June 1, 1948. W. J. SACKETT 2,442,513

APPARATUS FOR SEASONING AND GRANULATING ACIDULATED PHOSPHATE

Filed Nov. 11, 1943 5 Sheets-Sheet 1

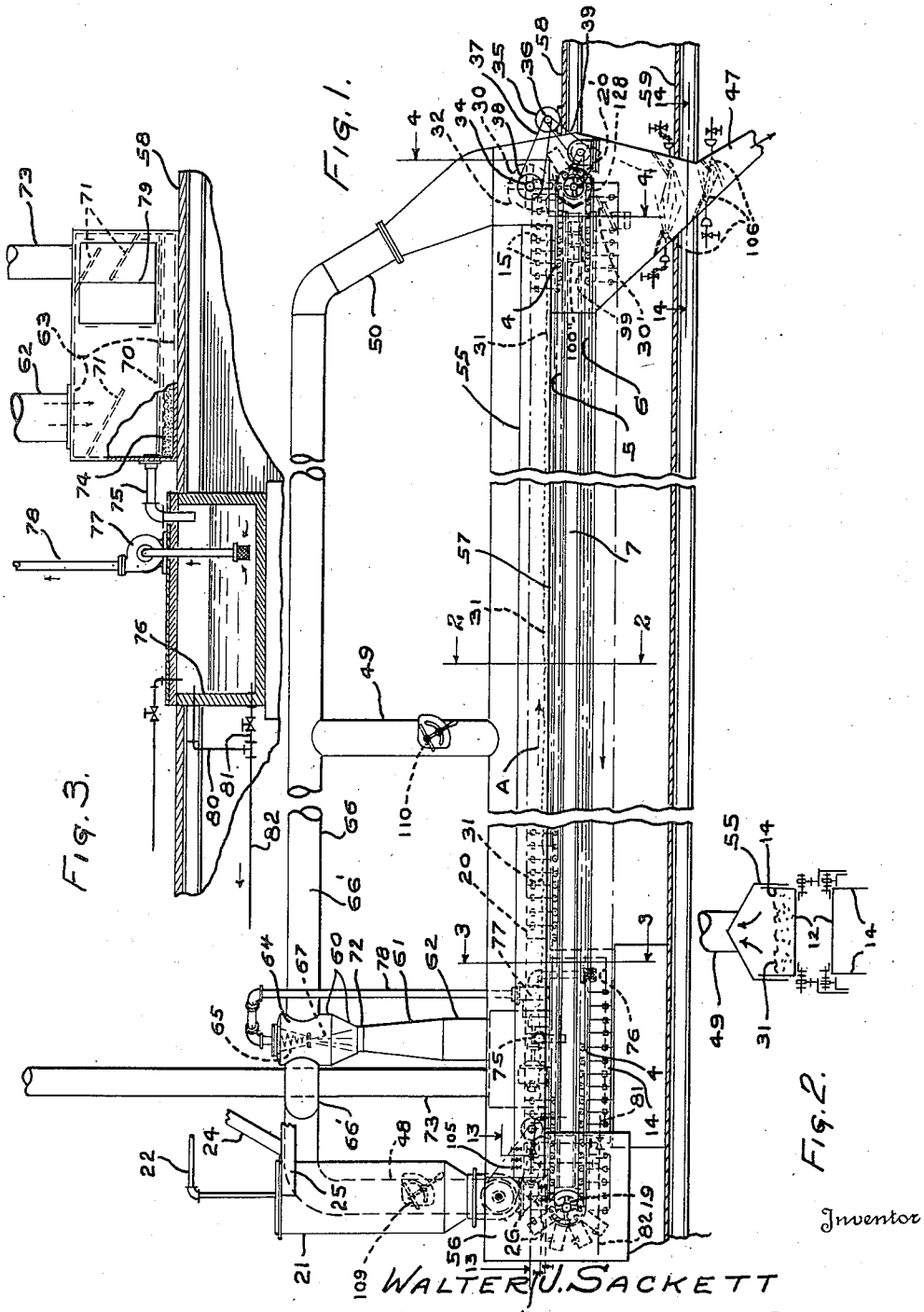


Fig. 1.

Fig. 3.

Fig. 2.

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APPARATUS FOR SEASONING AND GRANULATING ACIDULATED PHOSPHATE

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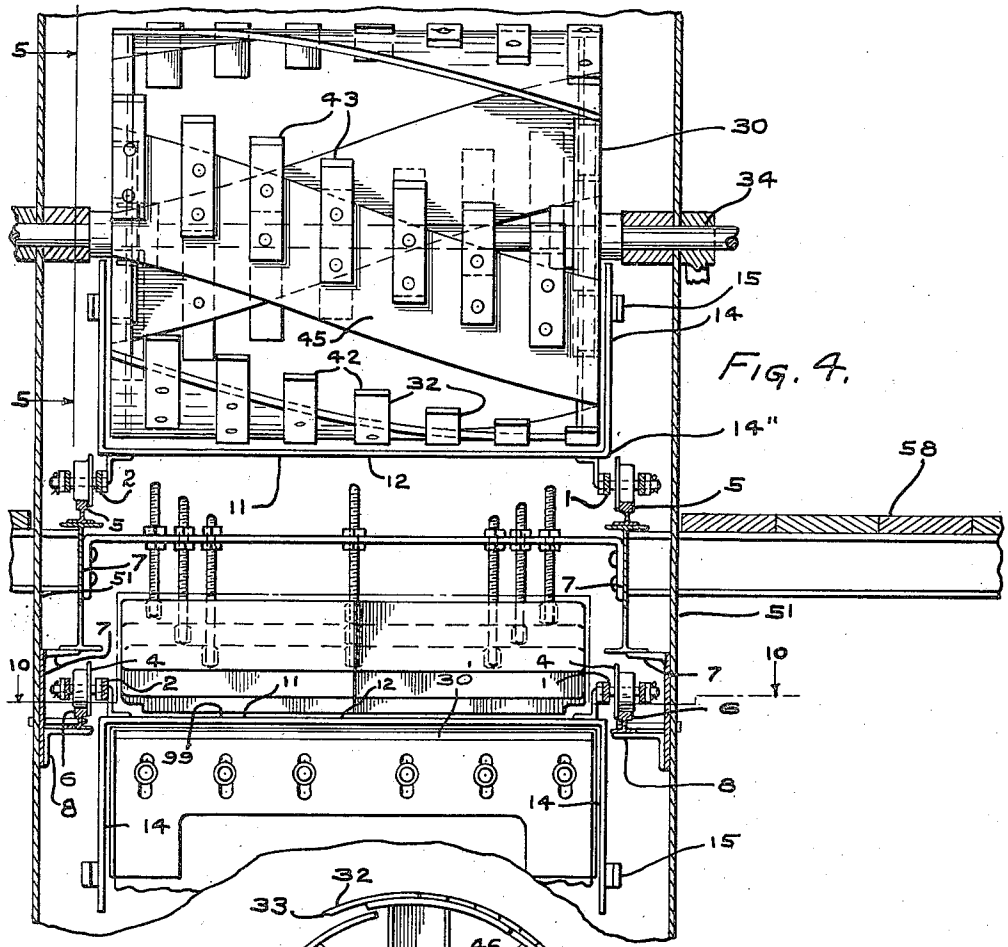


FIG. 4.

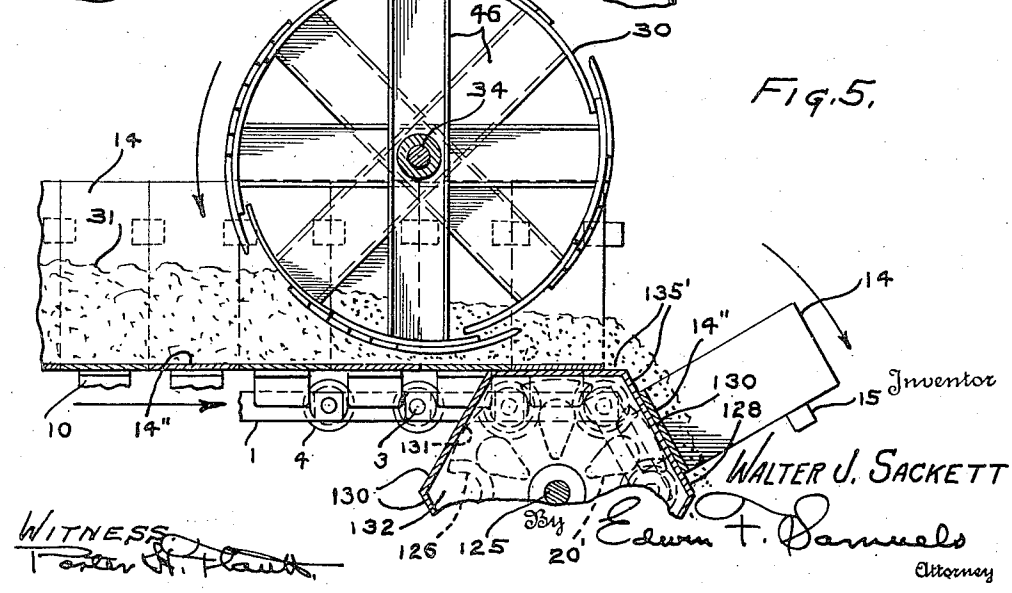


FIG. 5.

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APPARATUS FOR SEASONING AND GRANULATING ACIDULATED PHOSPHATE

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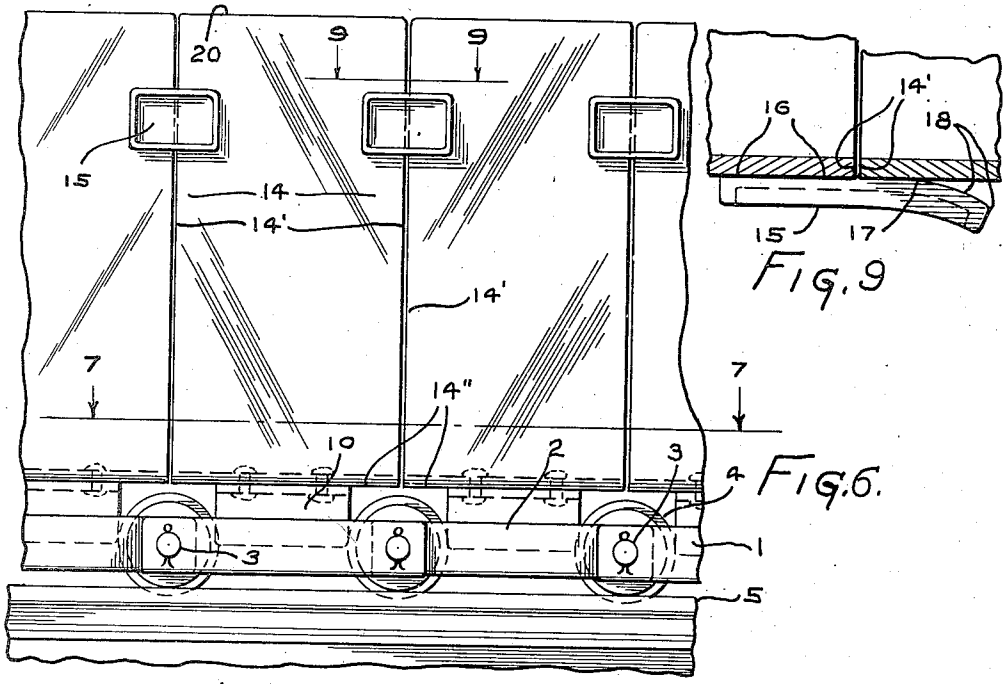


FIG. 9

FIG. 6.

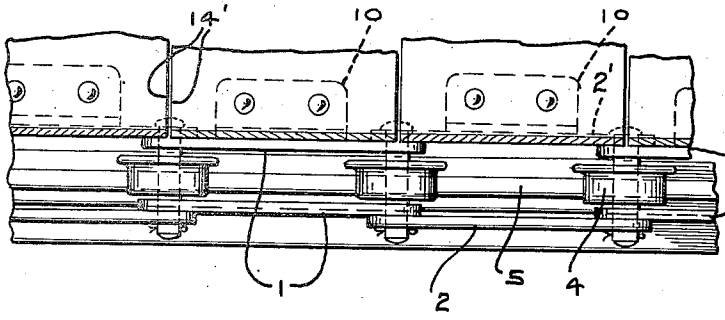


FIG. 7.

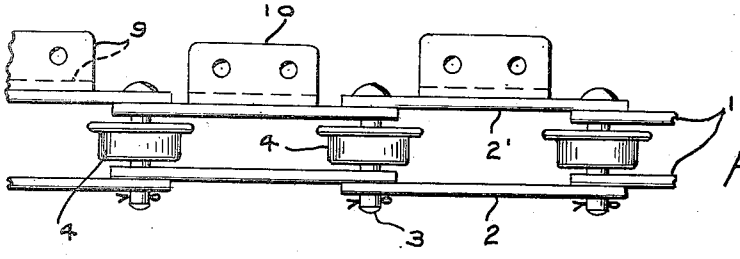


FIG. 8.

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APPARATUS FOR SEASONING AND GRANULATING ACIDULATED PHOSPHATE

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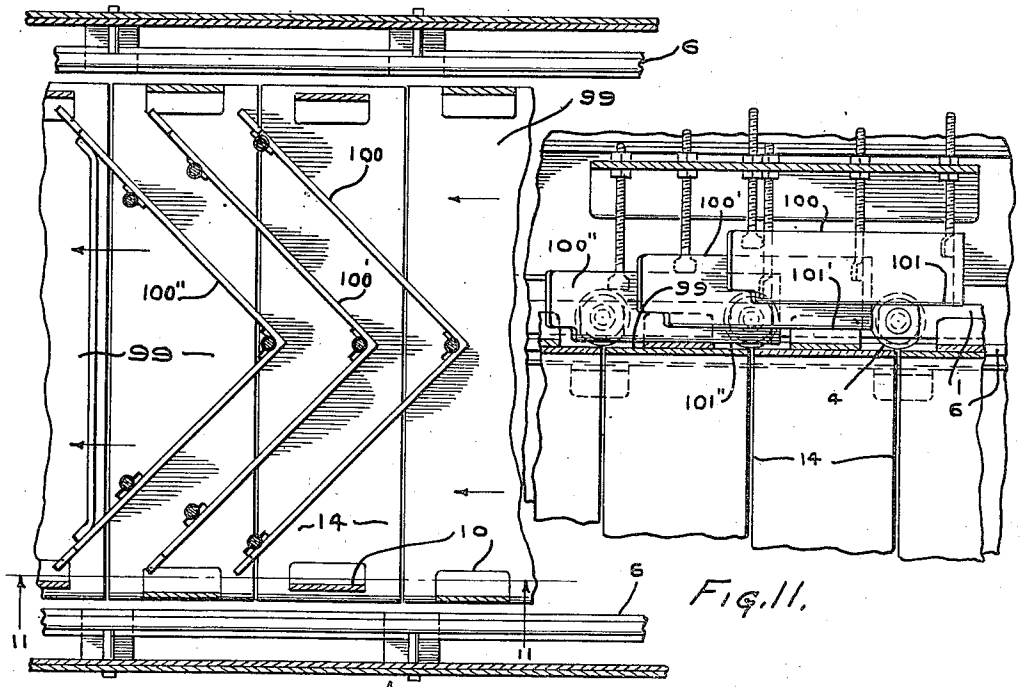


Fig. 11.

Fig. 10.

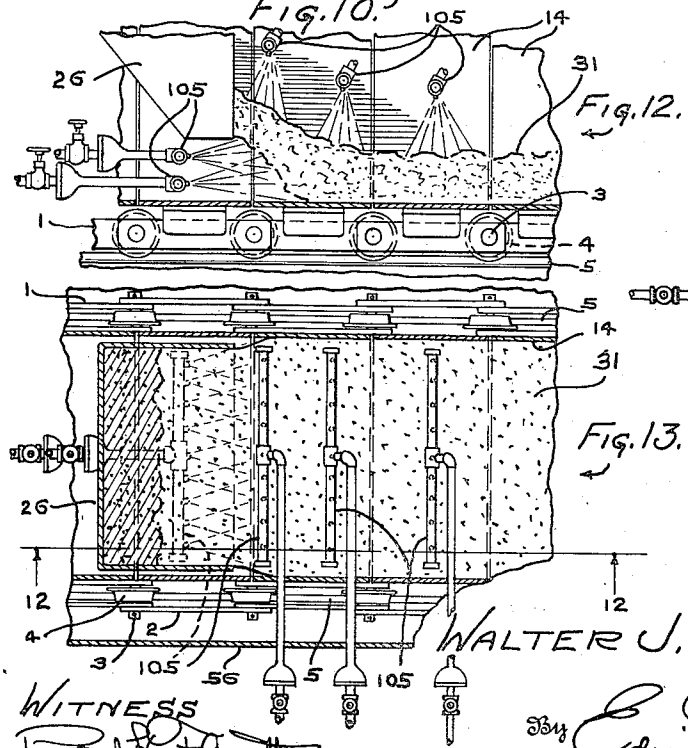


Fig. 12.

Fig. 13.

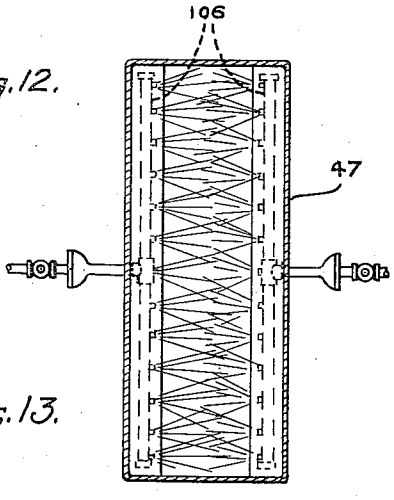


Fig. 14.

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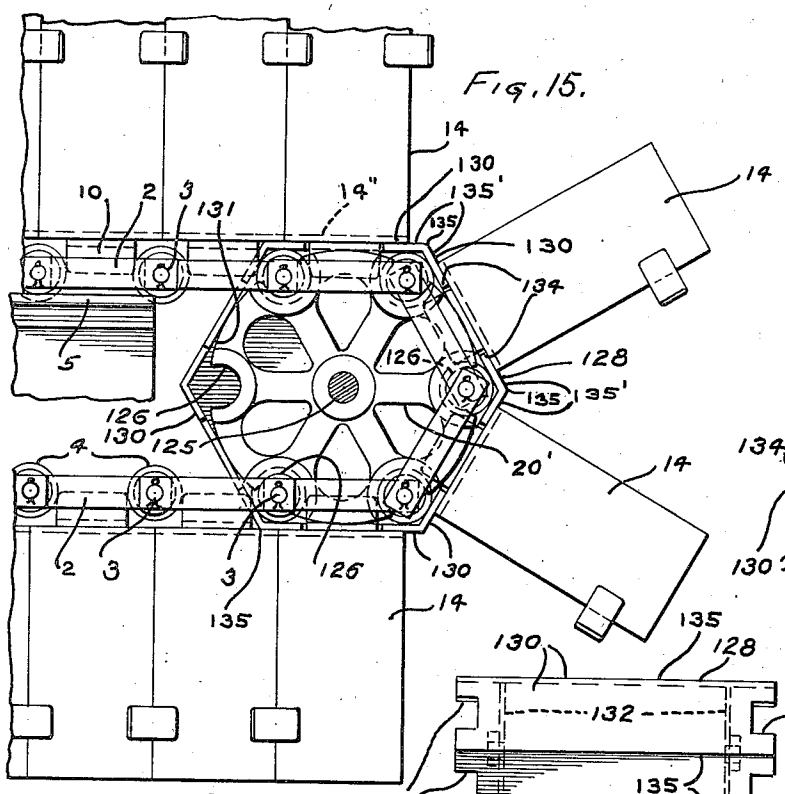
Foster H. Hamilton

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APPARATUS FOR SEASONING AND GRANULATING ACIDULATED PHOSPHATE

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Fig. 15.



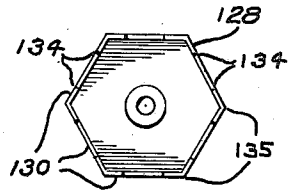


Fig. 18.

Fig. 17.

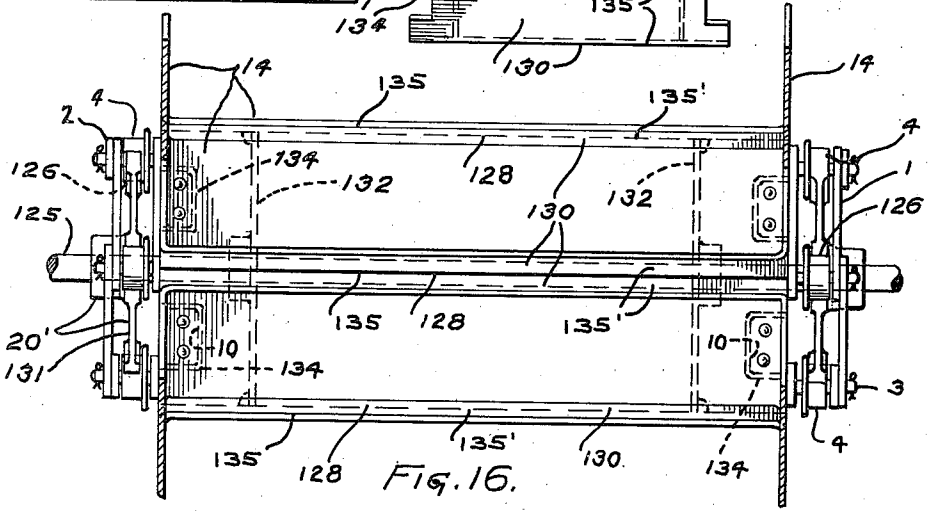


Fig. 16.

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Patented June 1, 1948

2,442,513

UNITED STATES PATENT OFFICE

2,442,513

APPARATUS FOR SEASONING AND GRANULATING ACIDULATED PHOSPHATE

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Application November 11, 1943, Serial No. 509,864

3 Claims. (Cl. 23—259.2)

1

While the inventive idea originated and had its development in connection with the acidulation of phosphate rock it is broadly applicable wherever a self-sealing fluid is formed into a moving cake of which the forward end portion is more or less continuously separated and removed, as the finished product, or to be further treated.

According to the existing practice in the production of acidulated phosphate, the phosphate rock is pulverized and mixed with acid, satisfactory formulas as to strength and proportions being well known. This mixing may be performed in a batch mixer or in a mixer into which sulphuric acid and finely divided phosphate rock are fed continuously and from which the resulting mixture is discharged continuously. With either type of mixer, the product is a liquid referred to as slurry of a varying consistency resembling that of pancake batter. According to existing practice, the mixer delivers directly into a concrete pit or den in which the material accumulates until the receptacle or den is filled to a convenient level.

The mixing process is then discontinued and the accumulated material is removed and placed in storage bins. This removal of the material from the den is performed from the top by crane buckets or through a removable side by mechanical excavators or by hand excavation. While the material is thus accumulating in the den it becomes partially seasoned and hardens or sets and must be broken, coming out in chunks or pieces of varying size which must be further reduced for feeding to and from a hopper.

The old method has several recognized disadvantages.

While the material is being removed, i. e., during the exdenning operation, the mixer and the attendants feeding and operating it are idle, with a consequent considerable loss of time of the machine and employees. The material which is first introduced may be the last removed, so that the seasoning period thus provided is a variable quantity and wholly indefinite, with a consequent tendency to deterioration of part of the material by over seasoning, or some of the material may remain so active for lack of seasoning that it can not safely be bagged on account of its tendency to attack the bag material, also the operation of removing at intervals the accumulation of hardened material from the den or bin is an expensive operation not involved in the new method, further under the conditions prevailing in the use of the old apparatus and method, the opportunity for the escape of the active gases which is the main purpose of seasoning, is limited as compared to that afforded in and by the new method and apparatus.

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The invention relates to a new and improved method and apparatus whereby the difficulties and deficiencies thus set forth and other defects in the old practice have been overcome.

In the practice of the new method or process, using the new apparatus both of which are regarded as features of the invention, the mixer is to best advantage of the continuous type, in that it discharges continuously into a new type of den or seasoning bin. The mixture or slurry as it comes to the den is still liquid or fluid, as above described and the den is in the form of a deep continuously moving channel provided by an endless conveyer which in the preferred form of apparatus shown is composed of U-shaped plates, mounted on a conveyer chain, whereby the top flight of the conveyer provides such a channel. It is regarded as of importance in this connection that while such a conveyer which is the only kind which could have sufficient capacity for the purpose, cannot be made liquid tight, it has been discovered that the particular liquid being treated is self-sealing, so that it does not escape by leakage and there is no loss on this account.

The material thus comes to the traveling den or conveyer in a liquid state, and is permitted to harden thereon, also becoming wholly or partially seasoned or neutralized by loosing the bulk of its active gases. In the present practice, to the details of which the invention is not limited, the traveling den is 4 feet wide and 80 feet long, and 20 inches deep, and travels at a rate of about 16 inches per minute so that the material is exposed in the den for a suitable period which in said practice of the invention is about an hour. According to the practice to the present date, the material in the den has been 18 inches in depth or thickness. In the complete or preferred form of the apparatus, the den is hooded throughout its length and the atmosphere is exhausted from the hood, being drawn in around the channel or den near the floor and withdrawn at successive locations spaced along its path.

According to the preferred practice, the atmosphere thus withdrawn, which is combined air, and gases, exhausted from the material in seasoning, is continuously washed, and the solids formed or deposited in the water are allowed to settle so that they may be separately removed and the remainder of the wash water is returned and reintroduced to the washing area. In

accordance with the preferred form of apparatus, the atomized water as introduced has an injector or ejector action whereby the atmosphere or air and gases are moved along the path above suggested.

A feature of importance is that the material progresses from the liquid to the solid condition on or in the traveling den, and at the delivery end the elongated cake formed by the hardened material, may be continuously cut loose from the den and at the same time, reduced to a condition which may be termed granular in which it can be fed to a hopper and distributed by suitable conveyers to storage bins or if sufficiently neutralized, a result which can, when desired, be accomplished by this apparatus, it may be immediately bagged for shipment.

At the time of exdenning or removal from the den, the material is so hard that in the old practice, excavating tools have been necessary, the exact degree of hardness being known to those skilled in this art. In the practice of the invention, the material, when removed from the traveling den is of similar hardness. The turning of the conveyor-like traveling den about the end sprocket, i. e. at the forward end of the top flight of the conveyor has been found to break the material into chunks. These are however, too large for delivery to and discharge from the usual type of hopper and would require further grinding.

According to the preferred practice of the invention, the hardened material is cut from the traveling den and reduced to the desired size by means of a rotary toothed cutter, which in the preferred form shown has its cutting edges arranged in the form of a multiple helix, with its axis transverse to the motion of the traveling den, whereby continuous and uniform contact of the cutter with the material is maintained, avoiding the shock and jar to the apparatus incident to repeated or intermittent action of the cutter. To complete the stripping of the den, a stationary cutter, slightly spaced, from the inside surfaces or the horizontal surface of the den may be located beyond the rotary cutter in the direction of traverse of the traveling den, other features being hereinafter described.

In the accompanying drawing, I have illustrated the apparatus of the invention in the form in which it has been developed, the same being subject to further changes of arrangement.

In the drawing:

Figure 1 is a side elevation, drawn to a minute scale, illustrating the apparatus in a general way, and partially diagrammatic, the den being broken away at two places, intermediately of its length for convenience of illustration.

Figure 2 is a transverse section on a similar scale taken on the line 2—2 in Figure 2.

Figure 3 is a transverse section on the line 3—3 in Figure 1, at the rear of the traveling den, showing the sump and settling tank, and adjacent parts, the settling tank being in elevation, and broken away for purposes of illustration.

Figure 4 is an elevation of the rotary cutter, the den and track, etc., being shown in section on the line 4—4 in Figure 1.

Figure 5 is the section at right angles to Figure 4 taken on the line 5—5 in said figure, and looking in the direction of the arrows, and illustrating the rotary cutter.

Figure 6 is fragmentary side elevation of the traveling den or conveyor.

Figure 7 is a horizontal section looking downwardly from the line 7—7 in Figure 6.

Figure 8 is a view similar to Figure 7 with the plates, i. e., the U-shaped den plates, removed.

Figure 9 is a fragmentary sectional plan on the line 9—9 in Figure 6, looking downwardly and showing the manner of engaging the adjacent plates one with the other to close the sides of the den.

Figure 10 is a sectional plan looking downwardly from the line 10—10, Figure 4.

Figure 11 is a vertical section on line 11—11 in Figure 10 looking in the direction of the arrows.

Figure 12 is a vertical section on the lines 12—12 in Figure 13.

Figure 13 is a sectional plan looking downwardly from the line 13—13 in Figure 1 and in the direction of the arrows.

Figure 14 is a sectional plan looking downwardly from the plane indicated by line 14—14 in Figure 1.

Figure 15 is a fragmentary side elevation of the delivery end of the conveyor illustrating the shield drum.

Figure 16 is an elevation taken from the right in Figure 15.

Figure 17 is a side elevation of the shield removed.

Figure 18 is an end elevation of the same.

Referring to the drawings by numerals: The construction shown comprises an elongated endless traveling conveyor chain 1 which in the form shown includes links 2, 2' connected by transverse pins 3, the double links 2 and 2' being spaced apart and each pin 3 carrying a supporting roller or wheel 4 between the links 2, 2', whereby the upper flight of the conveyor is supported on rails 5 and the lower flight is suspended from lower rails 6.

In the form shown, the rails 5 rest on longitudinal parallel I-beams 7, being preferrably near the floor level and the rails 6 are in the form shown supported by combined angle irons 7 and 8 which may be suspended from beneath the I-beams 7 or supported in any suitable manner, which is no part of the inventive thought.

The upper and lower rails 5 and 6 are each two in number, forming parallel tracks, spaced as best shown in Figure 4, the spacing in the structure from which the drawings were made, being a little over 4 feet.

Referring again to Figure 7, each of the inner links 2' has secured to its vertical side toward the center of the path or track, the vertical web of an angle iron 9 which provides a flat horizontally projecting plate or lug 10 on each link or any suitable proportion of the links. These plates or lugs may be described as in pairs, projecting inwardly or outwardly if preferred, from corresponding links of the conveyer chain 1, and each pair of such plates or lugs 10, and hence each pair of links 2' of each conveyer chain 1, has secured to it one end of the horizontal member 11 of a U-shaped plate 12. In the upper flight of the conveyer, the upright legs of the U at 14, project upwardly in an approximately vertical direction, with their vertical side edges 14' either in contact or in close relation as best shown in Figure 6, it being understood that the U-shaped members 12 are in the form shown, elongated flat plates of nearly uniform width and with their long edges parallel. Said plates being bent at the corners of the U's at 14'' to form the U-shaped members described.

In the preferred form, the adjacent edges 14' of the upright portions 14 which form the legs of the U plates, are held as nearly as possible in contact by the lugs 15, see Figures 6 and 9. These

lugs in the form of the invention shown are horizontally disposed with their greatest transverse dimension vertical and overlap the adjacent edges 14' of the plates, being secured to one edge as at 16 and in frictional engagement with the other adjacent edge as seen in plan, in Figure 9 at 17, the forward end of each lug being inclined outwardly away from the center of the conveyer or bin as at 18 to improve the contact at the initial portion of the engaging action which occurs as each plate swings about the sprocket at the beginning or initial portion of the top flight of the conveyer at sprocket 19, Figure 1. It may be noted that these clamping plates 15 are correspondingly released at the opposite end of the top flight of the traveling den or conveyer as it turns about the forward sprocket shown at 20' in Figure 1.

The general view of the apparatus, Figure 1, shows at the left in delivery relation to the initial end of the top flight of the conveyer, or traveling den 20, an acidulator 21, which is preferably of the continuous type though a batch mixer or several of them could be used with this apparatus to less advantage.

The drawing indicates a pipe 22 for the continuous introduction of acid and a chute 24 for the continuous introduction of ground phosphate rock and an air passage 25, whereby the pulverized or ground rock is blown into the apparatus. As both batch mixers and continuous acidulators capable of use with this apparatus have been shown in the prior patents, no specific description of this unit is regarded as necessary. The broader scope of the invention contemplates the use of other reagents and/or other solids producing a self-sealing liquid to be solidified into a continuous cake to be further treated substantially as herein described.

Treating the unit 21 as continuously operating; it delivers the slurry already described in a continuous stream to the initial end of the slowly moving traveling den 20, which in the form illustrated moves in the direction of the arrow A at the center of the apparatus. Preferably the delivery end 26 of the unit 21 fits in the channel of the traveling den 20 and a casing 56 further encloses it against escape of the gases and liquid, toward the open end of the apparatus at the left in Figure 1.

The slow motion of the conveyer or traveling den whereby the liquid is seasoned and solidified thereon, has already been described and the most approved manner of removal of the continuous cake thus formed at the end of the den at the right in Figure 1 has been outlined. The cutter by which the solid material is removed from the traveling den or rather the preferred form of cutter is illustrated in detail in Figures 4 and 5, being shown diagrammatically in Figure 1.

The cutter 30 as shown, fits in the channel within the U-shaped members 12, forming the traveling den, and it cuts from the forward end of the cake 31 which forms in the traveling den as best shown in Figure 5.

In the form shown, the cutter 30 is provided with forwardly disposed cutting teeth 32 having chisel-like cutting edges 33. In the form shown, the cutter rotates counterclockwise as seen from the left in the Figure 5 and each cutter 32 is in the form of a plate shaped longitudinally, approximately in the form of a circular arc, about shaft 34, but of reducing radius, backwardly, i. e. oppositely to the direction of rotation. Shaft 34 is driven by an electric motor 35 or in any suitable manner, a motor adapted to this purpose being indicated at 35 in Figure 1, said motor carrying a small pulley 36, which drives a belt or chain 37, which drives a larger pulley or sprocket 38 on the cutter shaft 34, and in the form shown, a chain 39 engages a small sprocket on the motor shaft, which by way of a reducing train, drives a large sprocket on the shaft with or secured to the forward sprocket 20' of the traveling den, driving the conveyer chain 1 and the den, any necessary speed reduction required to drive the den at the speed previously suggested or other similar and suitable speeds being included.

The nature of the cake 31 permits it to be reduced to granular form when cut by shaving in the manner illustrated in 5, it being understood that the cutters 33 are preferably arranged in lines spaced apart with the cutters of one line opposite the spaces in the next line as shown in Figure 4, the arrangement described being referred to for convenience as staggered.

While any method of disrupting or disintegrating or breaking the cake at its forward end is contemplated, it is found to be of advantage to provide a continuous engagement of the cutters with the advanced end of the cake and a substantially uniform engagement at all times to avoid the shock and the harmful vibration to the apparatus which would result from uneven or periodic cutting as if the cutters were arranged in lines parallel to the axis. To this end, the cutter body which is shown in the form of a cylinder is so constructed as to permit the lines 42, 43, etc., of cutters to be helically arranged so that the cutting contact of the cutters with the cake of material is substantially uniform and at least continuous, the alternate arrangement of cutting teeth contributing to the ease of cutting and also to the granular form of the product.

In the form shown, each line of cutters 42, 43 is mounted on a helically inclined plate 44, i. e. a plate helically related to the shaft which plate extends from one end of the cylinder to the other, the plates being preferably parallel and secured at their ends to diametrical bars or beams 46, which are in turn secured to the cutter shaft 34. The cutters 32 of each line project forwardly in the direction of rotation from the corresponding plate 44, being spaced apart as foresaid by an interval corresponding to the width of the cutters and preferably in helical lines or approximately so, the cutters of one line being circumferentially aligned with the spaces of another line or the next line.

The granular material in the form to which it may be reduced as it comes from the discharge end of the den, is discharged in any suitable manner as by way of chute 47, being thereafter distributed in the manner suggested in the preamble or any suitable manner, it being understood that the change of direction about the small diameter, forward sprocket would break and discharge the material in chunks which are usable but not capable of handling as just described, said sharp change of direction, constitutes a means for separating the material into fragments.

In the form shown, the fumes from the traveling den 20, and preferably also from the acidulator 21 and from the vicinity of the knife or rotary cutter are conducted at suitable points by way of risers which are shown for example at 48, 49, and 50, to a main 66, and later discharged. Any suitable number of risers may be employed. It may be noted that the riser 50 is connected to the cutter casing, shown at 51 in Figure 4,

and also in Figure 1 which knife casing leads downwardly and terminates in the chute 47. It also leads upwardly to the riser 50, also merging with the hood 55. This hood 55 extends the entire length of the traveling den, being closed at the delivery end of the latter, by junction with the discharge casing 51, and at the initial end by the intake casing 56 which is closed about the delivery of the acidulator 21.

The hood 55, preferably encloses the top and sides of the den, having its lower, horizontal side edges at 57, spaced but slightly above the floor, the level of the two adjacent floors being indicated at 58 and 59 in Figure 1 at the right.

The washing of the recovered atmosphere in the form of apparatus shown is performed in an inverted frustoconical chamber section 60, shown as depending from an upright cylindrical chamber 64 and having an upright frustoconical discharge section 61 from which a pipe 62 leads downwardly to the settling chamber 63 to be further described.

The upper section of the washing chamber at 64 contains a downwardly disposed atomizing nozzle 65 which is axially related to the chamber 64 and to the frustoconical sections 60 and 61, the cross-section of the jet at 72 being approximately equal to the cross-section of the restricted portion of the chamber at 72.

A pipe 66, in the nature of a main, connects the risers 48, 49, and 50 and such other risers as may be found desirable for the purpose of exhausting the atmosphere from the hood 55. Main 66 as shown, discharges into the two opposite sides 66', 66'' of the chamber 64, and the atomized jet 67 from the nozzle 65 has an ejector action whereby the air is drawn from both sections of the main 66 at 66' and 66'', and passes downwardly into the settling or separator chamber 63, where the liquid and the contained solids are deposited at 70, being separated from the air by suitable baffles 71, the washed air escaping through any suitable outlet as stack 73.

In the separator chamber 63, various materials accumulated in washing the atmosphere or air and gases from the hood are deposited in solid form at 74 and the relatively pure water is drained at a higher level by a drain pipe 75, which discharges into a sump 76 from which the wash water is withdrawn by a pump 77 which discharges under pressure through a pipe leading to the spray or atomizing nozzle 65.

The solids are withdrawn from the chamber 63 by way of doors 79, such removal being accomplished at suitable intervals and at times the water in the sump 76 is changed, new clear water being introduced by way of pipe 80, the saturated water being first withdrawn by way of pipe 81, both of which in the form shown are connected to a pipe 82, which by suitable valves may be connected alternatively to a supply or to a discharge.

For convenience and conformity with the terminology which has been used in connection with this apparatus, the hood 55, the risers 48, 49, and 50 and the main 66 are referred to as a vacuum system, the fact being that an appreciable reduction of pressure below atmosphere actually results from the ejector action incident to the operation of the jet 67 which being combined with the air, in the restricted area 72, and the expanding area 61 and continuing in contact therewith in the chamber 63, effects very complete washing.

In operation it has been found that some of the material removed by the cutter 30 accumulates on the surface 99 of the conveyor which is uppermost in the return or bottom flight. To remove this material scrapers 100, 100', 100'' have been provided as shown in Figures 10 and 11. In the form shown these scrapers are V-shaped as seen in plan, the point of the V being opposed to the advancing conveyor and material. In the form shown the bottom edges 101, 101', 101'' of the scrapers 100, etc., are at different levels the one adjacent the delivery end at 101'' being spaced upwardly from the conveyor bottom 99 by the greatest interval which is reduced by steps, the scraper 100'' being closely adjacent the conveyor. These scrapers are preferably located over the discharge 47, or in discharging relation thereto.

Due to change of operating conditions as the quantity of mixture fed to the den or the speed of the latter or other conditions, it is desirable to vary the vacuum in different parts of the den, particularly to decrease the vacuum near the initial end of the den, to eliminate any tendency to withdrawal, by the vacuum, of material which would otherwise be formed into the cake.

For this purpose damper 109 in riser 48 and 110 in riser 49 have been provided. As shown, these are hand operated and suitably held in various positions of adjustment.

It is also noted that it is found advisable to make the stationary scraper or cutter 30' which fits inside the U-shaped member 14, also of U shape, fitting the sides and bottoms of the U-shaped member 14, otherwise the cake tends to accumulate therein.

It is further of interest that the commercial acid now obtainable, or that ordinarily available at figures suitable to this use, is weak or contains a considerable amount of water. To have the cake relatively dry at the point of removal so that it is readily reduced to granular form, it is found helpful to heat the mixture or material as introduced into the den or at the discharge end, the heating of the material at other points in its path having the same tendency, but being regarded as somewhat less desirable. For the purpose stated, flame heaters are shown at the initial end of the den at 105, acting on the material as it comes from the mixer and at the discharge end at 106, other locations of the heaters and other heating means being within the broader conception of the invention.

It is also of importance that the undesirable fluorine content of the product is reduced by heating the material particularly at the discharge end as or after it passes the cutter.

To overcome the tendency of small fragments of the cake separated at the discharge end of the traveling den or conveyor channel or chamber to pass downwardly or drop between the U-shaped plates 14 where the contact between the edges 14 of said plates is broken as this conveyor rotates from the upper to the lower flight, about the forward sprockets 20' a drum-like form of shield has been devised. In the absence of this shield or other means for intercepting these particles a large part of them would lodge on the top surface of the bottom or return flight of the conveyor whereby a considerable portion of the material would avoid the delivery shute 47 being carried back to a location beneath the initial end of the upper flight.

This shield 128 in the preferred form shown, while it may be referred to as a drum is to best advantage of angular cross section being coaxial

with the shaft 125 on which the two forward sprockets 20' are mounted.

In this connection it may be noted that the forward sprockets have each of them six uniformly spaced notches 126 which admit and successively engage the corresponding opposite rollers 4 at each side of the conveyor 1. To best advantage the shield drum 128 is of hexagonal cross section, each side 130 of the drum being in the preferred form shown, tangent to the peripheral arc 131 between the corresponding sockets 126 or notches of the sprockets 20'.

The drum 128 in the form shown is supported on and carried by the sprocket shaft 125, the drum sides 130 extending from one sprocket to the other, the ends of the drum sides or side plates 130 being notched or rabbeted at 134 to admit the lugs 10 on which U-shaped channel plates 14 are supported and by which they are connected to the conveyor chain 1.

In the form shown the shaft 125 carries two drum supports 132 each of which is in a radial plane of the shaft 125 and secured thereto. These supports 132 are shaped according to the cross section of the drum, in the form shown being hexagonal and the drum sides 130 are secured to the supports forming the hexagonal drum 128.

The supports 132 are as shown spaced inwardly from the sprockets 20'.

In operation the shield 128 rotates with the sprockets 20' and with the conveyor 1 and channel plates 14, the vertices 135 of the hexagonal shield closing the openings 135 between bottom portions 14'' of plates 14 as they break apart in rounding the sprockets 20'. In this way leakage of the fragments through the bottom of the channel conveyor is prevented, all or practically all the material freed from the conveyor being delivered through and by way of the shute 47.

It may be noted that in addition to the rotary cutter 30, a fixed cutter 30' is also desirable, whereby the adhering material is finally removed from the plates 12, particularly the transverse portion 11, though the cutter may be U-shaped to fit each entire plate if desired.

While a continuous acidulator or mixer is preferred for feeding the apparatus of the invention, it is conceivable that one or more batch mixers may be arranged to feed it for a period of time or successive periods in which the supply of fluid to the apparatus would be continuous.

The method or process will be fully understood from the preamble taken in connection with the description of the apparatus, the operation of which is believed to have been made clear.

Important accomplishments of the invention are the continuous formation of a cake from a continuous supply of fluid acidulated phosphate rock, supplied in the form of the usual slurry with the continuous abrasion of the forward or hard end of the cake, whereby continuous production of granular acidulated phosphate is attained, it being however, feasible, if desired to merely break the cake at the delivery end of the den.

It is further of importance that the new process and apparatus eliminates the idle period of the mixing plant, and operators or attendants with consequent saving of time of both and a further increased output from the plant which results from elimination of idle periods necessary for removing the hardened material from the stationary den in which it has according to the prior practice been deposited.

A further important accomplishment is the elimination of the expense of excavation from the den and of the grinding or other reduction of the size of the particles after excavation.

Another and still further accomplishment is the continuous recovery of the active ingredients from the atmosphere which surrounds the location of seasoning, whereby pure air is discharged, the said ingredients are saved and contamination of the atmosphere is avoided.

Having thus described a single example of the application of my invention which is subject to a degree of variation in accordance with the ability of those familiar with the corresponding practice, and also having described an apparatus used and found practical in making acidulated phosphate in accordance with my invention, what I claim as new and desire to secure by Letters Patent is:

1. An apparatus for treating a solidifiable fluid fertilizer material which comprises an endless conveyor having a long substantially horizontal upper flight composed of a plurality of juxtaposed individually rigid members each having a bottom and upstanding sides, linked chains having rollers on horizontal spindles at the link joints, said members being mounted on the links above the roller spindles, said members being mounted on said chains to form a continuous longitudinally open channel in the horizontal flight in which each member contacts the adjoining member at the longitudinally extending edges of each respective member, and the contacting edges of adjacent members are in the same vertical plane as the spindles of said rollers, tracks on which the rollers ride to support the channel in its horizontal flight, means to discharge fluid material into the conveyor at the beginning of the horizontal flight, means at the other end of said flight to break up the material which has solidified during its passage from one end to the other of said flight, sprocket wheels for said chains having roller receiving sockets therein at the delivery end of said flight around which the conveyor passes and bends separating the adjacent edges of the channel members longitudinally, both at their sides and bottom, and breaking the continuity of the channel, said sprocket wheels having therebetween angled plates, the angle of the plates and the roller spindles lying in a common radius of the sprocket, the plates extending above the roller sockets and adjacent and under the open spaces between the bottoms of the conveyor members to render continuous the bottom of the conveyor as it rounds said sprocket wheels, and to keep the material from falling to the lower run of the conveyor.

2. An apparatus for treating a solidifiable fluid fertilizer material which comprises an endless conveyor having a long substantially horizontal upper flight composed of a plurality of juxtaposed individually rigid members each having a bottom and upstanding sides, linked chains having rollers on horizontal spindles at the link joints, said members being mounted on the links above the roller spindles said members being mounted on said chains to form a continuous longitudinally open channel in the horizontal flight in which each member contacts the adjoining member at the longitudinally extending edges of each respective member, and the contacting edges of adjacent members are in the same vertical plane as the spindles of said rollers, tracks on which the rollers ride to support the channel in its horizontal flight, means to discharge fluid material into the conveyor at the beginning of the horizontal flight, means at the other end of said

flight to break up the material which has solidified during its passage from one end to the other of said flight, sprocket wheels for said chains having roller receiving sockets therein at the delivery end of said flight around which the conveyor passes and bends separating the adjacent edges of the channel members longitudinally, both at their sides and bottom, and breaking the continuity of the channel, said sprocket wheels having therebetween angled plates, the angle of the plates and the roller spindles lying in a common radius of the sprocket, the plates extending above the roller sockets and adjacent and under the open spaces between the bottoms of the conveyor members to render continuous the bottom of the conveyor as it rounds said sprocket wheels, and to keep the material from falling to the lower run of the conveyor, means to firmly support the return flight of said conveyor and a plurality of scrapers projecting into the return flight of the conveyor, each successive scraper in the direction of travel of the conveyor being spaced nearer to the inverted bottom of the conveyor members, the final one being closely adjacent thereto to scrape the same clean, so that a tight channel may be presented for the receipt of further fluid material.

3. An apparatus for treating a solidifiable fluid fertilizer material which comprises an endless conveyor having a long substantially horizontal upper flight composed of a plurality of juxtaposed individually rigid members having a bottom and upstanding sides, chains on which said members are mounted, in the horizontal flight said members being mounted on said chains to form a continuous channel, means for driving said conveyor, material feeding means above the upper flight, at the beginning end, heating means between the material feeding means and the upper flight of the conveyor directed in the direction of movement of the conveyor to heat the material on the side that will then contact the sectioned channel conveyor.

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