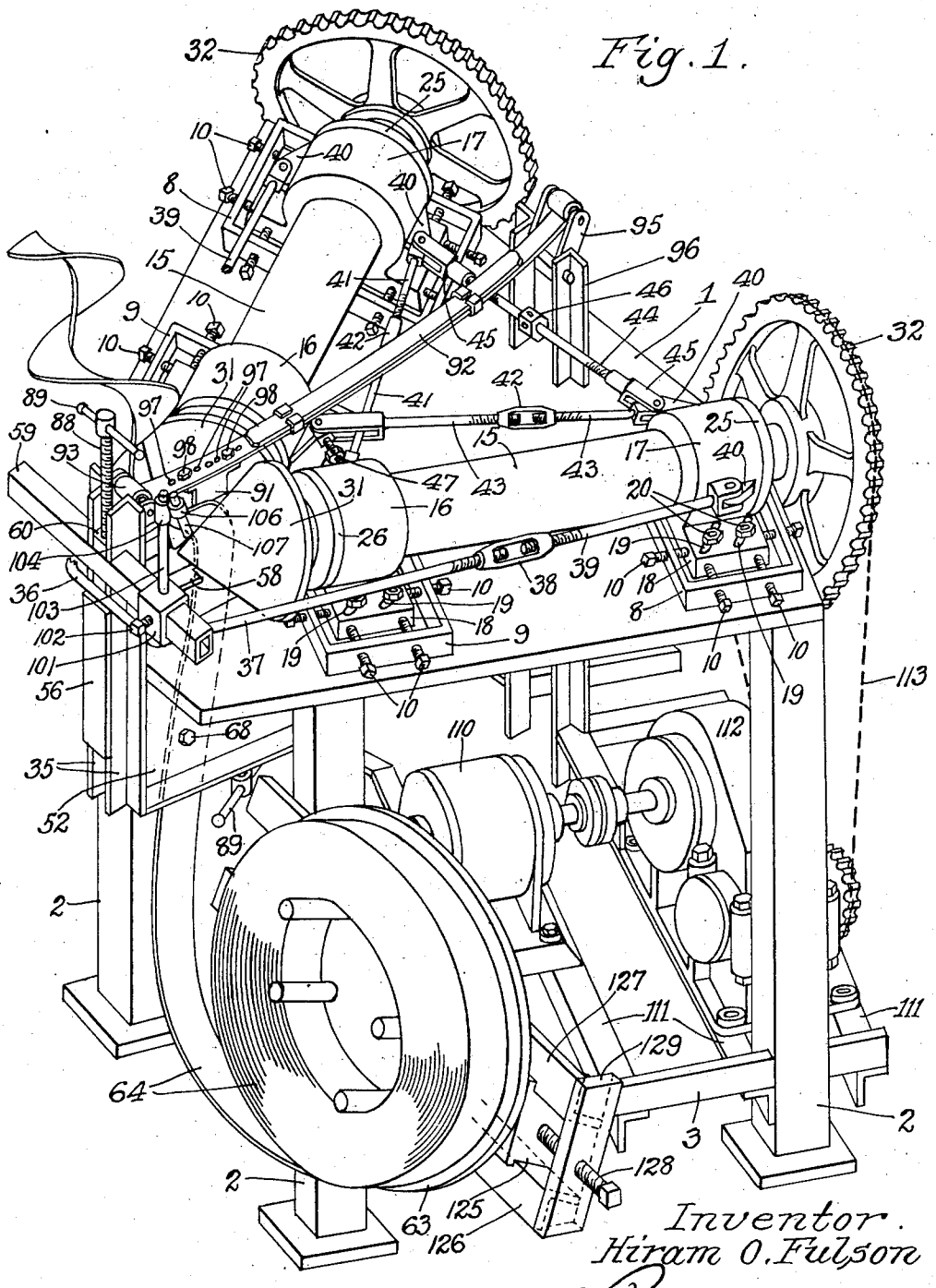
Nov. 11, 1941. H. O. FULSON 2,262,227

APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

Filed Nov. 25, 1938 8 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

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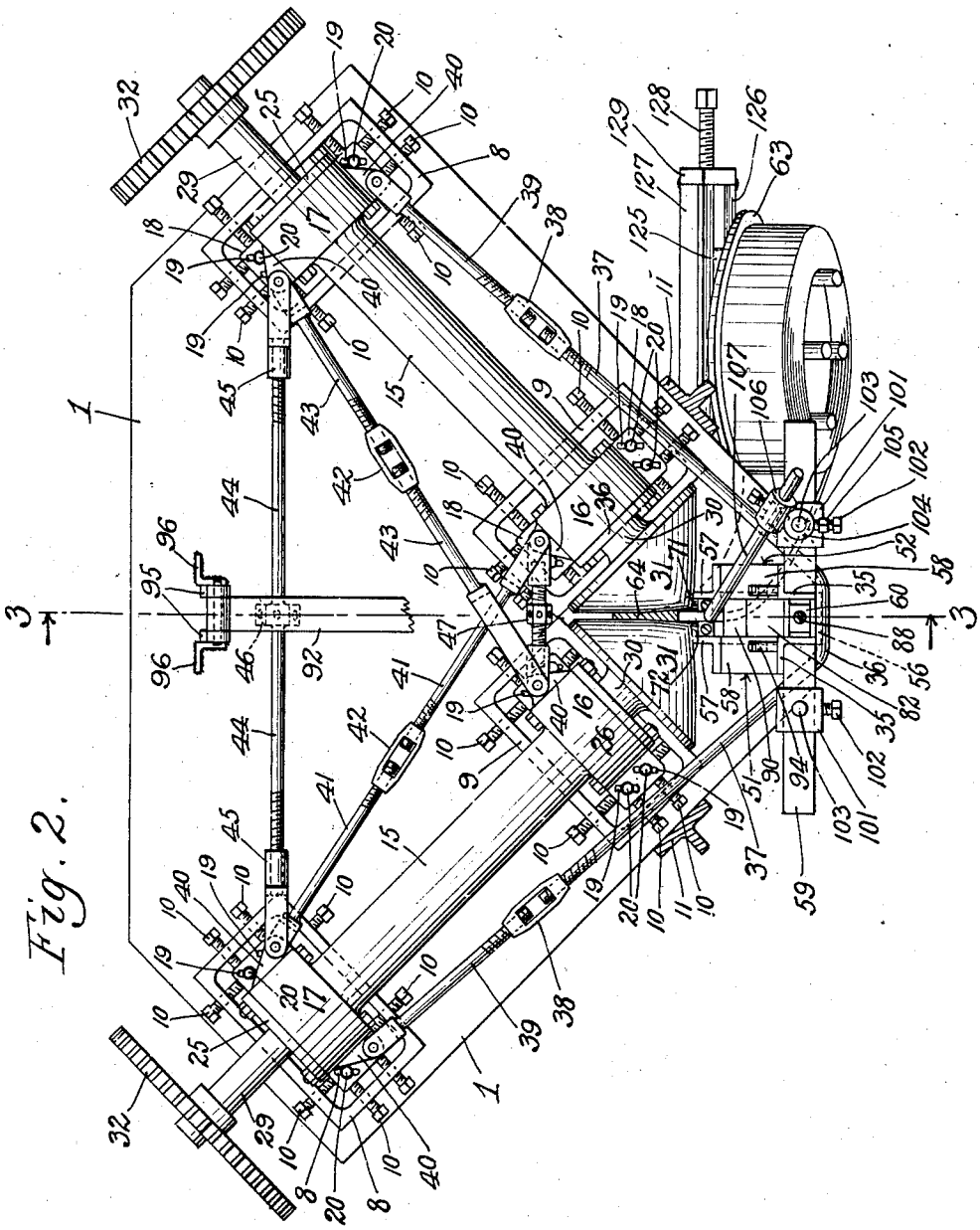


Fig. 2.

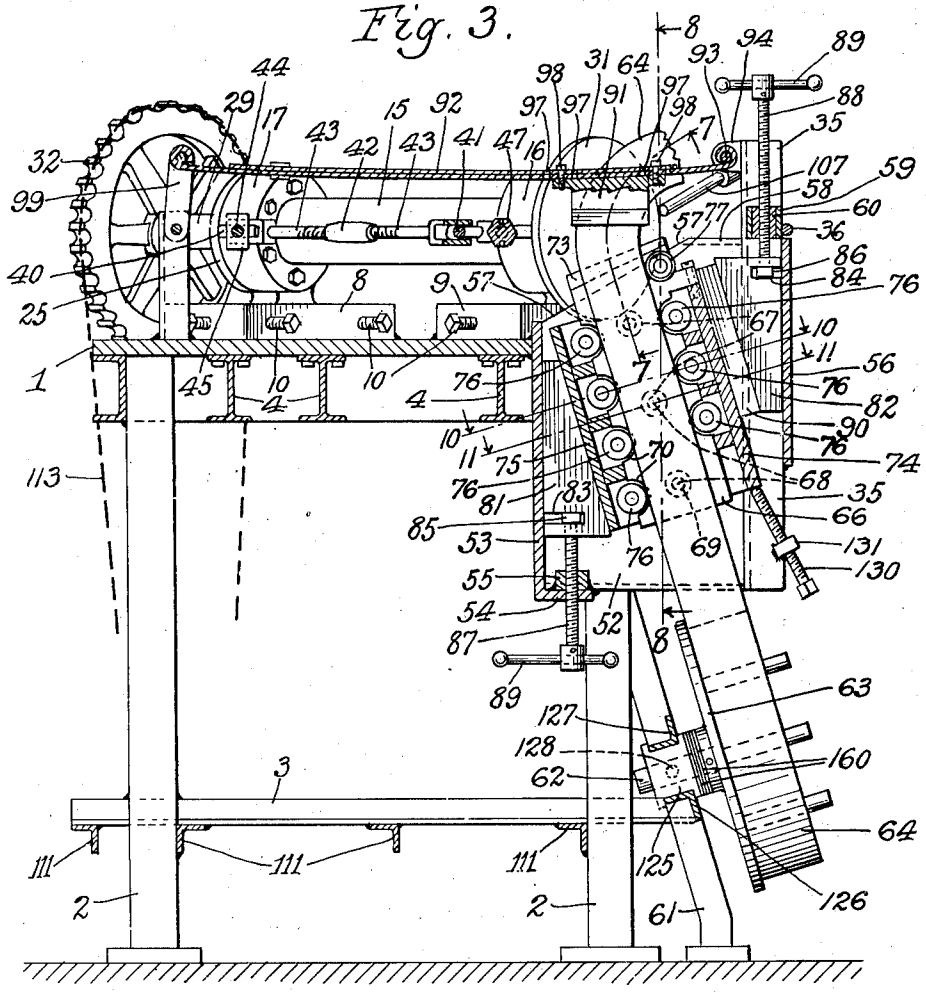
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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

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Fig. 3.



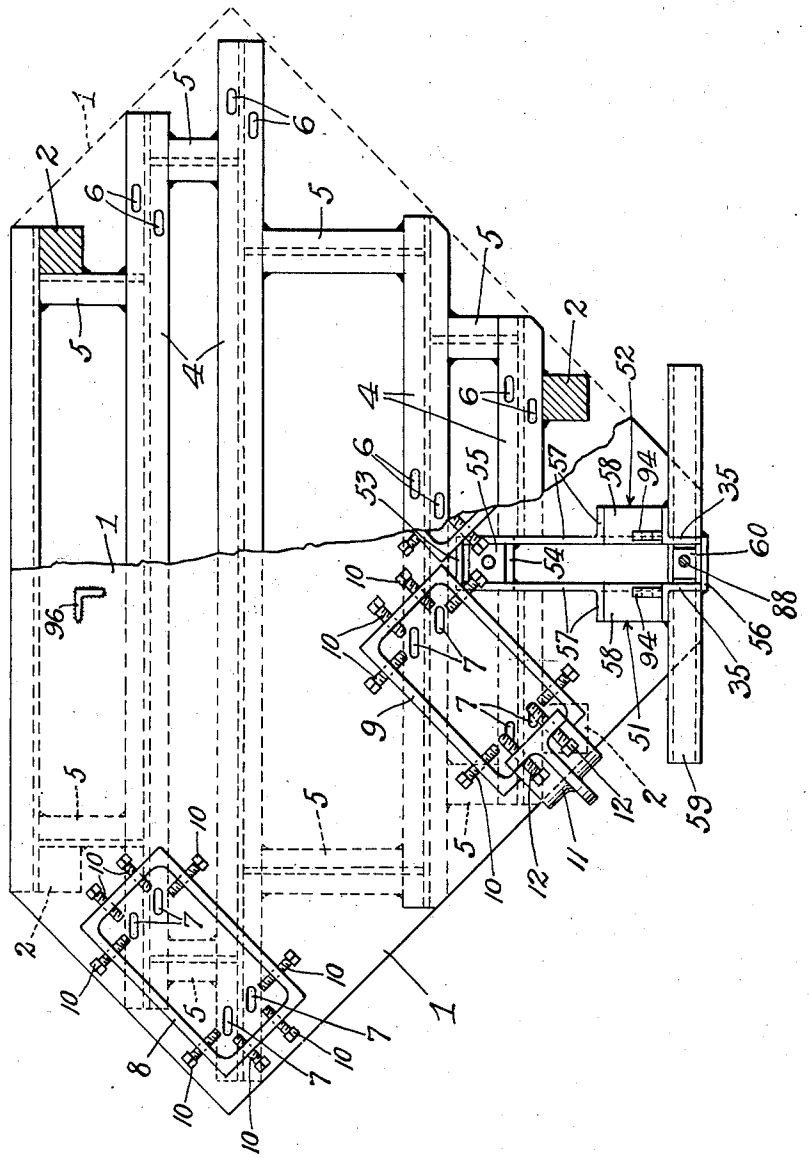
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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

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Fig. 4.



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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

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Fig. 5.

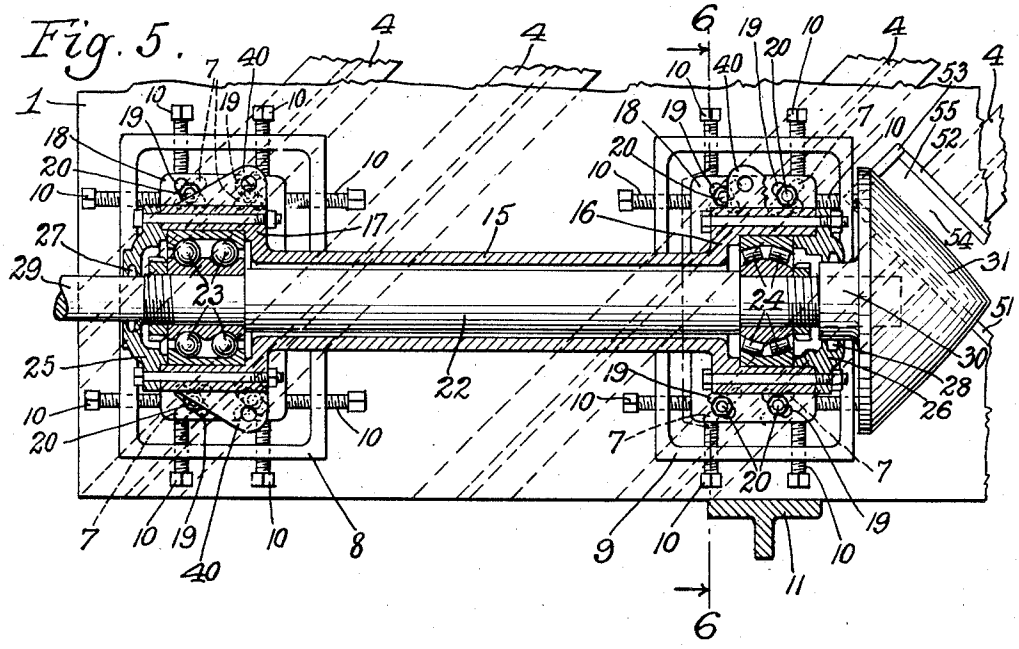
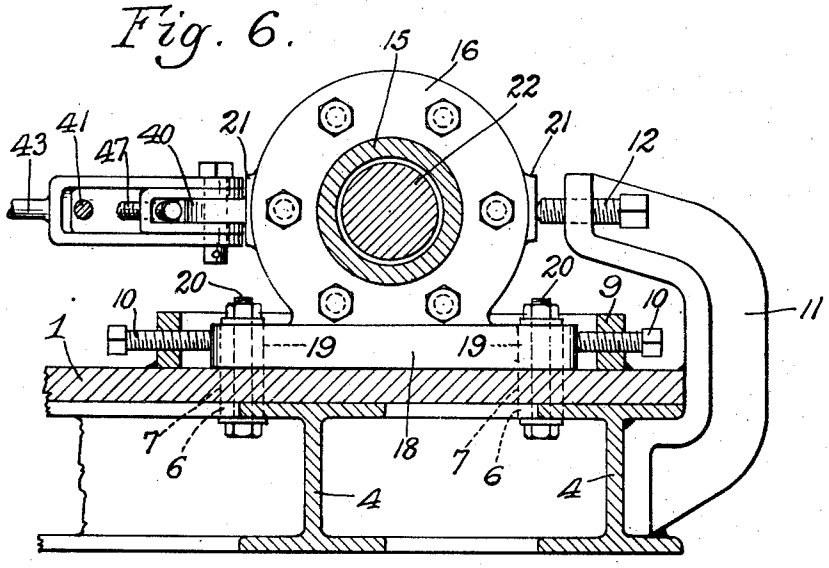


Fig. 6.



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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

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Fig. 7.

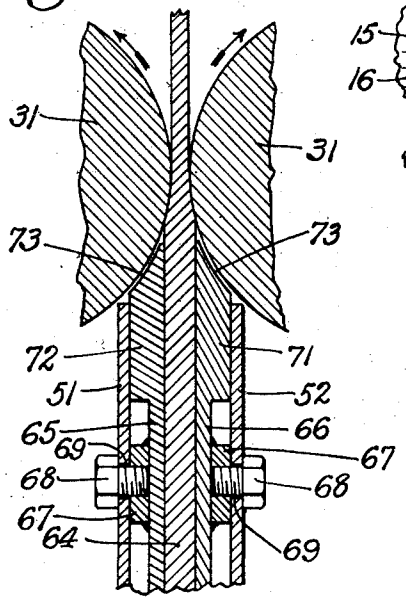


Fig. 8.

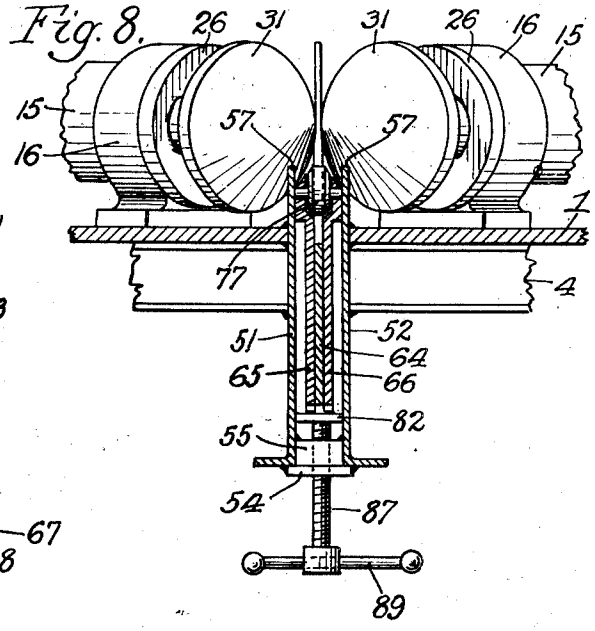


Fig. 9.

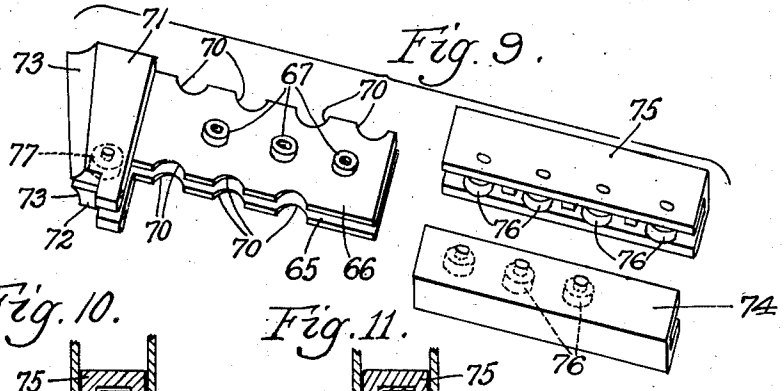


Fig. 10.

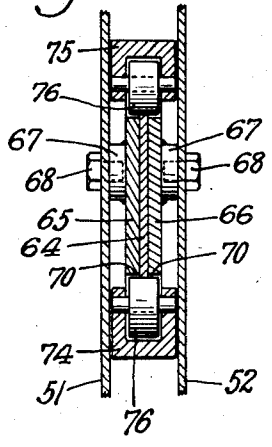
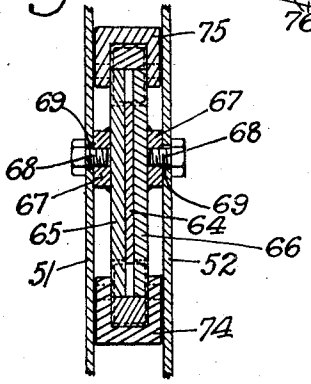


Fig. 11.



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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

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Fig. 12.

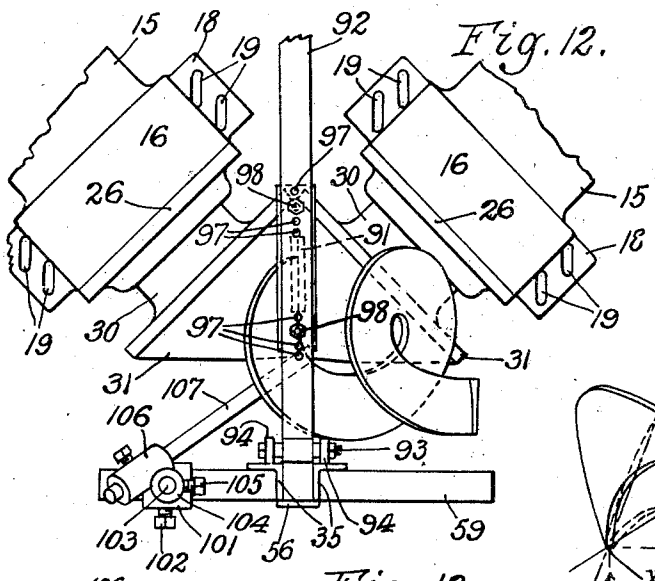


Fig. 13.

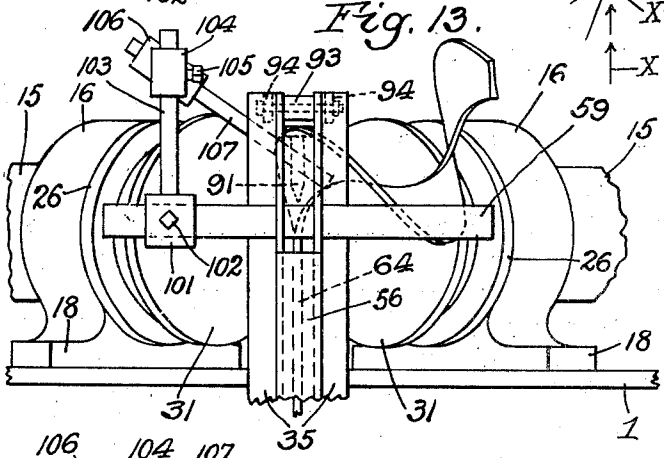


Fig. 14.

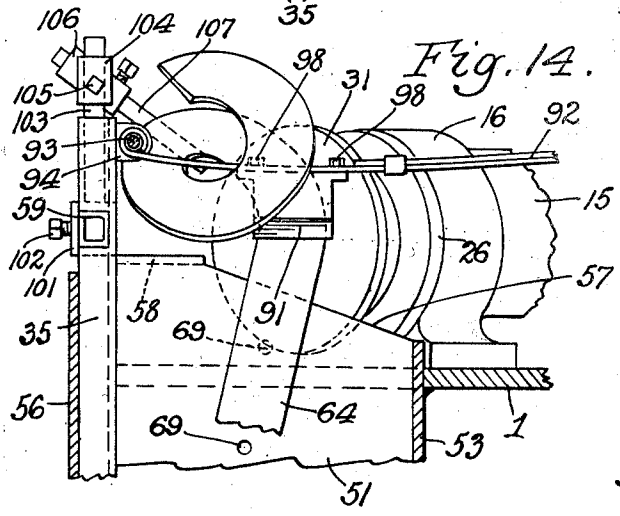


Fig. 15.

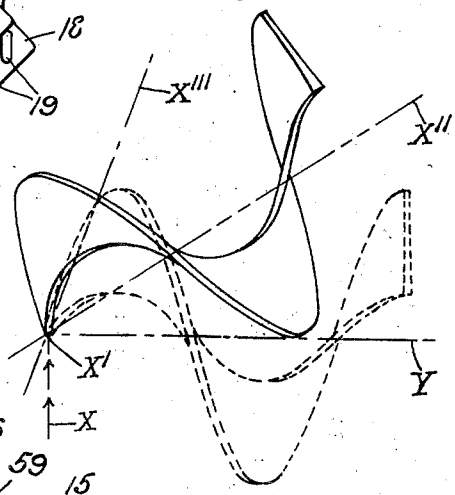
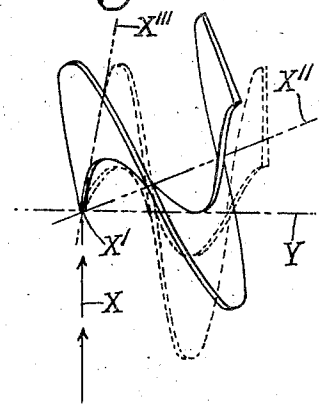


Fig. 16.



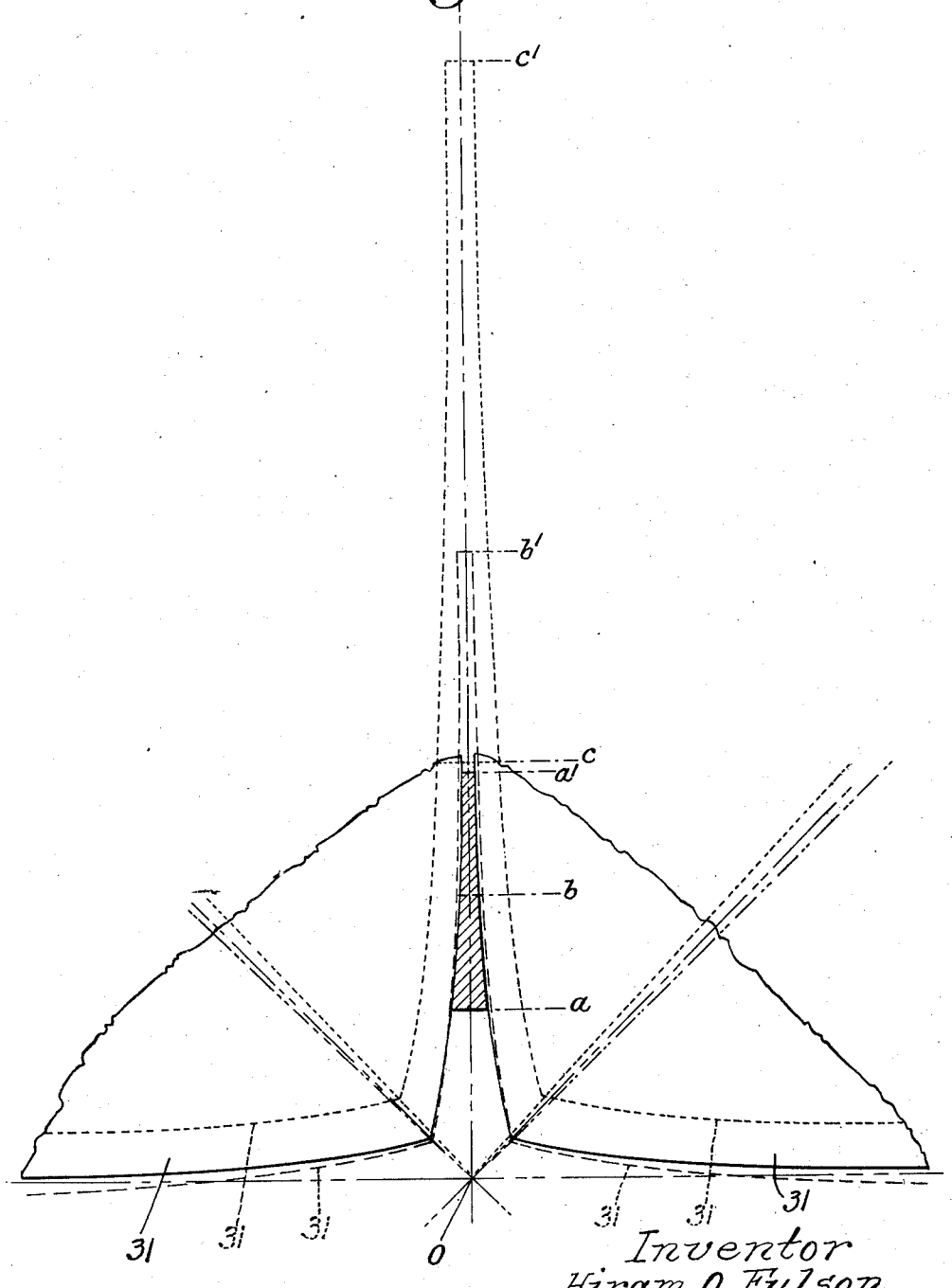
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APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

Filed Nov. 25, 1938 8 Sheets-Sheet 8

Fig. 17.



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Patented Nov. 11, 1941 2,262,227

UNITED STATES PATENT OFFICE

2,262,227

APPARATUS FOR ROLLING HELICOID CONVEYER FLIGHT

Hiram O. Fulson, Chicago, Ill., assignor to Link-Belt Company, a corporation of Illinois

Application November 25, 1938, Serial No. 242,198

13 Claims. (Cl. 80—31.1)

My invention relates to apparatus for cold rolling helicoid flight such as is used in connection with spiral or screw conveyers.

One object of my invention is to provide new and improved means whereby various sizes and dimensions of helicoid conveyer flight may with a minimum of difficulty be cold rolled on the same machine.

Another object of my invention is to provide an apparatus for cold rolling helicoid conveyer which is durable, accurate and relatively inexpensive to manufacture.

Another object is to provide a device which, with a minimum of adjustment can roll right hand or left hand helicoid flight of different pitches.

Another object is to provide means whereby adjustment for wear and slight changes may be easily and conveniently made.

Other objects will appear from time to time throughout the specification and claims.

Conveyer flight was first made by slitting and bending washers to form short sections of spiral flight which were welded or otherwise fastened together and mounted upon a pipe. Later metal strip was heated and then hot rolled and latterly apparatuses were built which would cold roll spiral conveyer. However, all flight conveyer apparatuses with which I am familiar involve the use of different rolls or relatively expensive adjustments for forming different sizes and shapes of conveyer flight within narrowly restricted ranges. The result of this is that when a change in the product is to be made outside of the narrowly restricted range of a current setting, the machines heretofore used must have expensive adjustments made or be dismantled, new parts interchanged with the parts previously used, the machine must again be adjusted and a number of trial runs made with adjustment between runs until the proper size and shape of flight is obtained. It thus requires a relatively large expenditure to change the machines hitherto in use when a different product is to be produced.

With my apparatus, on the other hand, one set of rolls will handle a wide range of helicoid conveyer flight and the adjustments necessary to change from one size or shape to another are reduced to a relatively small expenditure.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a perspective view of the machine with parts omitted;

Figure 2 is a plan view with parts omitted;

Figure 3 is a section along the line 3—3 of Figure 2;

Figure 4 is a plan of the table top with the top partly broken away to disclose the I-beam reinforcing below and with many parts omitted for the sake of clearness;

Figure 5 is a partial plan view of the table top with roll shaft housing and associated parts in section;

Figure 6 is a section along the line 6—6 of Figure 5;

Figure 7 is a section along the curved line 7—7 of Figure 3;

Figure 8 is a section along the line 8—8 of Figure 3;

Figure 9 is a perspective of a type of stock guide plates and roller cages in disassembled arrangement;

Figure 10 is a section along the line 10—10 of Figure 3;

Figure 11 is a section along the line 11—11 of Figure 3;

Figure 12 is a plan view of the conical forming rolls showing a right hand conveyer take-off with a wedge and forming pin;

Figure 13 is a front elevation of the parts shown in Figure 12;

Figure 14 is a diagrammatic side elevation of the elements shown in Figure 13 with parts in section showing a right hand conveyer flight issuing from the machine;

Figure 15 is a detail showing conveyer wherein pitch and outside diameter are approximately equal;

Figure 16 is a detail showing conveyer wherein pitch is approximately one-half of outside diameter; Figures 15 and 16 also illustrate the contrasting angles of the inner helix and the outer helix and also show the difference between the angle of discharge of the conveyer flight rolled on my machine and that heretofore used;

Figure 17 is a diagrammatic lay-out of the conveyer parts to illustrate method of computation of contour of parts, location of stock and adjustment of rolls.

Like parts are indicated by like characters throughout the specification and drawings.

1 is a table top. It is supported by legs 2. The top is generally triangular in cross section. The legs are tied together at the bottom by a horizontal framework 3, and at the top by a plurality of vertical parallel I-beams 4, joined by short perpendicular intermediate members 5, upon which the table top 1, rests, all uniting to

make a rigid stiff, solid structure. At the opposed ends of some of the I-beams are oblong bolt holes or slots 6, registering with similar holes 7, in the table top 1, as indicated. The purpose of these apertures will subsequently appear.

Welded or otherwise permanently attached to the table top 1, are four spaced rectangular sockets 8 and 9. These sockets all have inwardly extending set screws 10, which may be adjustable toward and from one another and the sockets 9 have associated with them brackets 11, which are rigidly attached to the I-beam structure below the table top, are welded to the table top as indicated and overhang the socket 9, each bracket having a plurality of set screws 12, which may be adjusted as indicated. The sockets 8 and 9 are arranged in two opposed pairs, one along each edge of the table top 1, along intersecting axes.

Supported on the table top are two hollow shaft housings 15, each terminating in enlarged bearing pockets or sleeves 16, 17. Each of these two bearing sleeves has a foot 18, adapted to rest upon the table top and each foot has a plurality of diagonal slots 19. When these feet are placed within the sockets 8 and 9, the slots 19 intersect the slots 6, so that holding bolts 20 may pass through both slots and because of the fact that the slots intersect, they permit adjustment of the foot in its position within the socket. The set screws 12 may also be manipulated to exert a pressure upon the pads 21. 22 is a roll shaft, there being one in each sleeve 15. These roll shafts are supported on anti-friction bearings 23, 24, which bearings are contained within the enlarged pockets 16 and 17. These pockets are closed at their outer ends by covers 25, 26, which covers are provided with grease seals 27, 28, the seal 27 being associated with the reduced end 29, of the shaft 22. The seal 28 being associated with a sleeve 30 at the rear end of the conical roll 31, which is rigidly mounted on the shaft 22. 32 is a driving sprocket on the reduced end 29, of the shaft. There are two such shafts and the arrangement for driving, mounting, supporting and lubricating them is the same in each case, there being one shaft in each of the shaft housings 15, so that the conical rolls at the front of the machine as indicated in Figure 1 come together to provide a pass between them for the stock to be worked as will hereinafter appear.

Projecting upwardly above the table top and extending below it are two opposed angle members 35, rigidly attached by suitable means to the table top and other parts of the frame of the machine. 36 is a tension yoke welded or otherwise rigidly attached in position, extending across the front of the machine and on both sides thereof extending rearwardly as indicated at 37, to engage turnbuckles 38, which turnbuckles also engage tension members 39, pivoted on lugs 40, on the two sleeves 17, furthest removed from the conical rolls.

Interposed between similar lugs 40 respectively on the sleeve 17, associated with one roll housing and the sleeve 16, associated with the other, is a tension member 41, including two separate threaded rods joined by a turnbuckle 42. A similar tension member 43 joins the other pair of sleeves 16 and 17, this member 43 being bifurcated intermediate its two ends to permit passage of the member 41, and being provided with a similar turnbuckle 42. Joining the lugs 40, on the two sleeves 17, is a compression-tension member 44, which includes yokes 45, into which are threaded in opposite directions the capstan member 46. Also joining the two lugs 40, on the two sleeves 16, adjacent the rolls is a similar compression-tension member 47.

By manipulation of these compression-tension members, after releasing the set screws and holding bolts which hold the feet upon which the shaft housings are supported, it is possible by manipulating the various compression-tension members to adjust the relative positions of the conical rolls, the rolls may be moved longitudinally parallel with their axes. They may be moved transversely by adjustment at either end, thus making it possible to provide a wide range of adjustment of the size and shape of the pass or area between the opposed portions of the two conical rolls. If desired, the set screws associated with the sockets may be used to assist in making this adjustment and once it is made all the set screws, holding bolts, tension-compression members may all be tightened up to rigidly hold, so far as that is possible in any machine, the two conical rolls in desired working relation.

In line with the angles 35, the table top 1 is slotted and two opposed horizontal channel members 51, 52, extend vertically through this slot, being welded to the table and to the front I-beams which are cut away to permit passage of the channel plates. 53 is a plate welded to the rear end of the two channels and extending vertically from a point above to a point below the table top 1, and having a right angle extension 54, which underlies and is welded to the channel flanges. This extension is perforated in line with a nut 55, the purpose of which will hereinafter appear.

56 is a plate joining the front edges of the channels 51 and 52, just as the plate 53 joins their rear edges. The upper portions of the channels 51 and 52 are cut away as at 57, adjacent the rolls 31, so that the flanges 58 along the upper edges of the channels terminate adjacent the apices of the rolls. 59 is a hollow square tube intersecting the forwardly extending flanges of the angles 35, which are cut away for that purpose. This tube is welded to the angles, projects across the machine and supports and contains welded therein a nut 60, the purpose of which will hereinafter appear.

61 is a bracket associated with one of the table support columns 2. It carries an inclined stub shaft 62, on which is mounted for rotation a reel 63, adapted to carry the stock or steel ribbon 64, which is to be used to form the helicoid flight. This steel ribbon is adapted to be fed upwardly from below into the pass between the rolls whereby it is formed into conveyer flight.

The means for guiding the stock include two opposed wear plates 65, 66 having a plurality of bosses 67, threaded to be engaged by studs 68, which enter through the channels 51, 52 by holes 69. These holes may be somewhat larger than the studs so as, if desired, to permit some measure of adjustable movement of the studs where they engage the bosses to assist in positioning the wear plates 65, 66. These wear plates are notched as indicated at 70, and terminate at their upper ends in guide members 71, 72, having tapered extremities 73, adapted to conform generally to the contour of the rolls so that these wear plates may guide the stock as closely up to the pass between the rolls as possible. 74, 75 are channel cages adapted to enclose the notched edges of the wear plates and terminating in heads 71, 72. Each of these cages carries pref-

erably three rollers 76, which fit within the recesses or notches 70, and are adapted to engage the opposed edges of the stock. There is an additional roller 77, carried by the guide heads 71, 72, immediately adjacent the pass where the stock enters the rolls. All this mechanism, including wear plates, cages, etc. is contained within the box formed between the two channel plates 51, and 52, and the wear plate and cage assembly may be removable and interchangeable to provide for a range of stock of different width and different thickness.

To roll conveyer flight of different diameters, it is important to be able to adjust the position of the stock as it is fed to the rolls. This is accomplished by the two wedges 81, 82, which are slotted at 83, 84, as indicated to engage screw heads 85, 86, on screws 87, 88, threaded respectively in the nuts 55 and 60. These screws are provided with capstan bars 89. If desired, a filler plate 90, may be interposed between the wedge 82, and the cage 74, or the wedge 81, and the cage 75, as the case may be, depending upon the position on the rolls that it is desired to have the stock enter. The use of the two opposed wedges makes it possible to move the whole feed box assembly including the wear plates, the rollers, the cage and the bosses in a direction perpendicular to the plane defined by the axes of the two rollers so that the stock may enter the rolls close to or far from their apices. The wedges may also be used to supply a sufficient initial pressure upon the opposed edges of the stock to insure proper operation.

When it is desired to disassemble the feed box, the pressure on the wedges is released and the box may then be withdrawn from below because the flanges of the channels are outwardly disposed. When the box has been withdrawn, it is then possible to withdraw the two wedges by moving them laterally in a direction perpendicular to the plates 53, 56, to disengage them from the nuts 84, 85.

As the stock is fed up through the pass between the rolls, it is distorted. The thickness remains constant or substantially constant at its inner periphery and is greatly decreased at its outer periphery. As a result, the inner periphery of the flight is short relatively to the outer periphery, this causes the stock to take generally the shape shown in Figure 8. Whichever way it goes, however, to the right or left as it comes out of the pass decides the question whether the flight is going to be a right hand or left hand flight. In order to control this, I use a wedge 91, which will be yieldingly held in the space between the rolls immediately adjacent the discharge side of the pass by a spring support 92, pivoted at 93, on a bracket 94, supported by the upper ends of the angles 35. At its rear end, this spring is supported by links 95, on angles 96, which extend up through the table top 1. The wedge 91 is adjustably positioned on the spring lever 92, by means of a plurality of spaced holes 97, engaged by studs 98, so that the wedge may be longitudinally adjusted in consonance with longitudinal adjustment of the position of the feed box and stock for different positions of the pass along the face of the rolls.

If the flight is to be discharged to the right, the wedge is placed on the right hand side of the flight instead of as would at first thought be expected on the left hand side. In other words, the wedge is placed on the side of the flight toward which the flight is to go. The reason for and effect of this will hereinafter appear.

101 is a bracket slidable along the shaft 59. It is adapted to be locked in position by means of a set screw 102. This bracket carries the upright 103, upon which is slidably mounted a sleeve 104, which may be angularly and vertically adjusted and held in position by the set screw 105; projecting laterally from this sleeve 104, is another sleeve 106, inclined to the sleeve 104. Under some circumstances, the sleeves 106 and 104 may be angularly adjustable with respect to one another or under other circumstances they may be adjusted once and for all and welded or otherwise rigidly fastened together. The sleeve 106 carries axially adjustable therein a flight guide 107, adapted to be adjusted in position to engage the flight as it passes out from between the pass in opposition to the wedge 91.

110 is a motor mounted on a platform 111, beneath the table top 1. This motor drives by means of a gear reducer 112, and chain 113, one of the sprockets 32. A similar motor gear reducer and chain drives the other sprocket 32 so that there is a separate drive and separate gear reduction for each of the two rolls, there being no mechanical connection between them except that provided by the stock in the pass between them, which, experience teaches is entirely sufficient to maintain the rolls in proper coordination.

Figures 12, 13, and 14 diagrammatically show the discharge of the stock from the pass between the rolls. Figure 13 shows the rolls as you would look at them standing in front of the machine. Figure 12 shows the rolls as you would look down on them from above. Figure 14 shows the roll if the near roll and associated elements were removed. In each case a right hand helicoid conveyer flight is shown.

Considering first the aspect of the flight as in Figure 13, the rolls are so positioned that the thickest part of the flight is nearest to the apices of the rolls and nearest to the point at which the axes of the rolls prolonged, intersect, that is, at the point of minimum diameter of the roll the flight is the thickest and as the diameters of the rolls increase, the pass between them decreases and the flight decreases in thickness.

As the stock comes up through the pass, the tendency is for it to form a washer, the decreased thickness of the outer periphery resulting in an increased peripheral length and if nothing were done about it, the stock would tend to form a flat or nearly flat series of washers.

The guiding means applied to the flight after it has come through the pass determine whether or not the flight shall be right or left hand and determine the pitch. It will be noted that the stiffest part of the flight is at the inner periphery where the thickness has been little if any reduced. There is a tendency for the stock to come straight up, bisecting the angle between the opposed roll faces. The flight guide member 107 engages the near face of the flight, and wedge 91 engages the forward side of the flight, as seen in Figure 13. The wedge tends to bend the thinner less resistant portion of the flight to the left, in Figures 12 and 13 in the direction opposite to the direction the flight is going to take in leaving the rolls. The guide 107 tends to cause the flight to discharge from the rolls toward the right. The operation of these two guide members fixes the direction of travel and the angle or pitch and the change in direction of the stiffer central portion of the flight is a

minimum while the change in direction or change in angle of the lighter, thinner, more flexible portion of the flight is a maximum. These two cooperating guide elements are all that is required to determine the direction of travel and the pitch. The wedge **91**, forcing the thinner portion of the flight over to the left causes the flight itself to form as it is discharged from the roll, the desired pitch of the stock to conform to the pitch imposed upon it by the guide **107**.

The idea of cold rolling helicoid conveyer flight is not new. The important thing about my device is that on one machine with one pair of rolls by merely adjusting the apparatus, I am able to roll a variety of diameters inside and outside and a variety of pitches and by substituting a single easily removable and easily adjustable feed box, I am able to roll stock of different width and thickness.

In setting up my apparatus, it is essential that the proper location of the stock within the rolls, that is the proper position and shape of the parts be predetermined, and the starting point for this is a determination of the distance from the inside edge of the stock to the point of intersection of the axes of the rolls.

Figure 17 is a diagrammatic fragmentary showing of the position of the rolls for rolling six inch flight showing in dotted lines the position of the rolls for sixteen inch flight and in dash lines the position of the rolls for a nine inch flight.

It will be noted that in each case the angles between the rolls varies from size to size, also that the distance between the roll apices and the starting point O also varies from size to size, thus demonstrating the necessity of providing in a machine of this type means for adjusting the rolls axially along the center line of the rolls, laterally at the front ends of the roll shafts and laterally at the back ends of the roll shafts.

This three-way adjustment of the roll shafts as indicated in Figure 17, in my experience is of the utmost importance. The rolls having a curved contour only generally conical may be adjusted to fit any shape of pass desired and they might be so adjusted to fit this shape of pass satisfactorily but the machine will not make a satisfactory conveyer unless the center lines of the axis of the two rolls intersect at a point common to all sizes of conveyers.

Under some circumstances, a wire range of interchangeable wear plates may be used, and the holes in the channels **51**, **52**, under these circumstances will be of such size and shape that when the studs are inserted into the bosses for any pair of wear plates, the wear plates will be fixed in position. The proper wear plates will be selected and will be bolted into position, the wedges being used both to assist in registering the wear plates with the stud holes in the channels and to help carry the load on the bolts. Such an arrangement insures a positive non-changing positioning of the wear plates for each size of flight.

One reason for the use of the filler plate **90** is that by using it a minimum wedge screw travel will be needed to fix the position of the cages and wear plates which form a part of the stock feed box.

If desired, the slots which permit the lateral disassembly of the wedges may have substituted for them a pocket which can be aligned with a hole in one or both of the channel plates so that access may be had to the end of the screw to pin or weld the head to the screw in the pocket in the wedge.

The stub shaft **62**, which carries the reel **63**, is mounted on a slide block **125**, which travels between the channels **126**, **127**, on the frame. This block may be horizontally displaced by a screw **128**, threaded in the nut **129**, rigidly supported on the channels **126**, **127**, so as to adjust the position of the reel to insure that the stock as it is paid off the reel into the feed box will always be discharged tangentially from the reel and will travel a straight path from such tangential discharge to the feed box.

In order to assist in positioning the feed box in place, it may be supported by a diagonal screw **130**, threaded in a nut **131**, supported between the angles **35**. This nut is sufficiently forward that the feed box when the pressure on the wedges has been released may be rotated enough to pass down between the wedge **81**, and the nut **131**, and the inner end of the screw **130**, to permit withdrawal of the box. The slight inclination of the screw is not sufficient to interfere with this operation.

Although the wedge **91**, might under some circumstances, be rigidly supported, experience teaches that it is better to have it spring supported, because a smoother action results and there is less danger of scarring the flight as it is discharged from between the rolls or of obstructing the movement of the flight between the rolls.

With particular reference to Figure 5, the anti-friction bearing, immediately adjacent the roll takes only radial load. The bearing at the rear end of the shaft takes both radial and thrust load. Of course, the radial load is a maximum adjacent the roll so that by having that bearing take only radial load, the total burden on the two bearings is satisfactorily divided.

Another important function of the feed box adjusting wedge is in connection with the initial setting up of the apparatus for a new size of helicoid conveyer flight. When the calculations have been made for setting up the rolls to properly shape and position the pass and for positioning the feed box in proper alignment with the pass, the various roll adjusting means and the feed box adjusting wedges will be manipulated to set the machine up according to the desired adjustment, then flight may be rolled. If it happens that because of slight inaccuracies of adjustment or because of yielding of the parts or wear of the parts, the adjustment is not absolutely correct, this will appear by measuring the flight, then the various adjustments including the feed box wedges may be manipulated to compensate for such inaccuracies. A further run may be made, the flight again measured and this process can continue until proper correct conveyer flight is discharged from the machine, then the positions of the various parts may be scribed or otherwise indicated on the table top and on the feed box support and at that time the feed box bosses may be welded in place so that whenever it is necessary to set the machine up again for the particular conveyer flight, the parts may be reset without further calculations.

In connection with Figures 15 and 16, conveyer flight has been shown both as discharged from the rolls according to my invention and as to devices of the past for the purpose of pointing out and emphasizing the fact that by my ar-

rangement with the conveyer flight so discharged and so guided that the central axis of the helix makes an acute angle with a plane tangent to the forming rolls extending from them in the general direction of discharge, the stiffer thicker portion of the helix is given a minimum bend, thereby decreasing the burden upon the rolls and guiding elements and also decreasing the distortion of the metal.

Referring especially to Figures 15 and 16, which show two right hand helicoid flights of different pitch but the same outside diameter, and adapted to be mounted on the same size pipe, the stock in each case approaches the rolls along the line x—x'. As the helicoid is formed by the rolls, the wedge 91 forces the outer thinner, less resistant portion of the helicoid to the left, and the thicker, stiffer, more resistant inner portion of the helicoid is deflected slightly to the right. The thinner portion that was first deflected to the left as the helicoid is rolled out, travels in unison with the inner thicker portion winding about it so that the whole helicoid is discharged along the line x'—x'' which is the center of the helix. The line x'—x''' is the line of the inner stiffer helix. Thus there is a minimum of distortion of the thicker portion of the helicoid as it is discharged from the roll. This is in sharp contrast with previous practice as indicated by the dotted line helicoid where instead of causing the two edges of the helicoid to discharge from the rolls, one on each side of the line of approach, the whole helicoid is forcibly bent to the right so that the thinner portion of the helicoid is discharged generally parallel with the line of approach and the deflection of the thicker, stiffer edge of the helicoid is greatly increased.

As a result, the distortion of the metal in my apparatus is reduced to a minimum in contrast with previously known devices where the distortion is a maximum. Because I allow the stiff portion of the helicoid so far as possible to travel the path it normally would travel doing the maximum amount of bending with respect to the thin, rather than the thick edge, I am able to use much lighter and cheaper guiding and positioning means. The wear on them and on the flight and the danger of scoring or distorting the flight is reduced to a minimum and even more important experience teaches that by my method the power requirements are substantially cut in half. The reverse of the above deflections would apply for left hand conveyer. The line x'—y indicates the center line of the helicoid discharged according to the old method.

It will be realized that while I have described and illustrated an operative machine, still many changes might be made in the size, shape, arrangement and disposition of parts without departing materially from the spirit of my invention and I wish, therefore, that my showing be taken as in a large sense diagrammatic.

I claim:

1. In an apparatus for rolling helicoid conveyer flight, a pair of opposed generally conical rolls, means for guiding the stock to be formed toward the pass between the rolls and for constraining it in its travel to a plane perpendicular to the plane defined by the axes of the rolls and bisecting the angle between said axes, a wedge member whose width is substantially equal to the width of the stock, means for holding the wedge member in position between the rolls on the side opposed to the guide means in substantially the plane of approach of the stock, the thin edge of the wedge being presented to the formed flight as it emerges from the pass between the rolls.

2. In an apparatus for rolling helicoid conveyer flight, a pair of opposed generally conical rolls, means for guiding the stock to be formed toward the pass between the rolls and for constraining it in its travel to a plane perpendicular to the plane defined by the axes of the rolls and bisecting the angle between said axes, a wedge member whose width is substantially equal to the width of the stock, means for holding the wedge member in position between the rolls on the side opposed to the guide means in substantially the plane of approach of the stock, the thin edge of the wedge being presented to the formed flight as it emerges from the pass between the rolls, means adapted to yieldingly urge the wedge in a direction opposite to the direction of movement of the flight from the rolls.

3. In an apparatus for rolling helicoid conveyer flight, a pair of opposed generally conical rolls, means for guiding the stock to be formed toward the pass between the rolls and for constraining it in its travel to a plane perpendicular to the plane defined by the axes of the rolls and bisecting the angle between said axes, a wedge member whose width is substantially equal to the width of the stock, means for holding the wedge member in position between the rolls on the side opposed to the guide means in substantially the plane of approach of the stock, the thin edge of the wedge being presented to the formed flight as it emerges from the pass between the rolls, means for adjustably positioning the wedge in a direction longitudinally of the pass between the rolls.

4. In an apparatus for rolling helicoid conveyer flight, a pair of opposed generally conical rolls, means for guiding the stock to be formed toward the pass between the rolls and for constraining it in its travel to a plane perpendicular to the plane defined by the axes of the rolls and bisecting the angle between said axes, a wedge member whose width is substantially equal to the width of the stock, means for holding the wedge member in position between the rolls on the side opposed to the guide means in substantially the plane of approach of the stock, the thin edge of the wedge being presented to the formed flight as it emerges from the pass between the rolls, a guide member adapted to engage the side of the flight opposite to the side engaged by the wedge at a point in its travel entirely out of register with and beyond the area of engagement of the wedge.

5. In an apparatus for rolling helicoid conveyer flight, a bed plate, a pair of conical rolls supported on one side thereof, and adapted to rotate about axes generally parallel with the plate, a box frame structure projecting from the side of the bed plate opposite the side upon which the rolls are supported in general alignment with the pass between the rolls, a stock guide within the box frame adapted to guide the stock toward the pass between the rolls, means for laterally displacing the guide in a plane generally perpendicular to the plane of the bed plate and bisecting the angle between the roll axes and for locking the guide in adjusted position, and means for holding the guide against angular displacement.

6. In an apparatus for rolling helicoid conveyer flight, a bed plate, a pair of conical rolls supported on one side thereof, and adapted to rotate about axes generally parallel with the plate, a

box frame structure projecting from the side of the bed plate opposite the side upon which the rolls are supported in general alignment with the pass between the rolls, a stock guide within the box frame adapted to guide the stock toward the pass between the rolls, means for laterally displacing the guide in a plane generally perpendicular to the plane of the bed plate and bisecting the angle between the roll axes and for locking the guide in adjusted position, means for moving the guide longitudinally in a direction generally parallel with the direction of travel of the stock and for locking the guide against such movement, and means for holding the guide against angular displacement.

7. In an apparatus for cold rolling helicoid conveyer flight and the like, a bed plate, a supporting frame therefor, a pair of inclined roll shafts supported on the bed plate and constrained to adjustable movement in a plane parallel with the plane of the bed plate, a conical roll on the end of each shaft, the rolls being in juxtaposition to one another to form a pass between their opposed faces, separate power means for each shaft, supported on the frame below the bed plate and a separate flexible drive connection between each power means and its associated shaft whereby each shaft may be longitudinally, angularly, and transversely displaced without interference with the drive connection between each shaft and its associated power source.

8. In combination, a pair of shafts having intersecting axes, a generally conical forming roll on the end of each shaft nearest the point of intersection of the axes, bearings spaced along each shaft, one of them being near each roll, a foot associated with each bearing, projecting away from the plane of the roll axes, means associated with each foot for positively, and micrometrically, moving it in all directions in a plane parallel with the plane of the roll axes and for locking it in position after such movement, separate adjustable means located in the plane of the roll axes for positively preventing displacement in said plane, of the roll axes in response to pressure applied at the rolls.

9. In combination, a pair of shafts having intersecting axes, a generally conical forming roll on the end of each shaft nearest the point of intersection of the axes, bearings spaced along each shaft, one of them being near each roll, a foot associated with each bearing, projecting away from the plane of the roll axes, and means associated with the feet for supporting the bearings and adjustable means located in the plane of the roll axes for positively preventing displacement in said plane, of the roll axes in response to pressure applied at the rolls.

10. In combination, a pair of shafts having intersecting axes, a generally conical forming roll on the end of each shaft nearest the point of intersection of the axes, bearings spaced along each shaft, one of them being near each roll, a bed plate generally parallel with the plane of the axes, a foot associated with each bearing, resting upon the plate, means associated with each foot and the bed plate for positively and micrometrically, moving the foot in all directions in a plane parallel with the bed plate and for locking it in position after such movement, separate adjustable means located in the plane of the roll axes for positively preventing displacement in said plane, of the roll axes in response to pressure applied at the rolls.

11. In combination, a pair of shafts having intersecting axes, a generally conical forming roll on the end of each shaft nearest the point of intersection of the axes, bearings spaced along each shaft, one of them being near each roll, a bed plate generally parallel with the plane of the axes, a foot associated with each bearing, resting upon the plate, and means associated with the feet for supporting the bearings and adjustable means located in the plane of the roll axes for positively preventing displacement in said plane, of the roll axes in response to pressure applied at the rolls.

12. In combination, a pair of shafts having intersecting axes, a generally conical forming roll on the end of each shaft nearest the point of intersection of the axes, bearings spaced along each shaft, one of them being near each roll, a supporting sleeve encircling each shaft and positively aligning the bearings associated therewith, a bed plate generally parallel with the plane of the axes, a foot associated with each end of each sleeve for supporting the sleeve upon the bed plate, means associated with each foot and the bed plate for positively and micrometrically moving the foot in all directions in a plane parallel with the bed plate and for locking it in position after such movement, separate adjustable means located in the plane of the roll axes and engaging the sleeves for positively preventing displacement in said plane of the roll axes in response to pressure applied at the rolls.

13. In combination, a pair of shafts having intersecting axes, a generally conical forming roll on the end of each shaft nearest the point of intersection of the axes, bearings spaced along each shaft, one of them being near each roll, a supporting sleeve encircling each shaft and positively aligning the bearings associated therewith, a bed plate generally parallel with the plane of the axes, a foot associated with each end of each sleeve for supporting the sleeve upon the bed plate, adjustable means located in the plane of the roll axes and engaging the sleeves for positively preventing displacement in said plane, of the roll axes in response to pressure applied at the rolls.

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