

April 20, 1954

J. F. JOY

2,676,005

DISINTEGRATING AND GATHERING CHAIN

Filed March 29, 1949

4 Sheets-Sheet 1

Fig. 1.

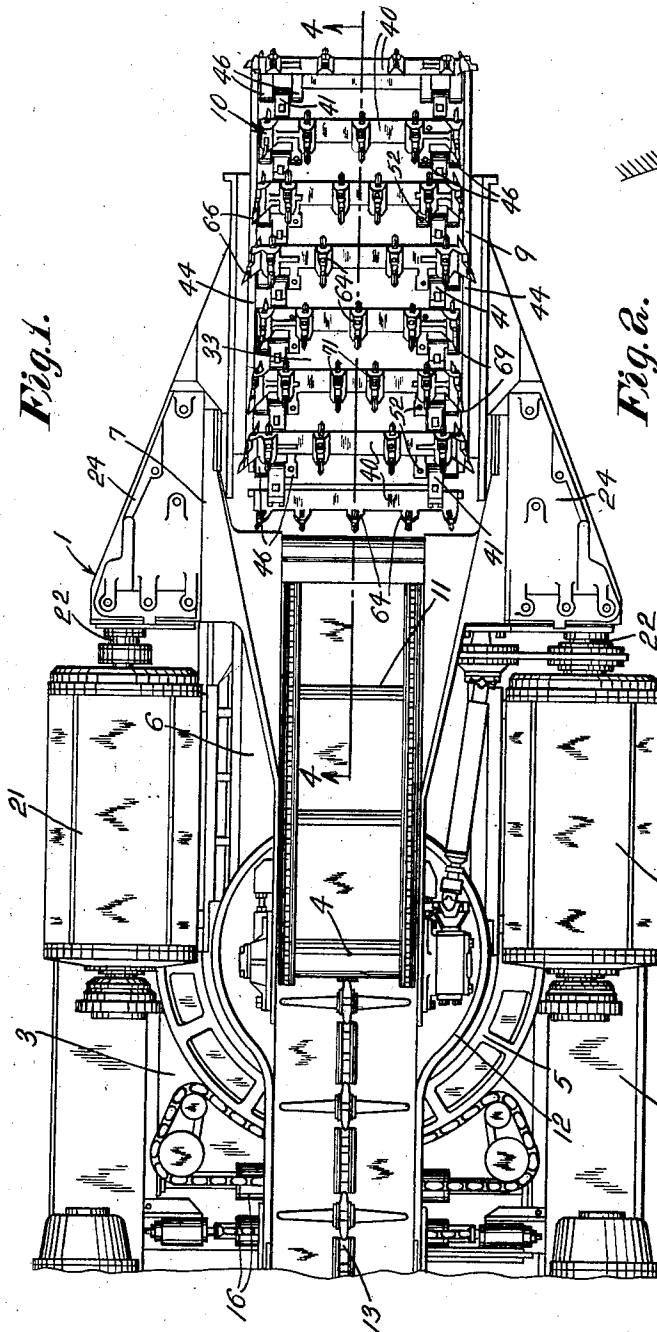
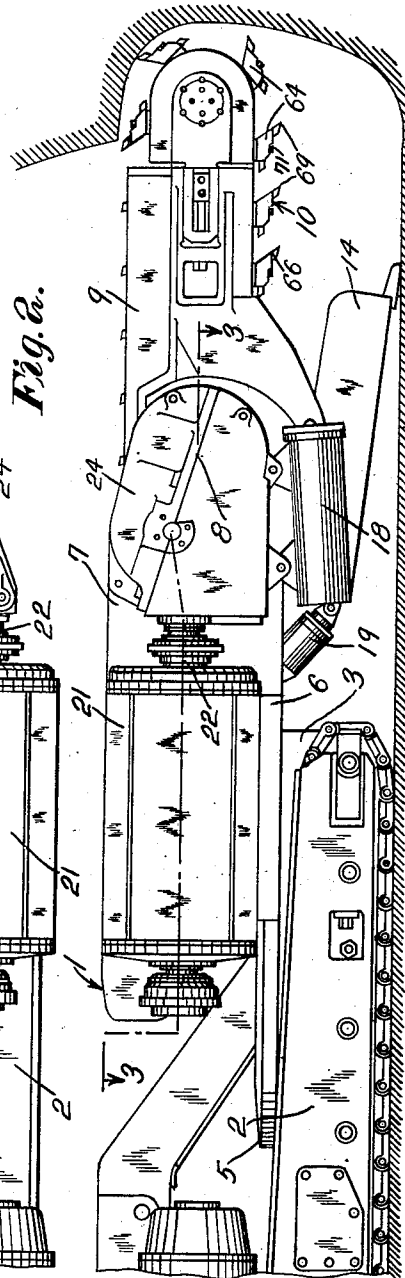


Fig. 2.



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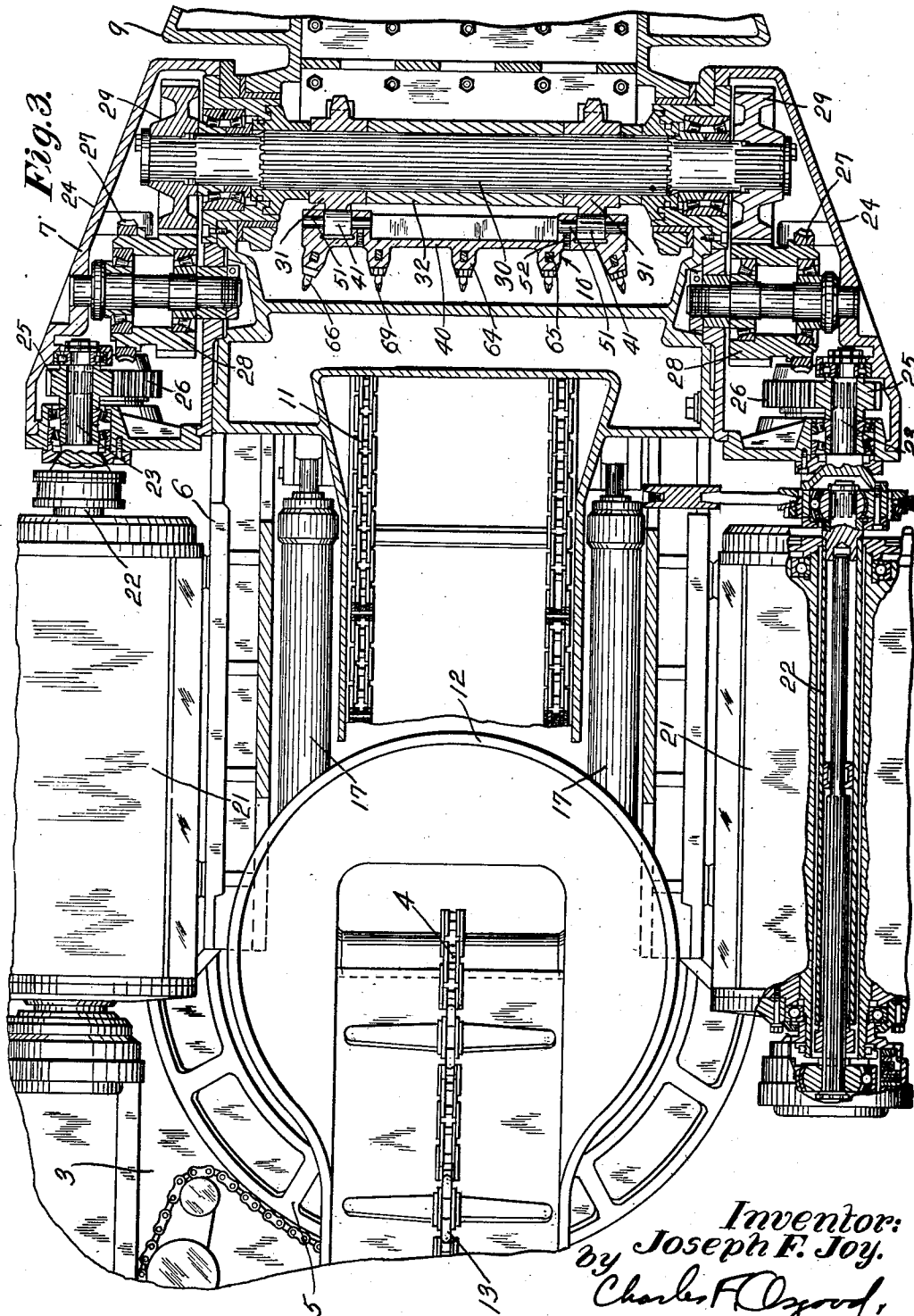
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4 Sheets-Sheet 2



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Fig. 4.

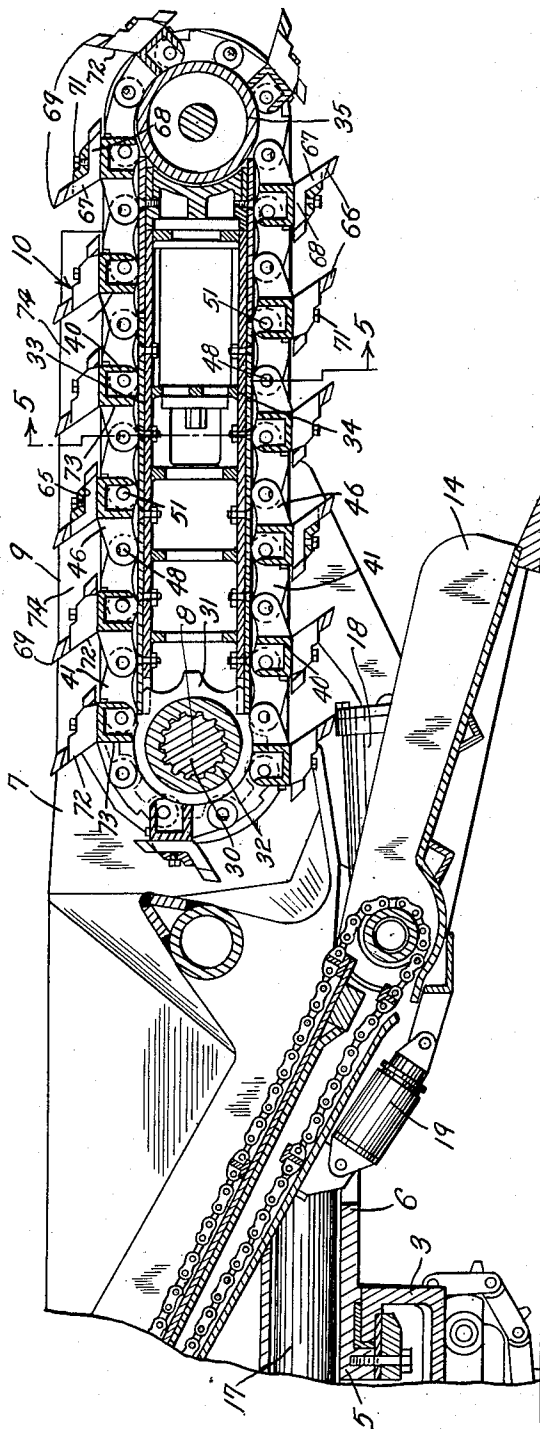
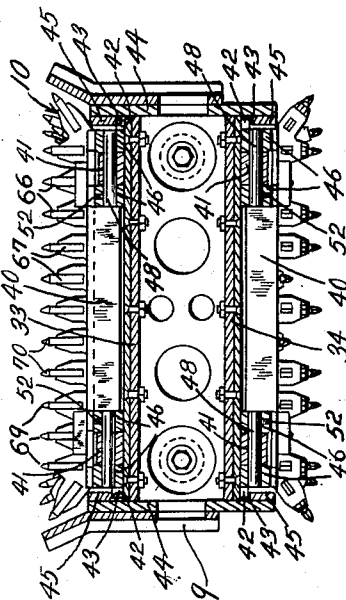


Fig. 5.



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Fig. 6.

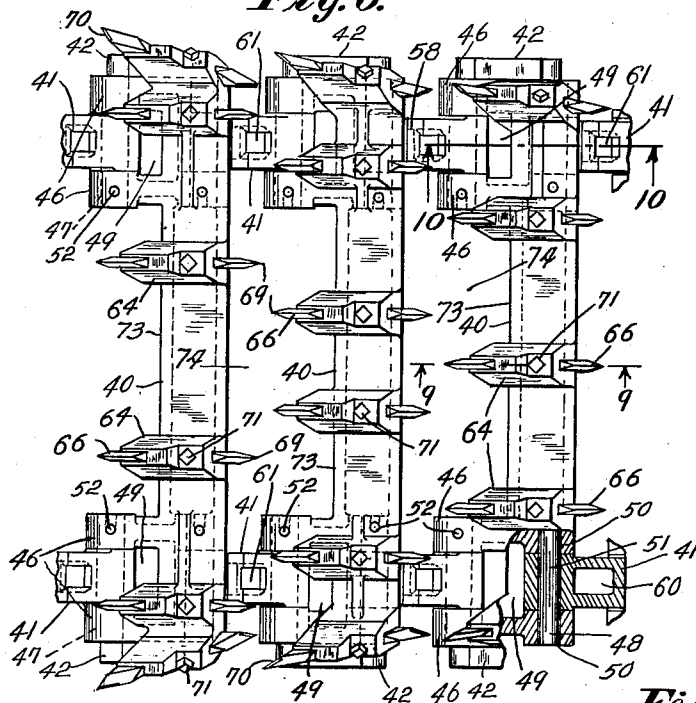


Fig. 7.

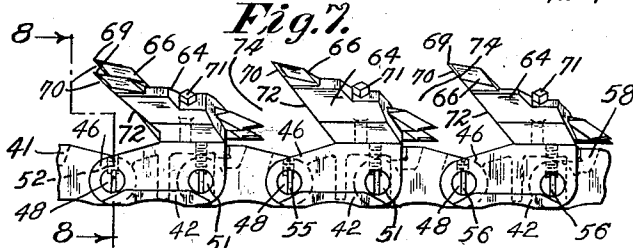


Fig. 8.

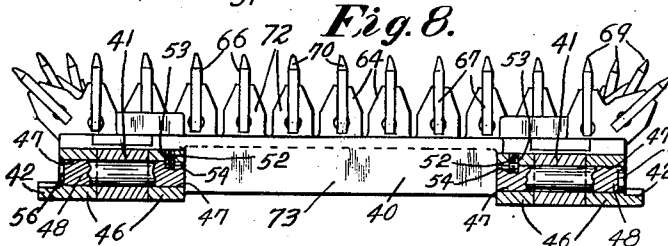


Fig. 11.

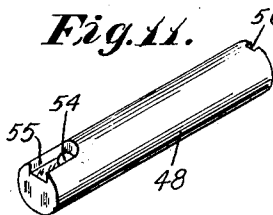


Fig. 9.

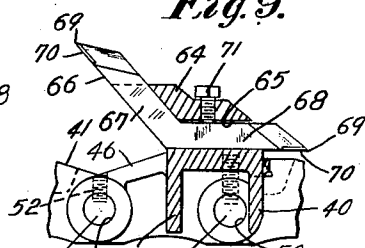
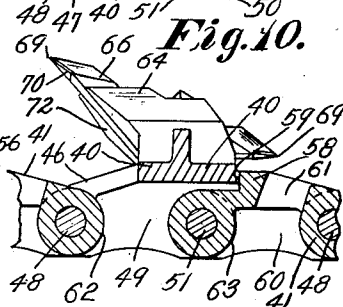


Fig. 10.



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UNITED STATES PATENT OFFICE

2,676,005

DISINTEGRATING AND GATHERING CHAIN

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Application March 29, 1949, Serial No. 84,129

11 Claims. (Cl. 262—33)

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This invention relates to mining chains and more particularly to a digging and gathering chain especially designed for use with the vein-attacking and disintegrating head of a continuous mining apparatus.

In continuous mining apparatus of a known type, a mine vein-attacking and disintegrating head serves to attack in succession a series of relatively wide, vertical segments of coal or other mineral for dislodging the latter in relatively large fragments from a solid coal seam or mine vein. The attacking and disintegrating head, as is fully disclosed in the applications above referred to, includes a vertically swingable bar structure providing guideways along which a series of parallel disintegrating chains are guided for circulation in vertical orbital paths, and these chains carry disintegrating instruments which dig into and rip or tear out the coal or other mineral as the attacking and disintegrating head is fed in a suitable manner with respect to the face of the seam or vein. The present invention contemplates improvements over known types of disintegrating chains in that it embodies both digging and gathering functions whereby the attacking and disintegrating head may be fed to effect disintegration of the solid coal or other mineral and to convey the dislodged coal or other mineral as it is dislodged, in an extremely effective manner. The disintegrating chain of the present invention is of the type which embodies cross bars or conveyor flights pivotally connected by links, and with the cross flights carrying digging instruments or teeth and traveling over the top plate on the attacking and disintegrating head, for dislodging the coal or other mineral and for conveying the disintegrated coal or other mineral rearwardly along the plate. The improved chain is extremely compact and rugged in design, and may be operated rapidly to tear away or dislodge the coal or other mineral in relatively large fragments and to convey the dislodged coal or other mineral rapidly away from the face as it is dislodged, thereby greatly expediting the mining operation.

An object of the present invention is to provide an improved mining chain especially designed for use with the attacking and disintegrating head of a continuous mining apparatus. Another object is to provide an improved digging and gathering chain whereby coal or other mineral may be rapidly dislodged in relatively large fragments from the solid and conveyed from the working face. Still another object is to provide an improved digging and gathering chain for the vein-attacking and disintegrating head of a continuous mining

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apparatus. A further object is to provide an improved disintegrating chain having transverse conveyor flights pivotally connected by side links with the conveyor flights carrying transverse rows of digging teeth, and with the teeth on certain flights staggered with respect to the teeth on others thereby to provide for proper "lacing" of the teeth to enable removal of a segment of coal or other mineral of a width substantially greater than the width of the bar structure on which the chain is guided. A still further object is to provide an improved digging and gathering chain of the endless flight type having toothed conveyor flights of improved construction together with improved pivoted link means for connecting the conveyor flights together. Another object is to provide an improved hinge pin structure for a disintegrating chain. Yet another object is to provide an improved disintegrating and gathering chain having novel features of construction. These and other objects and advantages of the invention will, however, hereinafter more fully appear as the description proceeds.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a plan view of a continuous mining apparatus, with the rearward portion broken away, in which an illustrative form of the improved disintegrating and gathering chain is embodied.

Fig. 2 is a side elevational view of the mining apparatus shown in Fig. 1.

Fig. 3 is an enlarged horizontal sectional view taken substantially on the planes of line 3—3 of Fig. 2.

Fig. 4 is an enlarged view in central longitudinal vertical section taken substantially on line 4—4 of Fig. 1, illustrating the vein-attacking and disintegrating head.

Fig. 5 is a cross sectional view taken substantially on the planes of line 5—5 of Fig. 4, illustrating structural details of the improved disintegrating and gathering chain.

Fig. 6 is an enlarged fragmentary plan view of the disintegrating and gathering chain shown in Figs. 4 and 5.

Fig. 7 is a fragmentary side elevational view of the chain shown in Fig. 6.

Fig. 8 is a cross sectional view taken substantially on line 8—8 of Fig. 7.

Fig. 9 is an enlarged detail vertical sectional view taken on line 9—9 of Fig. 6.

Fig. 10 is an enlarged detail vertical sectional view taken on line 10—10 of Fig. 6.

Fig. 11 is a perspective view of one of the hinge pins.

In this illustrative embodiment of the invention, the improved disintegrating and gathering chain is shown incorporated in a continuous mining apparatus of the type fully disclosed in the Russell and Sibley applications, Serial Nos. 102,995 and 102,996, filed on July 5, 1949, owned by the assignee of the present invention. The improved disintegrating and gathering chain is also of a type which may be associated with continuous mining apparatus such as that disclosed in an earlier filed application of Harold F. Silver, Ser. No. 11,688, filed February 27, 1948, also owned by the assignee of the present invention, and it will further be understood that the invention may be embodied in various other types of digging and disintegrating equipment.

The continuous mining apparatus shown herein is generally designated 1 and includes a mobile base 2, desirably a crawler base, having a frame 3, and swivelly mounted on the base frame at 4 to swing in horizontal planes with respect to the base is a frame 5. The swivelled frame 5 has a forwardly projecting frame portion 6 projecting in advance of the base and providing horizontal guideways on which a slidable frame 7 is guided for rectilinear horizontal movement along radial lines with respect to the swivel axis 4. Pivotally mounted at 8 on the sliding frame to swing in vertical planes with respect thereto is a frame or bar structure 9 of a vein-attacking and disintegrating head, and the improved disintegrating and gathering chain generally designated 10 is guided for circulation in a vertical orbital path above guideways on the frame structure 9. The attacking and disintegrating head may be operated to dig into and tear loose large fragments of the solid coal or other mineral from the coal seam or mine vein and the disintegrated material is moved rearwardly by the top run of the disintegrating chain and discharged onto a front conveyor 11 which conveys the disintegrated material rearwardly to discharge into a hopper 12 arranged coaxially with the swivel 4 and carried by the base frame. A rear discharge conveyor 13 removes the disintegrated material from the hopper and conveys the disintegrated material rearwardly of the apparatus to a suitable point of delivery. A gathering device or shovel 14 is carried by the sliding frame 7 beneath the attacking and disintegrating head, for cleaning up the floor in advance of the base and any loose material on the floor may be directed rearwardly by the gathering device onto the front conveyor 11.

As is fully disclosed in the above mentioned Russell and Sibley applications, hydraulic cylinder and piston devices 16, 16 mounted transversely on the base are operatively connected to the frame 5 for swinging the attacking and disintegrating head horizontally about the swivel axis 4 relative to the base. Hydraulic cylinder and piston devices 17, 17 extending longitudinally in parallelism on the swivelled frame 5 are operatively connected to the sliding frame 7 for moving the attacking and disintegrating head back and forth along the frame guideways. Hydraulic cylinder and piston devices 18 are connected between the sliding frame and the frame structure 9 for swinging the attacking and disintegrating head in vertical planes about the pivot 8. A hydraulic cylinder and piston device 19 is provided for tilting the gathering device 14. Since these cylinder and piston devices and the control

valve means therefor are fully disclosed in the above mentioned Russell and Sibley applications further description thereof is herein unnecessary.

As is also disclosed in the Russell and Sibley applications above referred to, motors 21, 21 on the swivelled frame 5 at the opposite sides of the hopper 12, are connected by self-adjusting, telescopic drive shaft connections 22 to longitudinal shafts 23 (Fig. 3) suitably journaled in gear housings 24 attached to the opposite sides of the forward portion of the sliding frame 7. Gears 25 fixed to these shafts mesh with gears 26 secured to parallel shafts likewise suitably journaled in the gear housings. Secured to these parallel shafts are worms (not shown) meshing with worm wheels 27 which drive spur gears 28 meshing with spur gears 29 keyed to the opposite ends of a transverse shaft 30, arranged with its axis in coincidence with the pivotal axis 3 of the swingable frame structure 9. A pair of chain drive sprockets 31 are keyed to the shaft 30 and engage and drive the disintegrating and gathering chain 10, to effect circulation of the latter about the guideways on the frame structure with its upper run moving rearwardly. Arranged on the shaft intermediate the chain sprockets is a spacing sleeve 32. The swingable frame or bar structure 9 includes top and bottom plates 33 and 34 and carried at the outer end of the frame structure is a guide roller 35, and the disintegrating chain is guided along these plates and about the guiding roller. Since the driving means for the disintegrating chain and bar structure are fully disclosed in the Russell and Sibley applications further description thereof is herein unnecessary.

Referring to the detail structure of the improved disintegrating and gathering chain it will be observed that transverse conveyor flights or cross bars 40 are pivotally connected together near their outer ends by strap links 41, and the flights have lateral gibs 42 which are slidably received in guideways 43 at the sides of the bar structure 9. The bar structure includes vertical side plates 44 (Fig. 5) to which the top and bottom plates 33 and 34 are secured, and guide strips 45 are fixed to the inner sides of these side plates to provide the guideways 43. The transverse conveyor flights or cross bars have at their ends laterally spaced front lugs 46 formed with aligned openings 47 which receive front hinge pins 48, and the rear ends of the strap links 41 project between these lugs and pivotally engage the hinge pins. The conveyor flights also have pockets 49 in their end portions for receiving the teeth of the drive sprockets, and the side walls of these pockets have aligned openings 50 for receiving rear hinge pins 51 which traverse the pockets in parallelism with the front hinge pins. The strap links 41 project at their front ends into the pockets and pivotally engage the rear hinge pins. Set screws 52 threaded within openings 53 in the inner lugs 46 and inner pocket walls, project into apertures 54 in the hinge pins for securing the latter against axial displacement in the lug openings. The hinge pins are longitudinally slotted at 55 at their inner ends on their exterior peripheries and are formed at their outer ends with transverse slots 56. When it is desired to remove the hinge pins the set screws 52 may be turned outwardly from the apertures 54 so that the pins may be driven out with the projecting ends of the set screws passing through the slots 55. Upon

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assembly the hinge pins may be inserted inwardly and as they are inserted they may be turned by a suitable instrument received in the end slots 56 to bring the longitudinal slots 55 into alignment with the projecting ends of the set screws, and when the hinge pins are properly positioned the set screws may be adjusted inwardly to bring their inner ends into the apertures 54 to lock the pins in position. The strap links 41 have outward projections 58 with which the rear surfaces of the cross flights 40 abut at 59, to provide a stiff back chain structure, thereby avoiding inward bending of the chain. The strap links 41 have pockets 60 opening through their bottom surfaces and openings 61 extend through the outer surfaces of the links and communicate with the pockets 60 for discharging any dirt collected in the link-pockets. The teeth of the drive sprockets 31 project into the pockets 49 and 60 in the flights and strap links and engage curved rearward surfaces 62 and 63 on the strap links to effect driving of the chain. The end portions of the cross flights 40 are of generally inverted T-shape in cross section (Fig. 10) while the intermediate portion is of channel shape or inverted U-shape cross section (Fig. 9), and the legs of the latter run close to the top surface of the top plate of the head structure, to move the disintegrated material rearwardly along the top plate. The cross bars or flights have at their outer surfaces laterally spaced lugs 64 formed with longitudinal sockets 65 opening through the front and rear ends of the lugs (Fig. 9). A double ended, reversible digging bit or tooth 66 has a body formed by relatively inclined portions 67 and 68 disposed at an obtuse angle and terminating in disintegrating or digging points 69 at the opposite extremities of the bit. The front faces of the disintegrating or digging points are protected by hard facing material or hard metal inserts 70 for resisting wear. The cutter bit is reversible and for end to present either digging point to the work and either portion of the bit body is receivable in the lug sockets, and set screws 71, threaded in top openings 72 in the lugs, are adjustable into engagement with the inactive bit portions received in the lug sockets for securing the teeth in position on the cross flights with the active digging points projecting forwardly and outwardly from the lugs in the manner shown. The bit supporting lugs are so arranged on different conveyor flights that a desired staggered relation of the bits on the chain is provided. When one digging point of a bit becomes dull the set screw 71 may be released and the bit be withdrawn from the lug socket, and the bit may then be reversed end for end and reinserted in the lug socket and again secured in position by the set screw 71. The plane front faces of the active portions of the bits lie flush with the forward plane surfaces 72 of the lugs and the latter are inclined forwardly and outwardly at a substantial angle with respect to the front surfaces 73 of the flights to provide material receiving pockets 74 of substantial area intermediate the flights in advance and inwardly of the tooth-carrying-lugs.

The digging and gathering chain during use is rapidly circulated about its guideways on the swingable frame or bar structure 9 and cross flights of the top run of the chain move rearwardly along the flat outer surface of the top plate 33 to convey the disintegrated material rearwardly as it is dislodged from the solid coal

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seam or mine vein, and the tips of the digging teeth as the conveyor flights move rectilinearly along the top plate lie substantially in a common transverse plane to provide what is known as a "table top" arrangement of the teeth. The digging teeth move in a curved path as they pass around the roller 35 at the outer end of the bar structure and then move rearwardly along a rectilinear path so that as the chain is fed into the coal or other mineral the latter is rapidly dislodged in relatively large fragments in an extremely efficient manner. The cross flights and the lugs and teeth are so arranged that substantial spaces or pockets for disintegrated material are provided between the flights, so that large quantities, and even large lumps, of material may be conveyed rearwardly along the top plate.

As a result of this invention an improved mining chain is provided which is rugged and compact in design and which is extremely efficient in operation. By the provision of the cross conveyor flights which carry the transverse rows of digging teeth the material is effectively dislodged in relatively large fragments and is conveyed by the cross flights rearwardly away from the working face. The novel structure of the cross flights and the strap links and the novel arrangement of the digging teeth on the cross flights results in a digging and gathering chain which is simple and rugged in design. By pivotally connecting the toothed conveyor flights at their outer ends to strap links and by driving the chain by engagement of the sprocket teeth with the strap links, driving of the chain is effected in an improved manner. The novel relation of the cross flights and strap links and the associated hinge pins results in an improved pivot structure between the cross flights. Other advantages of the invention will be clearly apparent to those skilled in the art.

While there is in the application specifically described one form which the invention may assume in practice, it will be understood that this form is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A digging and gathering chain of the endless flight type guided for orbital movement with its top run movable along a plane surface to convey material therealong, comprising a series of narrow, elongated, cross flights spaced apart longitudinally of the chain, each flight carrying a transverse row of digging teeth projecting from the outer surface thereof including a series of intermediate teeth and laterally inclined end teeth projecting laterally beyond the ends of the flight, the teeth on each flight being staggered with respect to the teeth of oppositely adjacent flights, said flights each having lugs at its opposite ends projecting longitudinally of the chain from one side thereof near the bottom of the chain, said lugs providing aligned apertures for receiving a transverse hinge pin, one hinge pin near each end of each flight, and strap links for connecting said cross flights together with each link pivotally connected to each cross flight and pivotally engaging said hinge pins at the opposite ends of said flights, said lugs and said strap links as said chain circulates orbitally moving over the plane surface and serving to support

said flights with the lower surfaces of said flights disposed in adjacency to the bottoms of said lugs and strap links and to said plane surface.

2. A digging and gathering chain as set forth in claim 1 wherein said cross flights near their ends have pockets formed between said lugs for receiving the teeth of drive sprockets with the sprocket teeth drivingly engaging the rear ends of said strap links to effect drive of said chain only at its opposite sides at the ends of said cross flights.

3. A digging and gathering chain as set forth in claim 1 wherein said digging teeth are carried by a spaced row of lugs which are secured to the outer surfaces of said cross flights and project outwardly therefrom, said lugs having forward plane surfaces which are inclined forwardly and outwardly at a substantial angle with respect to the front surfaces of said flights to provide pockets of substantial area intermediate said flights in advance of said tooth carrying lugs.

4. A digging and gathering chain as set forth in claim 1 wherein said spaced lugs at the ends of said flights extend forwardly from each end portion of each flight with said strap links having their rearward portions projecting rearwardly between said lugs and said pockets between said lugs arranged rearwardly of each strap link to expose the rear ends of the strap links for contact with the sprocket teeth whereby the latter may drivingly engage the rear ends of said strap links.

5. A digging and gathering chain as set forth in claim 4 wherein said strip links also have pockets for receiving the teeth of the drive sprockets with the sprocket teeth engaging the rearwardly facing surfaces of the front walls of said link-pockets.

6. A digging and gathering chain of the endless flight type guided for orbital circulation about a guide bar structure with the top run of the chain movable along a plane surface to convey material therealong, comprising a series of narrow elongated conveyor flights spaced apart longitudinally of the chain, each flight carrying a transverse row of digging teeth with the teeth on each flight being staggered with respect to the teeth on oppositely adjacent flights, the outer teeth at the ends of said cross flights being inclined laterally beyond the ends of said flights to permit complete disintegration of a segment of solid material to provide an opening of a width sufficiently wide to receive the guide bar structure, each flight having at its ends articulated connections with adjacent flights and each end connection moving along the plane surface and providing guiding supports for said cross flights with the bottoms of said flights lying in close adjacency to the bottoms of said end connections and said plane surface, said end connections engageable by the teeth of drive sprockets to effect drive of the chain only at the sides thereof at the ends of said cross flights.

7. A digging and gathering chain as set forth in claim 6 wherein said end connections comprise spaced inner and outer lugs at the ends of each flight and carrying hinge pins for engage-

ment with strap links, and the laterally inclined end teeth of said transverse row on each flight inclined laterally beyond the outer sides of the outer lugs beyond the sides of said plane surface.

8. A digging and gathering chain as set forth in claim 7 wherein said outermost lugs at the ends of each flight are formed with lateral gibs adapted for guided reception in lateral guideways on said guide bar structure at the outer sides of said plane surface.

9. A digging and gathering chain of the endless flight type guided for orbital movement with its top run moving along a plane surface to convey material therealong, comprising a series of narrow, elongated, cross flights spaced apart longitudinally of the chain, each flight carrying a transverse row of digging teeth projecting from the outer surface thereof, said flights having a spaced row of projecting lugs by which said teeth are carried, said lugs having forward plane surfaces which are inclined forwardly and outwardly at a substantial angle with respect to the front surfaces of said flights to provide large material receiving pockets of substantial area intermediate said flights in advance and inwardly of said tooth-carrying lugs, the teeth on the lugs of each flight being staggered with respect to the teeth of oppositely adjacent flights.

10. A digging and gathering chain as set forth in claim 9 wherein the teeth have forward plane faces which lie flush with said forward plane surfaces of said lugs, and the digging points of the teeth project outwardly beyond the outer surfaces of said lugs.

11. A digging and gathering chain as set forth in claim 9 wherein the outer lugs at the ends of said flights are laterally inclined outwardly beyond the ends of said flights to locate the digging points of said teeth carried thereby laterally beyond the outer sides of the plane surface over which the material is conveyed.

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