carrying belt supporting rollers, a conveyer belt supported by said rollers and longitudinally bodily movable with said cables and said movable supports, fixed supports, flexible cables extending between said fixed supports, clip plates adjustably mounted on the latter of said flexible supports and having belt supporting rollers, a second conveyer belt carried by said rollers between said fixed supports and adapted to receive the discharge of material from said first conveyer belt during the longitudinal movement of the latter, the clip plates adjustably carried between said movable supports having movement independent of and adapted to pass the clip plates carried between said fixed supports, whereby flexibility of operation of said conveyer belts is insured, means for receiving the discharge

from the second of said conveyer belts, and means for driving said belts.

21. A conveyer apparatus comprising movable supports and fixed supports, flexible cables extending between said movable supports and said fixed supports, conveyer belts extending between said movable supports and between said fixed supports, clip plates for supporting said conveyer belts carried by said flexible cables between said movable supports and between said fixed supports, said clip plates being horizontally and vertically adjustable on said flexible cables between said supports to vary the elevation of said conveyer belts to insure flexibility of operation of said belts relative to one another.

22. A conveyer apparatus comprising movable supports, a conveyer belt carried by said movable supports and bodily movable longitudinally therewith, means carried by one of said movable supports for defining the longitudinal path of movement of said apparatus, and means carried by the other of said movable supports for registering with said defined path of movement to maintain the supporting elements of the apparatus in alinement during their longitudinal movement.

23. A conveyer apparatus comprising movable supports, flexible cables extending between said supports, intermediate supporting clips adjustably carried by said cables, a conveyer belt extending between said supports and carried by said flexible cables and said supporting clips, said conveyer belt being bodily and longitudinally movable with said movable supports, means carried by one of said movable supports for defining the longitudinal path of movement of said apparatus, and means carried by the other of said movable supports and by said supporting clips for registering with said path of movement defined by the first of said movable supports, whereby said movable supports and said supporting clips are maintained in alinement during said longitudinal movement of the apparatus.

24. A conveyer apparatus comprising in combination: movable supports, a conveyer belt carried by said movable supports and bodily movable longitudinally therewith, fixed supports, a second conveyer belt carried between said fixed supports and adapted to receive the discharge of material from said first conveyer belt during the longitudinal movement of the latter, and means carried by one of said movable supports for defining the longitudinal path of movement of said apparatus, and means carried by the latter of said movable supports for registering with said defined path of movement to maintain the supporting elements of the apparatus in alinement during their longitudinal movement.

25. A conveyer apparatus comprising a

conveyer belt, flights carried by said belt, pinch rollers between which said belt passes to provide a driving engagement, and troughing rollers over which said belt passes after its passage through said pinch rollers to trough the load-carrying surface of said belt.

26. A conveyer apparatus comprising a conveyer belt, flights carried by said belt, pinch rollers between which said belt passes to provide a driving engagement, said pinch rollers engaging said belt outside of said flights, one of said rollers being adjustable relative to the other of said rollers to provide the proper driving tension, and troughing rollers over which said belt passes after its passage through said pinch rollers to trough the load-carrying surface of said belt.

27. The combination of upper and lower cable supports, rollers carried by the upper cable support, an upper conveyer belt mounted on said rollers, rollers carried by the lower cable support, a lower conveyer belt mounted on said rollers and arranged to receive the discharge of material from the upper conveyer belt, means for moving the upper cable support longitudinally relative to the lower cable support, and means for driving said conveyer belts.

28. In a conveying apparatus the combination of upper and lower cable supports, a conveyer carried by said upper support and bodily movable longitudinally together with said upper support, a conveyer carried by said lower cable support and arranged to receive the discharge of material from said upper conveyer, means for bodily moving said upper cable support and its conveyer longitudinally relative to said lower cable support, and means for driving said conveyers.

29. In a conveying apparatus, the combination of upper and lower cable supports, a conveyer belt carried by said upper support and bodily movable longitudinally together with said upper support, a conveyer belt carried by said lower cable support and arranged to receive the discharge of material from said upper conveyer belt, means for bodily moving said upper cable support and its conveyer belt longitudinally relative to said lower cable support, and means for driving said conveyer belts.

In testimony whereof I affix my signature.
EDWARD S. MCKINLAY.

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