

March 9, 1948.

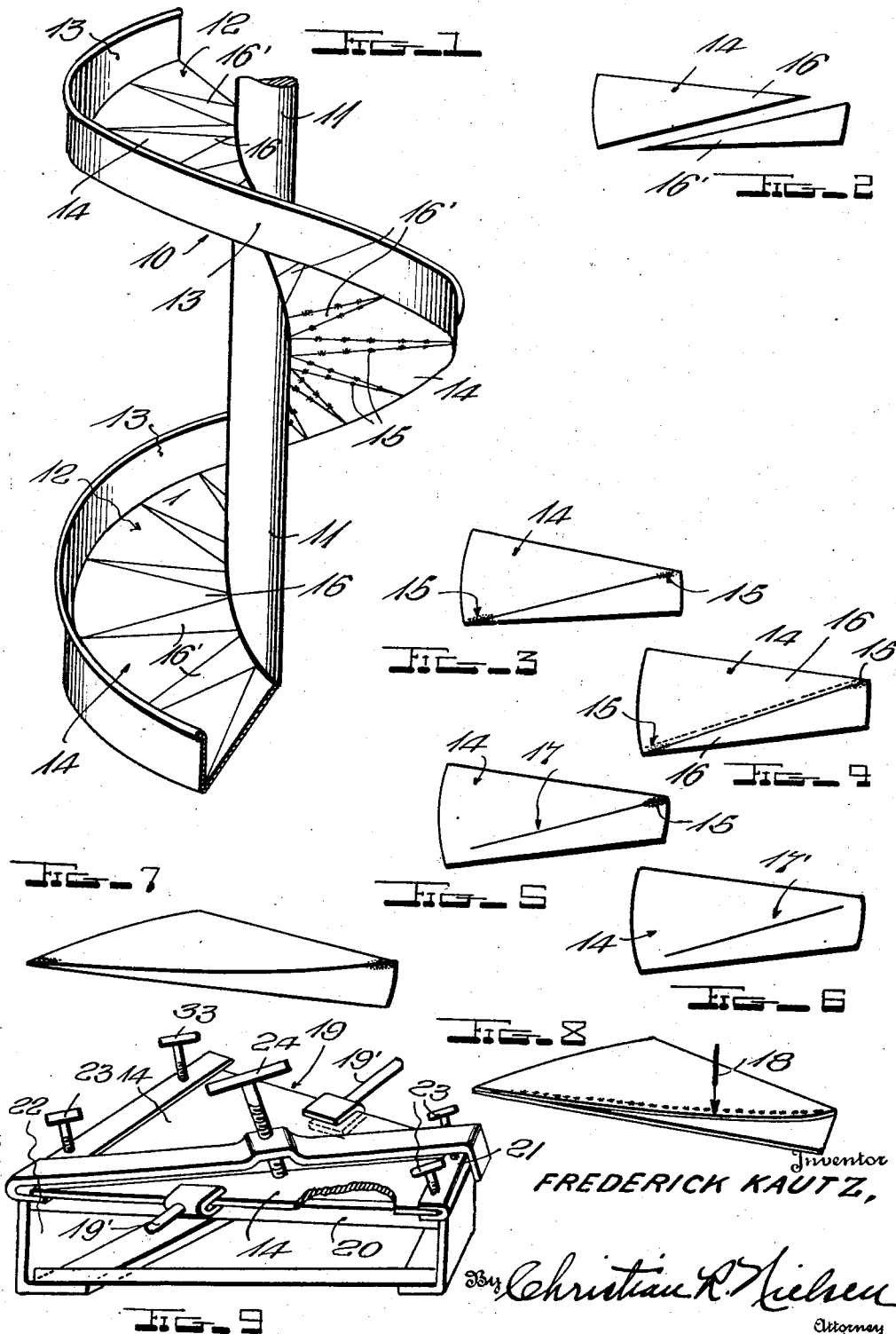
F. KAUTZ

2,437,259

METHOD OF FORMING PLATES FOR RUNWAYS IN SPIRAL CHUTES AND THE LIKE

Filed March 20, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

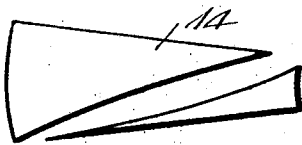


FIG. 10



FIG. 11



FIG. 12

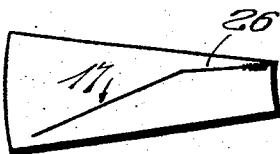


FIG. 13

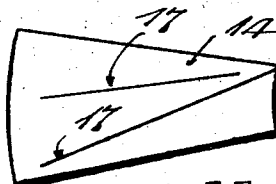


FIG. 14

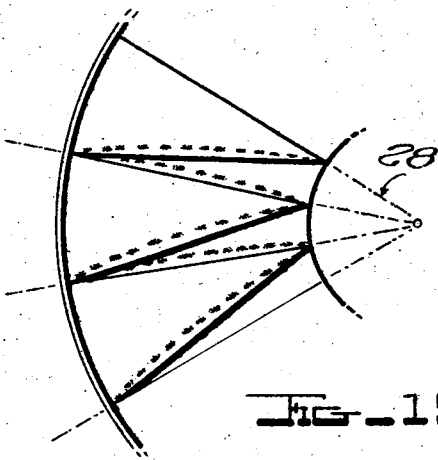


FIG. 15

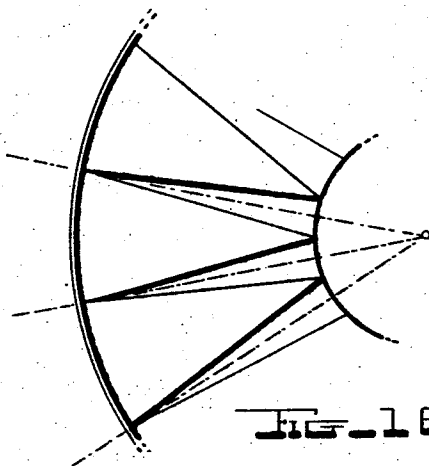


FIG. 16

Inventor

FREDERICK KAUTZ,

By *Christian R. Nielsen*
Attorney

UNITED STATES PATENT OFFICE

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METHOD OF FORMING PLATES FOR RUNWAYS IN SPIRAL CHUTES AND THE LIKE

Frederick Kautz, Philadelphia, Pa.

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19 Claims. (Cl. 29—148)

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This invention relates to spiral chutes having a helical winding runway and also to curved chutes which are fractions of spiral chutes, although in such curved chutes the runway may not always be of true helical shape. In particular, the invention deals with methods of forming sections from which the runways of said chutes are to be assembled.

In building metallic spiral and curved chutes, the shaping and assembly of the runway has been often difficult and expensive. Use of large portions of sheet metal is not to be recommended as too difficult to shape and, instead, smaller sectional portions or flights are employed. Such flights require to be pre-shaped unless consisting of narrow strip-like sheets which may be readily placed in respective positions accompanied, however, by the disadvantage of retarding the assembling operation on account of more numerous flights due to the narrow width thereof. The degrees of shaping are largely dependent upon the degree of helical progression or "drop" of the runway. Generally, the degree of the shaping operation of the flights increases with the steepness of the runway and with the reduction of the diameter of its inner helix in combination or respectively.

One of the best methods heretofore employed is the shaping of the flights by dies under pressure, but this method has the disadvantage of being inflexible, as it would require great expense to provide die facilities for every possible helical progression and width of runways in commercial demand. In practice, this method is limited, therefore, to certain, most often used chutes.

Shaping by manual hammering or application of drop hammers has also been used, but such methods are slow and require skilled operators.

It is, however, possible to eliminate the need of shaping said flights by reducing them to narrow strips of sheet metal, but in such arrangement the more numerous flights would retard assembling considerably.

In considering the characteristics of a helical or similar contour of a runway, one notes that the difference of the progression between the outer and inner peripheral edges requires the opposite ends of a flight to be disposed in different planes and a flight therefore, must undergo a gradual twist to meet such requirement.

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In shaping such flights accordingly, it has been found that certain portions of the sheet metal expand and other portions contract. It also has been evident that the sheet metal submits more readily to expansion, but resists contraction, and the difficulties encountered in the shaping process are caused by the latter fact.

It is therefore one of the main objects of this invention to provide a respective forming process or method employing flights or sections, subjected to the forming of a shape in which said resistance to contraction of the material is considerably reduced in order to facilitate and simplify said process by minimizing the effect of the main obstacle encountered in forming. It is another aim of the invention to provide flight units consisting initially of separate or partly separated portions with shapes equally favorable to said reduction of the resistance to contraction and intended to be subjected to forming methods collectively so that said units can be made of sizes to represent larger sections or sectors in runways than usually found practical in conventional forming methods. It is an additional object of the invention to provide an inexpensive shaping process for said flights by manual methods or pressure devices or by combined efforts.

A further object of the invention is to provide a shaping process of flexible nature so as to be applied to all varying conditions in said chutes, without involving extra costs.

Still another object shall provide for the utilization of welding in said shaping process to obtain better results.

Additional objects, advantages and features of invention will be apparent and better understood from the following detailed description and the drawings, wherein,

Figure 1 is a perspective view of a spiral chute embodying the novel flight arrangement,

Figure 2 is a detail view of two reciprocal flights, before shaping.

Figures 3 to 6 are detailed views of flights in several modifications, before shaping.

Figures 7 and 8 are perspective views of flights showing the shaping process by pressure devices in principle.

Figure 9 is a perspective view of a shaping apparatus for the novel flights.

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Figures 10 to 14 are detailed views of further modifications of the flights, before shaping.

Figures 15 and 16 are fractional top plan views of modifications of flight arrangements in a spiral chute.

The invention utilizes in the runways of referred chutes sectional plate or flight portions of prematurely reduced shape towards the center of chutes with the resulting unfilled space compensated by reciprocally disposed similar portions with outwardly directed reductions. These portions are preferably cut to a substantially triangular shape and combined in units in which ordinarily a larger and smaller portion, reciprocally directed to each other, have their wider ends located at the outer and inner peripheries of the assembled runways respectively with adjacent edges of the portions forming substantially diagonal lines in the units. The portions thus combined are subjected to a forming operation collectively in order to acquire the helical contour of sections in runways, as desired, and thereupon united, preferably by welding, at said diagonal edges. In one of the modifications of the invention, integral plates with partial division along diagonal lines are employed to obtain referred triangular and reciprocally directed portions which, in turn, are likewise formed and united, preferably by welding, at the edges of said diagonal divisions.

Due to the triangular shape of the portions in said units, the resistance to contraction of the material and, therefore, to twisting motions is considerably reduced, as the broader ends of the portions remain substantially in the planes of the outer and inner helix of the chutes respectively and only the more narrow, tapered sections of the portions must be warped, and which can be carried out efficiently by simple manual or mechanical means, especially, as has been found, if said portions are treated collectively, as indicated.

As shown in the drawings, 10 represents a spiral chute having a central tubular structure 11, in vertical position, also known in the art as the center post, to which a helically winding runway 12 is secured. The outer edge of the runway is lined by a sheet band 13 at right angles thereto serving as outer guard rail to prevent the conveyed objects from being dislocated, and for the inner guard rail, the center post takes the place. For the purpose of illustrating my invention, only one type of spiral chute is shown, known as the closed center chute, but there are other chutes in use in which the center post is replaced by an inner guard rail similar to the outer one here shown, and the outer guard rail may also be replaced or supplemented by a cylindrical casing or housing enveloping the entire chute.

In the present instance, the spiral chute is shown as a welded structure, since it is superior to other methods of fastenings, such as riveting or bolting, which, however, may also be used is found desirable.

The runway is composed of a plurality of sectional portions or flights 14 having their contacting edges in overlapping relation and secured together by intermittent welding, preferably at the undersides of the chute, as indicated at 15. These flights are of substantially triangular shape and arranged in such way as to have inwardly pointing flights 16 supplemented by reciprocally located outwardly pointing

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flights 16' which essentially represents the novel feature of the invention.

Due to the characteristic nature of a spiral chute, the outwardly pointing flights are smaller in comparison to the larger inwardly pointing flights, and the sides of the triangles located at the edges of the runways are curvilinear. As shown, for example, in Figure 1, each of the complementary flights reach fully across the runway and their contacting edges alternately lie in a radial line and at an angle thereto, although other arrangements may be used in which each of said edges are located angularly to the radial lines as explained hereinafter.

The small area in which spiral chutes can be placed is recognized as one of their main advantages. Of these chutes, the closed center type is more preferred for reasons of its compactness and narrow transverse dimensions resulting from the small diameter of the inner helix of the runway made possible by the use of a tubular core member. In comparison thereto, the open center type spiral chutes include usually wider transverse dimensions caused by the larger diameter of said inner helix and respective inner support structure instead of a tubular core which is impractical in this instance, due to said larger diameter of said helix. Described difficulties in respect to shaping and forming of the flights have been, however, more apparent in the preferred closed center type spiral chutes in view of the proximity of the inner helix therein to the central axis as previously indicated. The respective forming processes of the invention deal, therefore, preferably with the latter type of chutes. In accordance with the customary practice, the center post 11 or core in chute 10, determining said inner helix, is shown with a diameter corresponding to a fraction of the width of runway 12. Said diameter usually varies in practice from approximately one-half to one-fifth of the runway. The proportions of the flights may not be considered to have the shape of narrow strips. In particular, the dimensions of the ends of the inwardly pointing larger flights 16 at outer periphery of runway 12 are shown to be at least one-third to one-half the width of said runway, a proportion which requires a distinct shaping operation for conventional flights of respective equal dimensions combined with a helical progression of the runway amounting at one revolution at least to the dimension of the double width of said runway, as further indicated in the structure of Figure 1. All described proportions in combination contribute largely to the difficulties of shaping the flights ordinarily encountered.

The described shape of the flights of the invention in combination with the reciprocal arrangement facilitates the shaping process considerably. It becomes obvious that the broader portions of the flights can be easily secured to the respective plane of the outer and inner helix of the runway and left unchanged in this location, and only the smaller tapered portions must be twisted which is easily performed as the resistance of the material in the latter portions to such process is but slight.

For obtaining better results and especially to facilitate the use of flights comprising larger sections in the runway as heretofore employed, the following shaping method is recommended.

A large and small substantially triangular flight, as in Figure 2, is abutted in reciprocal relation to each other and united by tack welding at

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opposite ends of the joint. The resulting tetragonal unit acquires a substantially diagonal division, stopping short near the edges, as shown in Figure 3. A similar unit is shown in Figure 4, having its portions joined in overlapping relation.

The same result is also obtained by providing a tetragonal flight having a cut 17 along a substantially diagonal line stopping short near one end, the opposite end of the cut closed by tack welding, as in Figure 5; or, an integral flight of the same shape may be provided having said diagonal division 17 stopping short near both opposite ends as in Figure 6.

In such flights (Figures 3-6) a twisting is easily performed to dispose the respective portions in the plane of the outer and inner helix of the runway, as in Figure 7. The dividing line of two different planes is provided by said diagonal cut which also eliminates the resistance of the material to the twisting method.

In securing the opposite ends of such flights to said locations which may be also done by welding them directly to the chute, a subsequent application of blows or pressure along said diagonal line, principally from a vertical angle to the flight, as indicated by the arrow 18, in Figure 8, will depress the diagonal ridge, as shown in Figure 7, and bring about a gradual equilibrium in the material between the two different planes of said opposite ends.

By such method, the mutually abutted edge portions along said partial diagonal division move in reciprocal direction to an overlapping relation which is most apparent at the middle section of said tetragonal units, resulting in a shrinkage of the material which can freely take place, due to said diagonal division. Said overlapping joint is subsequently secured together, preferably by tack welding at the under side, thus completing the shaping process, except for small irregularities in the material which may be easily adjusted by light hammering. The heat radiated from welding further increases the desired shrinkage effect with beneficial results on the formed shape of the units.

Likewise, in a unit as in Figure 4, in which the edges are already overlapped, said shaping process further overlaps the material at said middle portion. The separate unshaped portions of Figure 2 may be treated by the same shaping process if means are available to secure the opposite ends firmly to respective grades of chute. For instance, one of such means is provided by welding said ends directly to the chute followed by pressure or blows to obtain desired results as described.

This shaping process takes in account the fact that in twisting a sheet of tetragonal shape, the contraction of the material is substantially centered along a diagonal line and the expansion along the outer edge portions, and as described, the resulting difficulties caused by these circumstances are effectively eliminated, either by diagonal division or the similar use of triangles in reciprocal relation.

The forming jig 19 of Figure 9 may serve as a further aid to ease and speed up the shaping process. Mounted on a base 20, two spaced anvil portions 21 and 22 are located at an incline corresponding to the desired respective outer and inner pitch of the chute. These portions may be channel members as shown, the hollow sides facing each other so as to be able to receive within the ends of the flight units (Figures 3 to 6), which

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preferably are twisted beforehand, as shown in Figure 7. Respective fasteners, in the present instance, bolts 23 with operating handles threaded through the walls of the channel members are used to secure the ends of the flight firmly to the inclined position of the anvil portions, whereupon a pressure device 24 is operated to depress the ridge portion in the flight unit along said diagonal division. In the present instance, a worm 25 with an operating handle is chosen as such pressure device, held in position by a bracket anchored to the base of the apparatus. To prevent denting of the entire flight unit, the edge portions are supported by bar members which connect the spaced inclined anvil portions, leaving such an ample space open at the under side of flight as to have an unobstructed access for application of welding at the diagonal seam after shaping. Said connecting bar may follow a straight or curved course dependent on the desired nature of the runway (straight or concave). Also the incline of the anvil portions as well as the width of the jig may be made adjustable, so as to comply with all possibilities of flights or runways. The pressure may also be supplemented by a leverage device 19' heeled and pivoted to the radial edge of the flights and reach therefrom towards the mutual seam of the flight portions, so as to depress the area of the seams. Obviously, other means may be employed. Flight units after being shaped in a jig as described and shown, may be incorporated in chutes by welding, bolting, or otherwise found practical.

The flights of Figure 10 and the flight units of Figures 11 and 12 are modifications of Figures 2, 5 and 6 respectively. In these forms, said diagonal division is provided by a slit obtained by the respective curvilinear edge portions. The slit being of a width corresponding to the contraction of the material, is subsequently closed in the shaping process, whereupon the resulting but seam is secured together by welding. In this manner, smooth flight units are obtained.

In Figure 13, the diagonal division is deviated from regular course by an angular bend 26 which may also be substituted by a curve. In such manner, it is possible to better regulate the deepest level of concavity in a runway at a location as desired.

In another modification of the invention, a flight unit is provided in which the inwardly directed larger section may be subdivided into two smaller portions by an additional division as shown in Figure 14. Therein, the tetragonal flight is represented as having a cut 17 following a diagonal line and the larger of the two sections thus obtained is halved by an additional cut. These cuts are performed as shown in Figure 5, stopping near one end of the flight, the opposite end of the cuts being closed by tack welding which is, however, not the exclusive way of obtaining such cuts as shown before and it is understood that other methods may be followed.

Various methods of forming such flight units may be employed such as manual twisting of the portions or pressure devices applied. In the latter case, the outer ends of the inwardly directed portions are held in an identical plane contrary to the end of the outwardly directed portion in accordance with the differential outer and inner grade of the chute. The pressure or blows are principally applied along said diagonal division as previously described to obtain said resulting contraction in the material and the process is to be supplemented by pressure upon

said division halving the larger flight portion for further contraction and adjustment of the material of said area. The thus treated portions are secured together as previously described.

Such method may be especially appropriate in shaping extra large flights to be used for obtaining quicker assembling results.

The flight unit as shown in Figure 14 may be also composed of three separate triangular portions having two portions successively pointed inwardly relative to chute and supplemented by a portion disposed in opposite direction, to be followed by subsequent connecting of the mutual seams by tack welding at outer ends to obtain said divisions preparatory to shaping, or, said separate flights may be directly welded to outer and inner helix of chute in stated succession and formed thereafter by pressure devices or other methods as outlined before.

The curvilinear edge portions shown in Figures 10, 11, 12, etc., may be used in the above arrangement for the same purpose and effect.

In Figure 15, the contacting edges of flights follow alternately a radial line 28 and a line at an angle thereto, as in Figure 1. Such disposition of seams caused by a respective shape of the triangular flights or flight portions is best suited for runways having a straight transverse runway. For concave runways the arrangement of Figure 16 is preferable, in which every contacting seam of the flights lie in a line at an angle to the radial line.

By giving the triangular flights a scalene shape, the angularity of the seams relative to a radial line may be still increased to obtain an even greater concavity of the runway if desired.

It is understood that the disclosures herein serve for the purpose of illustration only, and that the flights may be subjected to changes regarding size, proportions, shape, and that they may be used on helical or otherwise curved chutes of various kinds.

I claim:

1. The process of forming a sectional unit in the runway of a chute conveyor of the tortuous kind or the like, consisting in preparing plates of tapered shape, arranging said plates in units and forming said units so as to acquire the contour of said runway with the aid of an apparatus having a base in which two opposite planes corresponding to the outer and inner grades of the assembled chute conveyor respectively and said apparatus further having retaining means at spaced portions and a pressure device operable upon said base, and said respective steps of arranging and forming said units, comprising placing said tapered plates upon said base in reciprocal relation to each other with respective edge portions thereof in mutual adjacency, and attaching respective peripheral ends of said plates lying at the outer and inner curve in the assembled chute conveyor to said spaced portions with said retaining means thereby disposing said plates in the plane of said outer and inner grade respectively, depressing the material of said plates lying inwardly from said spaced portions by operating said pressure device thereupon so as to cause a movement of said edge portions in the direction of the pressure combined simultaneously with a reciprocal and gradual turn of the planes of the plates between said peripheral ends and effect a gradual equilibrium in the material between said respective grades, and completing said unit by securing adjacent edge portions of said plates to each other.

2. The process of forming a sectional unit in the runway of a chute conveyor of the tortuous kind or the like, consisting in preparing a unit of plating with a substantially diagonal division stopping short near the edges, forming the thus partially divided sections of said unit so as to acquire the contour of said runway with the aid of an apparatus having a base in which two opposite planes corresponding to the outer and inner grades of the assembled chute conveyor respectively and said apparatus further having retaining means at said spaced portions and a pressure device operable upon said base, and the step of forming said unit comprising placing said unit upon said base and attaching respective peripheral ends thereof lying at the outer and inner curve in said chute conveyor to said spaced portions with said retaining means thereby disposing said sections in the plane of said outer and inner grade respectively, depressing the material of said unit lying inwardly from said spaced portions by operating said pressure device thereupon so as to cause a movement of the edge portions of said sections at the diagonal division in the direction of the pressure combined simultaneously with a reciprocal and gradual turn of the planes of the sections between said peripheral ends and effect a gradual equilibrium in the material between said respective grades, and completing the union of said sections by securing respective edge portions at said diagonal division to each other.

3. The process of claim 1 in which the step of securing said edge portions to each other is performed by welding applied at the side opposite from said pressure device, made accessible by a substantial opening in the base of said apparatus.

4. The process of claim 2 in which the step of securing said edge portions to each other is performed by welding applied at the side opposite from said pressure device, made accessible by a substantial opening in the base of the apparatus.

5. The process of forming sections in the runway of a chute conveyor of the tortuous kind or the like in which the width of the assembled runway is of a dimension greater than the diameter of the inner tortuosity of said runway, the steps which comprise providing units of flat material having at least two reciprocally directed portions with tapered reductions in area supplementary arranged so as to converge substantially in inward and outward direction respectively relative to the assembled chute conveyor to dispose the wider ends of said tapered portions at the outer and inner periphery of the assembled runway respectively, with respective edge portions of said tapered portions in mutual adjacency and with said wider ends of said inwardly directed portions in said units of a length corresponding at least to one-third of the width of said runway and further, with said tapered reductions of the inwardly directed portions substantially increased in comparison to such sectors in the plane of the assembled runway with wider ends at said outer periphery equal in length to such in said inwardly directed portions, forming said units so as to acquire the contour of respective sections in the assembled runway by forcing the material of said units to undergo twisting motions with pivotal axes lying at lines substantially transversely to assembled runway permitting simultaneously an areal readjustment of said units by respective motions of said portions and said adjacent edge portions respectively in relation to each other in order to dispose said wider ends of said portions in the respective different grades

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of the outer and inner peripheries of the assembled runway and the material of said portions therebetween in co-ordinated and graduated planes so as to effect a gradual equilibrium between said respective grades and by said readjustment effecting a change in the area of said units as means for facilitating said step of forming, and uniting said tapered portions in said units by securing said adjacent edge portions to each other.

6. The process of forming sections in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise providing units of flat material having at least two reciprocally directed portions with substantial tapered reduction in area supplementary arranged so as to converge substantially in inward and outward direction respectively relative to the assembled chute conveyor to dispose respective edge portions of said tapered portions in a substantially diagonal line in said units and in mutual adjacency relative to each other with the wider ends of said tapered portions forming substantially the ends of said units lying at the outer and inner periphery of the assembled runway respectively, forming said units so as to acquire the contour of respective sections in the assembled runway by placing said tapered portions in the different grades of the outer and inner periphery of the assembled runway respectively and employing means for retaining said wider ends of said tapered portions in said respective positions and further forcing the material of said tapered portions therebetween to undergo twisting motions with pivotal axes at lines lying substantially transversely to the assembled runway combined with a thereby initiated reciprocal readjustment of said tapered portions and said adjacent edges respectively in relation to each other substantially between said retained ends in order to dispose the material of said tapered portions therebetween in co-ordinated and graduated planes so as to effect a gradual equilibrium between said respective grades and by said readjustment effecting a gradual shrinkage in the area of said units between said retained ends as means for facilitating said step of forming, and uniting said tapered portions in said units by securing said adjacent edge portions to each other.

7. The process of claim 5 in which the step of preparing said units includes disposing said adjacent edge portions in substantially abutted relation relative to each other to be changed to gradually overlapping relation between said peripheral ends by said areal readjustment in the step of forming said units as means for obtaining said change in the area of said units.

8. The process of claim 5 in which the step of preparing said units includes cutting said tapered portions to a substantially triangular shape.

9. The process of claim 5 in which the step of preparing said units includes the provision of a major portion converging inwardly relative to the assembled chute conveyor supplemented by a reduced portion reciprocally directed thereto.

10. The process of forming a sectional portion in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise preparing a plate having a partial substantially diagonal extended division so as to form partially divided tapered sections connected to each other outwardly from the terminals of said division and with respective edges of said sections converging substantially in in-

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ward and outward direction respectively relative to the assembled chute conveyor with wider ends of said tapered sections lying at the outer and inner periphery of the assembled runway respectively, and with respective edge portions of said sections at said division in mutual adjacency, forming said plate so as to acquire the contour of a sectional portion in the assembled runway by forcing the material thereof to undergo twisting motions with pivotal axes at lines lying substantially transversely to the assembled runway and in a manner permitting simultaneously an areal readjustment of said plate by respective motions of said sections and said adjacent edge portions respectively relative to each other in order to dispose said wider ends of said sections in the different grades of the outer and inner periphery of the assembled runway respectively and the material of said sections therebetween in coordinated and graduated planes so as to effect a gradual equilibrium between said respective grades and by said readjustment effecting a disposition of said adjacent edge portions in overlapping relation to each other gradually inwardly from opposite terminals of said division resulting in a respective shrinkage in the area of said plate as means for facilitating said step of forming, and uniting said sections of the plate by securing said overlapped edge portions to each other.

11. The process of claim 10 in which the step of preparing said plate includes providing said plate for a chute conveyor in which the width of the assembled runway is of a dimension greater than the diameter of the inner tortuosity of said runway with wider end of a respective inwardly directed section at the outer periphery of the assembled runway of a length corresponding at least to one-third of the width of said runway.

12. The process of claim 10 in which the step of forming said plate includes attaching the wider ends of said sections lying at the outer and inner periphery of the assembled runway respectively to supports in the respective planes of the outer and inner grade of said runway so as to have said sections disposed in said planes respectively with said diagonal division as a dividing line, applying pressure upon said plate as means for obtaining twisting motions with pivotal axes lying substantially at the outer edges of said plate extended between said outer and inner periphery in order to force the material of said sections in said coordinated and graduated planes between said attached and substantially constant ends and said adjacent edge portions in said overlapping relation for the purpose of obtaining said shrinkage.

13. The process of forming a section in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise the cutting of plates to substantially triangular shape, attaching ends of two plates lying at the outer and inner periphery of the assembled runway respectively to supports in the respective planes of the outer and inner grade of said runway so as to have said plates disposed in said planes respectively in supplemental and reciprocal relation to each other with converging edges of said plates extended from said attached ends substantially in inward and outward direction respectively relative to the assembled chute conveyor and with respective edge portions of said plates in mutual adjacency to form a dividing line between said planes, forming said plates so arranged as a unit so as to acquire the contour of a respective sec-

tion of the assembled runway by applying pressure thereupon and in a manner so as to force the material thereof between said attached and substantially constant ends to undergo twisting motions with pivotal axes lying substantially at the outer edges of said plates extended between said attached ends combined with a thereby initiated areal readjustment of said unit by respective reciprocal motions of said plates and said adjacent edge portions substantially inwardly from said attached ends in order to dispose the material of said plates between said attached ends in coordinated and graduated planes so as to effect a gradual equilibrium between said outer and inner grade and by said readjustment effecting a shrinkage in the area of said unit between said attached ends centered principally at mid-section of said unit as means for facilitating said step of forming, and uniting said plates by securing said adjacent edge portions to each other.

14. The process of claim 13 in which the step of forming said unit provides applying pressure at an area concentrated along said adjacent edge portions of the plates.

15. The process of claim 13 in which the respective steps of attaching said ends and securing said adjacent edge portions together provide welding said ends to respective supports of the runway in the chute conveyor and welding said edge portions to each other.

16. The process of forming a sectional portion in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise preparing a plate with a partial substantially diagonally extended division performed by a partial cut in the material of the plate along a diagonal line stopping short near an edge portion of said plate at one side and closing said cut by welding near an edge portion of said plate at another side so as to form partially divided tapered sections connected to each other between said edge portions and terminals of said division and converging substantially in inward and outward directions respectively relative to the assembled chute conveyor with wider ends of said tapered sections lying at the outer and inner periphery of the assembled runway respectively and with respective edge portions of said sections at said diagonal line in mutual adjacency, forming said plate so as to acquire the contour of a respective sectional portion in the assembled runway by distorting the material of said sections about pivotal lines lying substantially in transverse directions to the assembled runway in order to dispose said wider ends of the sections in the grades of the outer and inner periphery of said runway respectively and the material of said sections therebetween in coordinated and graduated planes so as to effect a gradual equilibrium between said respective grades, and uniting said sections of the plate by securing said adjacent edge portions to each other.

17. The process of forming a sectional portion in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise preparing a unit of flat material with a partial substantially diagonally extended division performed by arranging separate sections of tapered shape in reciprocal relation to each other and welding the adjacent edge portions thereof together near marginal edges of said unit so as to form partially divided tapered sections separated from each other inwardly from said welded connections and converging substantially in inward and outward direction respectively relative to the as-

sembled chute conveyor with wider ends of said tapered sections lying at the outer and inner periphery of the assembled runway respectively, and with respective edge portions of said sections at said diagonal division in mutual adjacency, forming said unit so as to acquire the contour of a respective sectional portion in the assembled runway by distorting the material of said sections around pivotal lines lying substantially in transverse directions to the assembled runway in order to dispose said wider ends of the sections in the grades of the outer and inner periphery of said runway respectively and the material of said sections therebetween in coordinated and graduated planes so as to effect a gradual equilibrium between said respective grades, and uniting said sections by securing said adjacent edge portions to each other.

18. The process of forming a section in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise providing a unit of flat material having reciprocally directed portions with tapered reduction in area supplementarily arranged so as to converge substantially in inward and outward direction respectively relative to the assembled chute conveyor with wider ends of said portions lying at the outer and inner periphery of the assembled runway respectively and with respective edge portions of said tapered portions partially separated from each other by a slit inwardly from said respective wider ends produced by cutting said edge portions on curvilinear lines, forming said unit so as to acquire the contour of a respective section in the assembled runway by distorting the material of said portions around pivotal lines lying substantially in transverse directions to the assembled runway in a manner permitting simultaneously an areal readjustment of said unit in order to dispose said wider ends of the portions in the grades of the outer and inner periphery of said runway respectively and the material of said portions therebetween in coordinated and graduated planes so as to effect a gradual equilibrium between said respective grades and closure of said slit by reciprocal approach of said portions in the course of said readjustment, and uniting said portions by welding respective edge portions thereof at the closed slit to each other.

19. The process of forming a section in the runway of a chute conveyor of the tortuous kind or the like, the steps which comprise providing a unit of flat material having reciprocally directed portions of varied size with substantial tapered reduction in area supplementarily arranged so as to have a major portion converging in inward direction relative to the assembled chute conveyor and a reduced portion reciprocally converging thereto with wider ends of said portions lying at the outer and inner periphery of the assembled runway respectively and with respective edge portions of said portions disposed in mutual adjacency and deviated from a diagonal line in said unit in order to decrease the area of the major portion combined with a respective increase of the reduced portion substantially inwardly from said wider peripheral ends comparative to respective portions divided by a diagonal line, forming said unit so as to acquire the contour of a respective section in the assembled runway by distorting the material of said portions about lines lying substantially in transverse directions to the assembled runway in order to dispose said wider ends of said portions in the grades of the outer and inner periphery of said

runway respectively and the material of said portions therebetween in coordinated and graduated planes so as to effect a gradual equilibrium between said respective grades, and unting said portions of the unit by securing said adjacent edge portions to each other.

FREDERICK KAUTZ.

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