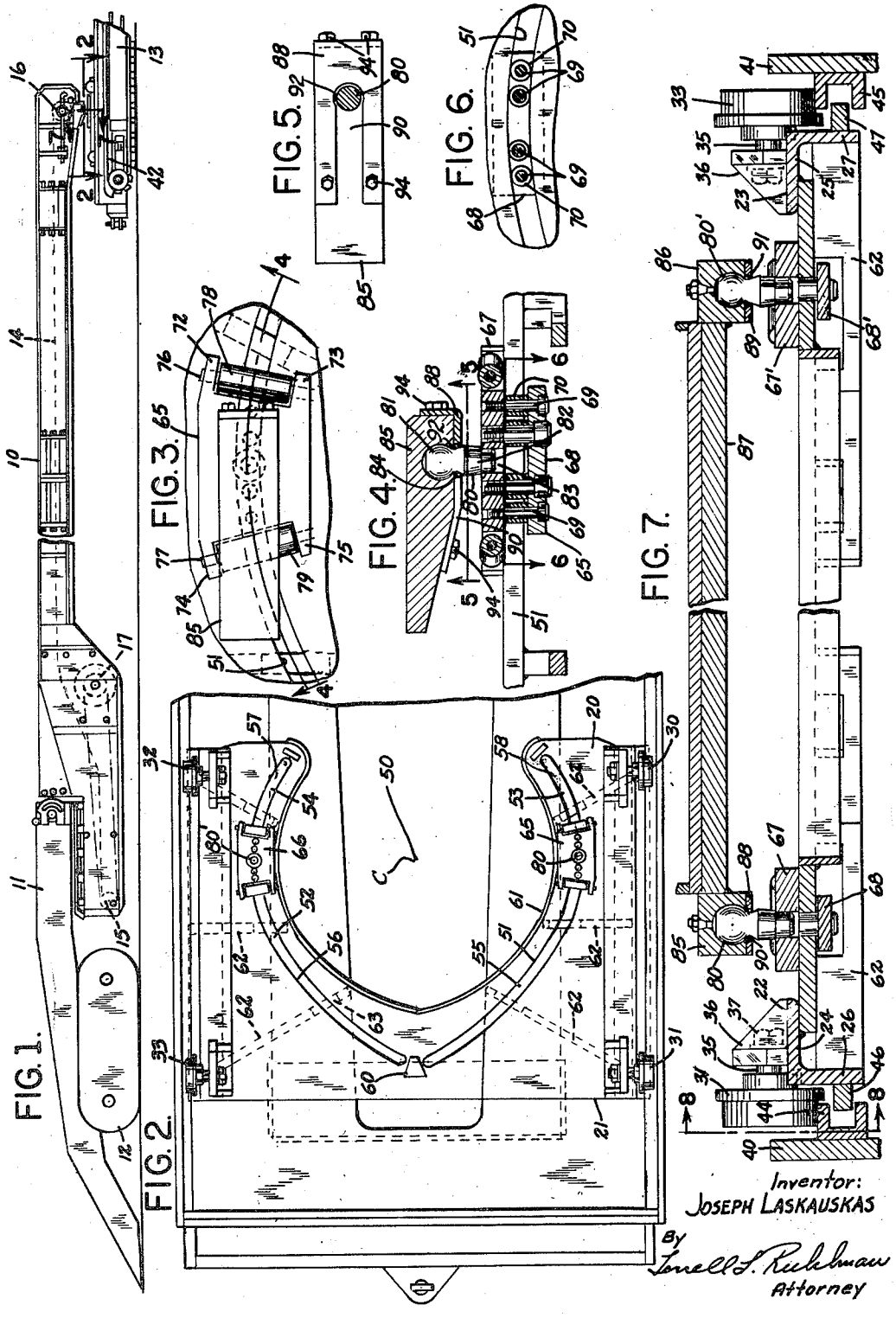
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SWIVEL COUPLING

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SWIVEL COUPLING

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FIG. 8.

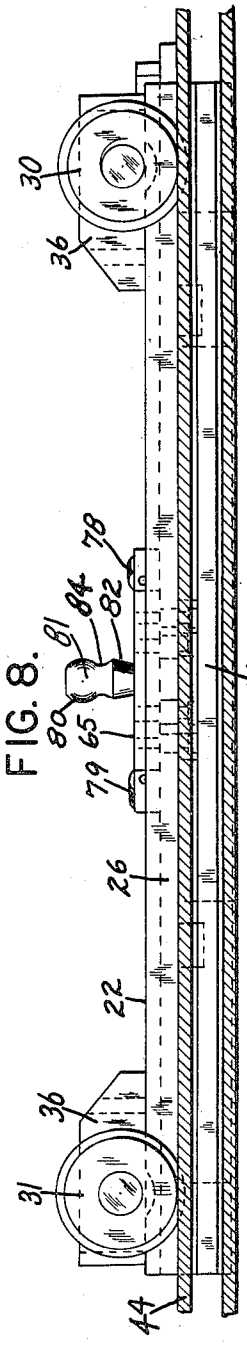


FIG. 10.

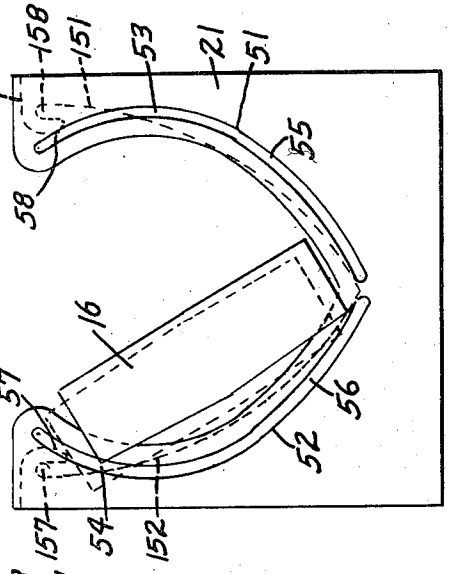
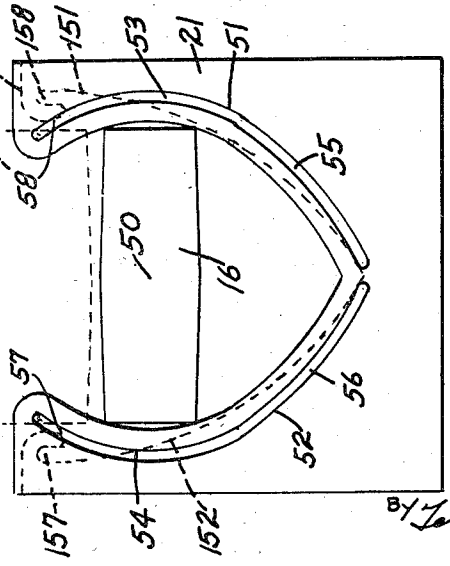


FIG. 9.



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SWIVEL COUPLING

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18 Claims. (Cl. 198—95)

This invention relates to swivel couplings and more particularly to a swivel joint for connecting for swinging movement elements of a conveying system which are disposed one above the other.

In mining operations and particularly underground mining operations where the material being mined is moved from the mine face to a point more remote therefrom by means of a conveying system including a series of conveyors and/or mining and loading mechanisms, it is necessary to have free swinging movement between these elements of the conveying system to effect the necessary maneuverability in the mine. The present invention relates more specifically to an improved swivel joint between certain elements of a conveying system whereby such free swinging movement can be effected in a more practical and efficient manner.

As a general rule in conveying systems wherein a mineral is being conveyed from a point in adjacency to a mineral face to a point more remote therefrom and where the mineral is being discharged from a mining machine or a loader onto a bridge conveyor and finally onto a further conveyor, it is desirable to secure the bridge conveyor to the other elements of the conveying system in such a manner that there is possible relative longitudinal movement as well as relative swinging movement between the bridge conveyor and at least some of the other elements of the system. Such an arrangement is desirable, particularly in order to eliminate the necessity of having to move the conveyor onto which the bridge conveyor discharges material, for each new position of the miner or loader. Such movements are generally laborious and time consuming and thus costly. Swivel couplings which permit swinging movement between elements of a conveying system have been developed previously and are now in use in which transversely spaced guide members carried by an element of a conveying system coact with arcuate guideways on the other element of the conveying system to which the first element is to be connected. In these prior devices the guideways are made with a constant radius of curvature from end-to-end, but are struck from different centers, with the result that the swing of one element relative to the other is about a fixed axis throughout the swinging movement in one direction from a position of longitudinal alignment to the full extent of the swinging movement in that direction. The present invention is directed to a swivel joint in which swinging movement may take place within a shorter longitudinal space by reason of the guideways each comprising a plurality of arcuate portions, successive ones of which have different length radii. In this manner it is possible to effect the same degree of swinging movement between the elements of the conveying system and at the same time swing them more sharply, i. e. through the same angle, however over a shorter longitudinal distance. In effect therefore, the conveying elements may be made shorter in length with the same effective discharge area as the prior known devices of the

conveying elements may be made of the same length to provide a greater effective discharge area and thus minimize the number of movements of the main or room conveyor onto which the bridging conveyor discharges material.

It is a primary object of the present invention to provide an improved swivel joint which is not only low in overall height and rugged and durable in construction, but also permits greater maneuverability. It is a more specific object of the present invention to provide an improved swivel coupling which will permit a greater effective discharge area between the elements of the conveying system than would conventional couplings of this general type of like length and/or decrease the required overall length of a connecting conveyor while effecting the same effective discharge area between the elements. It is a still more specific object of the invention to provide an improved swivel coupling of this general type in which the guideways, which in part control the swinging movement between the elements, each comprise end-to-end arcuate portions, successive ones of which have different length radii, to thus effect successive swinging movements in either direction between the elements about a plurality of different axes.

In a preferred embodiment of the invention a guide plate is secured for longitudinal movement to one element of a conveying system and is cut away to provide a pair of elongated guideways which curve inwardly toward a point of intersection. The guide ways are formed in such a manner that each comprises a pair of end-to-end arcuate portions, the radius of one being desirably approximately twice the radius of the other. For guiding coaction with the guideways there is provided a pair of transversely spaced guide means pivotally secured to the conveyor element which is to be coupled with the first mentioned conveyor element, which guide means comprise upper and lower plates respectively partially overlying and partially underlying the guide plate adjacent the guideways. The plates are held together by means of a plurality of members extending between the plates and positioned within the guideways, desirably with anti-friction means such as rollers carried at each end of the upper plates spanning said guideways and engageable for rolling contact with the upper surface of the guide plate, at least when the guide means are to transmit downwardly the weight of the conveyor element to which they are secured. Upstanding pivot elements are rigidly fixed one to each of the upper plates of the guide means with the other of the conveyor elements having means for loosely securing it to the pivot pins for swinging movement thereabout. The guide means are positioned in such a manner that, when the conveyor elements are in longitudinal alignment, they (the guide means) are bisected by an upright plane generally bisecting the smaller-radii arcuate portions of said guideways. As the conveyor elements are swung relative to each other from this position of longitudinal alignment, pivoting takes place about the common axis of the smaller-radii portions of the guideways, with the result that each of the guide means travels along its respective guideway. As the conveyor elements continue to swing, one of said guide means abuts the end of its guideway and is held there as pivoting now takes place about, the upstanding pivot element carried by the latter guide means while the other guide means then moves along its associated guideway of longer radius.

Other objects and advantages will be apparent from the following more detailed description of the invention when read in conjunction with the attached drawings in which:

Fig. 1 is a side elevational view showing a bridge

conveyor connected between the delivery end of a loading machine and a main conveyor, the latter connection being effected by means of a swivel coupling made according to the present invention;

Fig. 2 is a horizontal transverse sectional view taken on the plane of line 2—2 on Fig. 1 however on a larger scale;

Fig. 3 is a plan view of one of the guide means of the present coupling;

Fig. 4 is a vertical sectional view taken on the plane of line 4—4 on Fig. 3;

Fig. 5 is a horizontal sectional view taken on the plane of line 5—5 on Fig. 4;

Fig. 6 is a similar view taken on the plane of line 6—6 on Fig. 4;

Fig. 7 is a transverse vertical sectional view taken on the plane of line 7—7 on Fig. 1;

Fig. 8 is a vertical sectional view taken on the plane of line 8—8 of Fig. 7;

Fig. 9 is a plan view of the guide plate with the tail pulley of the bridge conveyor illustrated, a guide plate and tail pulley of a conventional swivel coupling being shown superimposed thereon in broken lines, for purposes of comparison; and

Fig. 10 is a similar view showing the parts in a different position.

Referring now specifically to the drawings, there is illustrated in Fig. 1 a bridge conveyor designated generally by the reference numeral 10 secured between the delivery conveyor 11 of a loading machine 12 and a main or room conveyor 13. The bridge conveyor is of a conventional type in which a belt or chain 14 extends around a front pulley 15 and tail pulley 16 and is driven by means of a conventional chain drive mechanism 17. Although the swivel coupling of the invention is illustrated as connecting the delivery end of the bridge conveyor to the room conveyor, it will be understood that the coupling of the present invention is not limited to such an application but could as readily be used between the loader and the receiving end of the bridge conveyor, and to connect elements in other types of conveying systems wherein it is desirable and/or necessary to have free swinging movement between the elements.

Referring now to the swivel coupling of the present invention per se, a guide plate 21 forms a part of a dolly 20 which is mounted for longitudinal movement along the upper portion of the conveyor 13. A pair of elongated longitudinally extending angular members 22 and 23 having horizontal portions 24 and 25 and vertical portions 26 and 27 respectively are secured, as shown, to the upper surface of the guide plate 21, one on each side thereof by means of welding or the like. Mounted adjacent the ends of the angular supporting members 22 and 23 are pairs of wheels 30, 31 and 32, 33 respectively. Each of these wheels is journaled for free rotation on a stub shaft 35 the inner ends of which are secured to flanges 36 by means of lock nuts 37, the flanges in turn being secured in any conventional manner to the upper surface of the horizontal portions 24 and 25 of the angular supporting plates.

The frame of the conveyor 13 includes a pair of longitudinally extending side plates 40 and 41. A pair of mutually facing channel members 44 and 45 also extend longitudinally of the tail conveyor and are secured by welding or the like to the inner side surfaces of the plates 40 and 41. A pair of ribs 46 and 47 which extend the length of the dolly 20 are also secured in any conventional manner to the outer side surfaces of the vertical legs 26 and 27 respectively of the angular supporting members 22 and 23. The channel members 44 and 45 thus serve the dual purpose of providing a trackway for the dolly wheels as well as a guideway in which the ribs 46 and 47 can be positioned for the purpose of preventing vertical displacement of the dolly with respect to the tail conveyor.

Plate 21 has a generally circular cut-out portion, the center axis 50 of which lies intermediate the ends of the plate and less than a radius length from one end of the plate to thus provide an opening in one end of the plate. Plate 21 is also cut away to provide a pair of guideways 51 and 52 which extend from a point adjacent the open end of the plate and are curved toward a point of intersection but desirably do not quite reach. The rearward portions 53 and 54 of the guideways are struck from a common center C which may desirably coincide with the center 50, while the forward guideway portions 55 and 56 are struck respectively from points 57 and 58 which may desirably be located midway between the sides of guideway portions 54 and 53 adjacent their forward ends. It will be noted that the radii of guideway portions 55 and 56 are, as shown, about twice the length of the radii of guideway portions 53 and 54, for purposes which will be explained in detail hereinafter.

A stop member 60 which is secured to the upper surface of plate 21 is positioned between the ends of the arcuate portions 55 and 56 of the guideways to provide a limiting means for motion along the guides as will also be explained hereinafter. Also secured to the guide plate 21 is a reinforcing rib 61 which extends throughout the periphery of the plate portion surrounding the aforementioned generally circular cut out. A plurality of strengthening ribs 62 are also secured to the under surface of the guide plate and are cut away at 63 adjacent the guideways 51 and 52 to allow free passage of the guide means which coact with the guideways and which will now be described.

As each of the guide means 65 and 66 are identical, only one will be described in detail, the other bearing, for identification purposes, the same reference numerals, however with the addition of a prime. Guide means 65 comprises an upper plate 67 and a lower plate 68, see particularly Fig. 4, which partially overlie and underlie plate 21 adjacent guideway 51. The plates are held together by means of a plurality of threaded members 69 which extend through the guideway 51, with sleeves 70 carried by these threaded members engageable with the walls of the guideway. The upper plate 67 is bifurcated at each end to provide a pair of supporting arms 72, 73 and 74, 75 in which are journaled shafts 76 and 77 carrying rollers 78 and 79 respectively, the latter spanning the guideway 51 and rolling freely along the upper surface of plate 21.

A pivot pin 80 having a generally spherical or ball shaped upper end portion 81, a tapered lower portion 82 and an intermediate neck portion 84 of reduced diameter is secured in an aperture 83 in the upper plate 67 intermediate the center tie members 69. The structure for securing the delivery end of the bridge conveyor to the dolly 20, as seen best in Figs. 4, 5 and 7, includes a pair of supporting blocks 85 and 86 secured as by welding to a cross bar 87 which forms a part of the conventional frame structure of the bridge conveyor. Angular shaped supporting plates 88 and 89 having longitudinal extending slots 90 and 91 opening at one end of the plates and terminating intermediate the ends thereof in generally circular openings 92 only one of which is shown in the drawings, are adapted to be secured to the respective blocks 85 and 86 by means of threaded elements 94. The bridge conveyor is therefore readily securable to the dolly which rides along the upper surface of the tail conveyor by first sliding the plates 88 and 89 over the reduced neck portions 84 and 84' of the pivot pins 80 and 80' and then securing the plates to the supporting blocks by means of the aforementioned threaded elements 94 and 94'. The bridge conveyor is mounted for free pivotal movement about the upstanding pins 80 and 80' which are carried by the tail pulley dolly. It might also be pointed out that the circular openings 92 in which the upstanding pins 80 and 80' are positioned, lie, as illustrated in Fig. 1, substantially in a vertical plane in which the axis of the tail pulley 16

lies, with the result that pivotal movement of the bridge conveyor takes place about a rearwardmost point on the latter conveyor.

The actual swinging movement of the bridge conveyor with respect to the room conveyor can be seen by referring to Fig. 2. With the bridge conveyor and the tail conveyor in longitudinal alignment, the guide means **65** and **66** are positioned intermediate the ends of the smaller radii portions **53** and **54** of the guideways. As the bridge conveyor is swung in a clockwise direction, as viewed in Fig. 2, the swinging movement of the bridge conveyor will take place about the axis C, with the guide means **65** and **66** moving along the respective guideways **52** and **51** until the guide means **66** abuts the rearward closed end of guideway **54** and the axis of the pivot **80'** is in coincidence with the pivot **57**, at which time the bridge conveyor and the supporting block **86** will begin to pivot about the pivot pin **80'** which is carried by the guide means **66**. At the same time guide means **65** enters and moves along the arcuate guideway portion **55** until it reaches the closed forward end of the latter guideway at which time it is in abutting relation with the limiting member **60**. At this time the bridge conveyor has reached its full pivotal movement in the aforementioned direction.

As the bridge conveyor begins to swing in a counter-clockwise direction, as viewed in Fig. 2, guide means **65** will move rearwardly along guideway **55** with pivoting still taking place about pivot pin **80'** of the guide means **66** which is held initially in its last mentioned position against the rearward closed end of guideway **54**. As guide means **65** approaches the position shown in Fig. 2 and reaches the forward extremity of the arcuate portion **53** of guideway **51**, guide means **66** will begin to move forwardly along the guideway as guide means **65** continues moving rearward until the conveying elements are in their longitudinally aligned position, at which time the guide means **65** and **66** will be in the position shown in Fig. 2.

As the bridge conveyor continues to swing in a counter-clockwise direction about axis **50**, guide means **66** will continue to move forwardly and guide means **65** will continue to move rearwardly. When guide means **65** is at the end of its rearward movement and in engagement with the closed rearward end of guideway **53** and the axis of the pivot **80** is in coincidence with the pivot **58**, the bridge conveyor and supporting block **65** will begin to pivot about the pivot pin **80** carried by the guide means **65** while the guide means **66** will continue to move forwardly along the guideway **56**, this latter condition continuing until the guide means **66** reaches the closed forward end of guideway **56** and the limiting stop **60** at which time the bridge conveyor has been swung through its full extent in a counter-clockwise direction relative to the tail conveyor. As the bridge conveyor again begins to swing clockwise, as viewed in Fig. 2, the guide means **66** will move rearwardly along the guideway **52** with pivoting taking place about pivot pin **80** until the guide means **66** approaches the forward extremity of arcuate portion **54** of guideway **52** at which time pivotal movement will again take place about axis C, with the result that guide means **65** will begin to move forwardly as guide means **66** continues to move rearwardly toward the position in which they are shown in Fig. 2, at which point the conveying elements are longitudinally aligned.

For purposes of illustrating several advantages of the swivel coupling of the present invention over conventional swivel couplings of this general type there is illustrated in Figs. 9 and 10 in superimposed positions, in full line, the guide plate of the present invention along with the tail pulley of the bridge conveyor and in broken lines a guide plate of the prior known type swivel coupling provided with guideways of approximately the same length along with a tail pulley of a conveying element associated with this latter coupling. In Fig. 9 the parts are shown with the conveying elements in longitudinal alignment while in Fig. 10 the parts are shown with the elements swung relative to each other to their full extent of swing in one direction.

As will be known to those familiar with swivel couplings of this general type, in the conventional coupling the guide plate **121** is cut away to provide a pair of arcuate guide surfaces or guideways **151** and **152**, as the case may be, each conforming to a single arc and in the illustrated form be struck about points **157** and **158** respectively adjacent the rearward end of the opposite guideways. The guide means which are adapted to slide along the guideways **151** and **152** lie in a plane which extends through the rotational axis of the tail pulley **116** with the result that when the conveying elements are in longitudinal alignment the guide means are positioned adjacent the rearward end of their respective guideways. As the bridge conveyor begins to swing in a clockwise direction, as viewed in Fig. 9, the guide means which is associated with guideway **152** will be held against the rearward end of guideway **152** as the other guide means swings forwardly along guideway **151**. On the other hand, if the bridge conveyor begins to swing in a counter-clockwise direction, as viewed in Fig. 9, the guide means associated with guideway **151** will be held against the rearward end of the guideway **151** as the other guide means slides forwardly along its guideway **152**. As previously pointed out, the guide means in the present invention also lie in a plane through the rotational axis of the tail pulley of the bridge conveyor and when the bridge conveyor and tail conveyor are in longitudinal alignment the plane through the rotational axis of the tail pulley will also approximately bisect the guideway portions **53** and **54** of shorter radii. As also aforementioned, as the conveyor elements are swung relative to each other rotational movement first takes place about the axis **50** and then the pivotal axis switches to point **57** or point **58** depending upon the direction of swing.

As will be appreciated by those familiar with the use of conveying systems, the materials being discharged from one element, such as the bridge conveyor in the present illustration, are discharged toward the rearward end or the open end of the dolly guide plate, through the opening in said plate, and onto the tail conveyor which travels therebelow. Looking then at Fig. 9, it can be seen that when the conveying elements are in longitudinal alignment, the tail pulley **16** in the present invention over which the material is discharged is positioned a substantial distance forwardly, i. e. toward the lower end as viewed in Fig. 9 to thus discharge the materials onto the other conveying element, such as the tail conveyor in the present illustration, at a point very near the receiving end thereof, i. e. at the end of the conveyor which is closer to the bridge conveyor. In the prior known swivel assembly, however, as can be seen from Fig. 9, the tail pulley is so positioned that the material is discharged over the tail pulley **116** farther toward the discharge end of the tail conveyor. It can be seen therefore, particularly from the illustration in Fig. 9, that since the conveying element onto which the bridge conveyor is discharging can be moved farther away from the bridge conveyor each time the former is moved, by using the present swivel coupling rather than the conventional coupling, the bridge conveyor can be moved longitudinally with respect to the tail conveyor over a greater distance to thereby obviate the need for moving the tail conveyor as often as with the conventional type swivel coupling. In actual practice the advantage distance-wise is approximately a foot and taking into consideration the possible use of a similar coupling between the receiving end of the bridge conveyor and the loader or miner from which material is discharged to the bridge conveyor, a distance advantage of approximately two feet is realized. Those skilled in the art will therefore readily realize that with the added effective discharge area between the conveying elements, a more efficient system is clearly realized. In the alter-

native the length of the bridge conveyor could be cut down by about two feet and the same effective discharge area realized as with the conventional type swivel coupling.

Fig. 10 shows the positions of the tail pulleys 16 and 116 when the bridge conveyor has swung in one direction, clockwise as shown in the figure, to its full extent. It can be seen therefore that the tail pulleys are in almost identical positions with respect to the opening in the dolly plate and for all practical purposes no loss of discharge area over that present in the conventional coupling results when the present coupling is used and the elements are swung relative to one another.

From the foregoing description of the illustrated swivel coupling of the present invention it is apparent that I have provided a swivel coupling, for connecting for swinging movement about upright axes, elements of a conveying system which are disposed one above the other to provide not only a rugged and durable connection between these elements but also one which is more efficient from the standpoint of maneuverability and from the standpoint of minimizing the time loss in moving the conveying elements from place to place.

What I claim is:

1. A swivel joint for connecting for swinging movement of wide angular range about upright axes, elements of a conveying system which are disposed one above the other, said joint comprising a guide plate secured to one of said elements and having a pair of elongated guideways in fixed relation thereto, said guideways being curved toward a point of intersection and each including a plurality of end-to-end arcuate portions, the radii of successive portions of each guideway being of different lengths, transversely spaced guide means one positioned for coaction with each of said guideways, and means for pivotally securing the other of said elements to said guide means, the guide means about which pivoting takes place during at least a portion of the relative swinging movements of said elements being held against one end of its associated guideway by the coaction of the other guide means and guideway.

2. A swivel joint for connecting for swinging movement of wide angular range about upright axes, elements of a conveying system which are disposed one above the other, said joint comprising a guide plate secured to one of said elements and having a pair of elongated guideways in fixed relation thereto, said guideways being curved toward a point of intersection and each including a pair of end-to-end arcuate portions of different length radii, transversely spaced guide means one positioned for coaction with each of said guideways, and means for pivotally securing said other element to said guide means, the guide means about which pivoting takes place during at least a portion of the relative swinging movement of said elements being held against one end of its associated guideway by the coaction of the other guide means and guideway.

3. A swivel joint as set forth in claim 2 in which the radius of one said arcuate portions in each pair is approximately twice the length of the radius of the other arcuate portion.

4. A swivel joint as set forth in claim 2 in which said pivotal securing means comprises pivot elements one rigidly secured to each of said transversely spaced guide means and having its longitudinal axis generally perpendicular to path of travel of the guide means.

5. A swivel joint as set forth in claim 2 in which said transversely spaced guide means are provided with antifriction means, the latter means engaging a surface of said plate adjacent said guideways.

6. A swivel joint as set forth in claim 5 in which said transversely spaced guide means include an upper and lower plate respectively partially overlying and partially underlying said guide plate and said antifriction means includes at least one roller carried by one of said plates and engageable for rolling contact with said guide plate.

7. A swivel joint as set forth in claim 6 with means extending through said guideways for securing said upper and lower plates together, and a pair of rollers mounted on said upper plate for rolling engagement with the upper surface of said guide plate.

8. A swivel joint for connecting for swinging movement of wide angular range about upright axes, elements of a conveying system which are disposed one above the other, said joint comprising a guide plate secured to one of said elements and having a pair of elongated guideways in fixed relation thereto, said guideways being curved toward a point of intersection, transversely spaced guide means one positioned for coaction with each of said guideways, said guide means including spaced upper and lower plates respectively overlying and underlying said plate and having means extending therebetween for coaction with said guideways, antifriction means carried by one of said guide means and engageable with said plate, and pivot elements, one rigidly secured to each of said guide means for pivotally securing said other element to said guide means, both guide means being movable simultaneously along a portion of their associated guideways during a portion of the swinging movement of said elements and the guide means about which pivoting is taking place along another portion of their associated guideways during another portion of the relative swinging movement of said elements being held against one end of its associated guideway by the coaction of the other guide means and guideway.

9. A swivel joint as set forth in claim 8 in which said guideways include a plurality of end-to-end arcuate portions, the radii of each successive portion being of a different length.

10. A swivel joint as set forth in claim 8 in which said guideways include pairs of end-to-end arcuate portions the radius of one of which is approximately twice the length of the radius of the other.

11. A swivel joint as set forth in claim 1 in which said guideways include pairs of end-to-end arcuate portions the radius of one of which is approximately twice the length of the radius of the other.

12. A swivel joint for connecting for swinging movement of wide angular range about upright axes, elements of a conveying system which are disposed one above the other, said joint comprising a guide plate secured to one of said elements and having a pair of elongated guideways in fixed relation thereto, said guideways being curved toward a point of intersection and each including a pair of end-to-end arcuate portions having different length radii, a pair of transversely spaced guide means pivotally secured to the other of said elements, one positioned for coaction with each of said guideways and lying intermediate the ends of said guideways when said elements are longitudinally aligned, said guide means being movable simultaneously in opposite directions along their respective guideways during at least a portion of the swinging movement of said elements relative to each other.

13. A swivel joint as set forth in claim 12 with means for limiting the swinging movement of one of said guide means while the other of said guide means continues to swing, pivoting taking place about the former of said guide means.

14. A swivel joint for connecting for swinging movement of wide angular range about upright axes, elements of a conveying system which are disposed one above the other, said joint comprising a guide plate secured to one of said elements having a pair of elongated guideways in fixed relation thereto, said guideways being curved toward a point of intersection and each including a pair of end-to-end arcuate portions having different length radii, a pair of transversely spaced guide means pivotally secured to the other of said elements, one positioned for coaction with each of said guideways and lying inter-

mediate the ends of said arcuate portions of the guideways of smaller radii when said elements are longitudinally aligned, said guide means being movable simultaneously in opposite directions along their respective guideway portions of smaller radii during at least a portion of the swinging movement of said elements relative to each other.

15. A swivel joint as set forth in claim 1 in which the smaller radii portions of each of said guideways are struck from a common center.

16. A swivel joint for connecting for swinging movement of wide angular range about upright axes elements of a conveying system which are disposed one above the other, said joint comprising a guide plate cut away centrally at one end to provide an opening and having at opposite sides of said opening elongated guides each providing an arcuate portion of opposite convexity to a corresponding portion of the other and struck on a radius of a length equal to one half the distance between parallel lines tangent to said portions, said guides each also comprising another arcuate portion constituting an extension of one of the first portions and of longer radius.

17. A swivel joint as set forth in claim 16 in which

said last mentioned arcuate portions extend at least into close adjacency to each other at their ends away from said first portions.

18. A swivel joint for connecting for swinging movement of wide angular range about upright axes elements of a conveying system which are disposed one above the other, said joint comprising a guide plate cut away centrally at one end to provide an opening and having at opposite sides thereof oppositely curved guide surfaces of which two of the corresponding ends are relatively widely spaced and the other two lie at least much more closely adjacent to each other, extended portions of the guide surfaces near one of the ends struck with a uniform radius from a point between said surfaces, and the remaining portions struck from points, in the case of each thereof, in at least close proximity to the first mentioned portions of the other.

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