June 6, 1961 P. J. HOMAN 2,987,307

COMBINED CONTINUOUS SINTERING AND COOLER MACHINE

Filed June 18, 1958 6 Sheets-Sheet 1

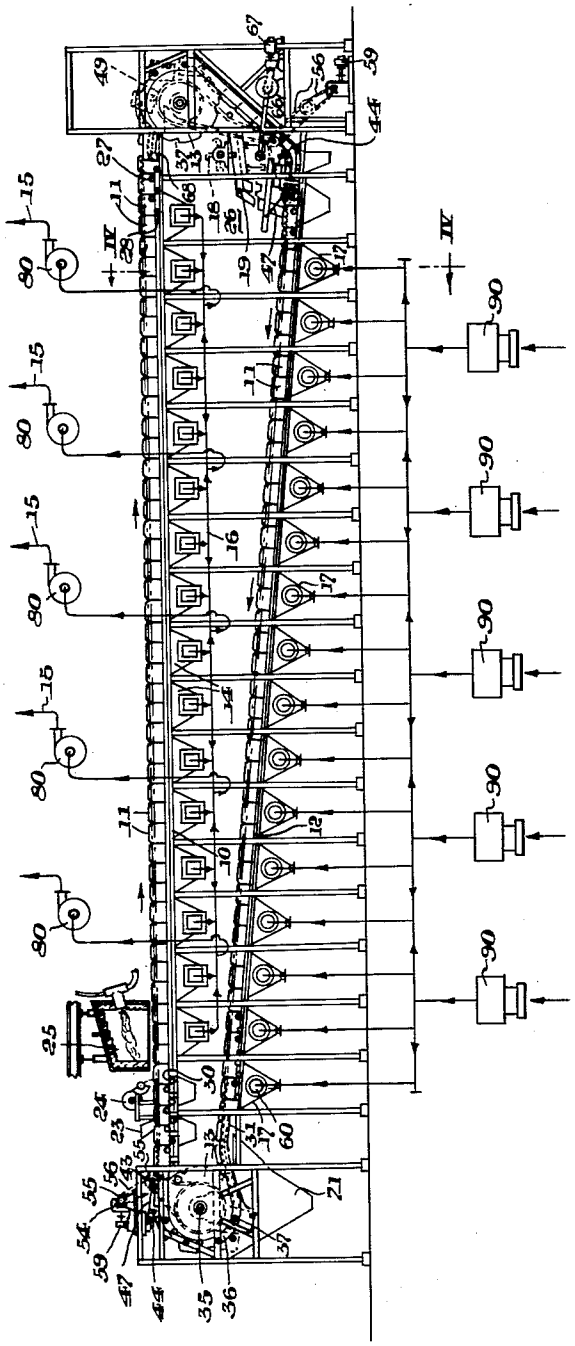

Fig. 1.

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COMBINED CONTINUOUS SINTERING AND COOLER MACHINE

Filed June 18, 1958 6 Sheets-Sheet 2

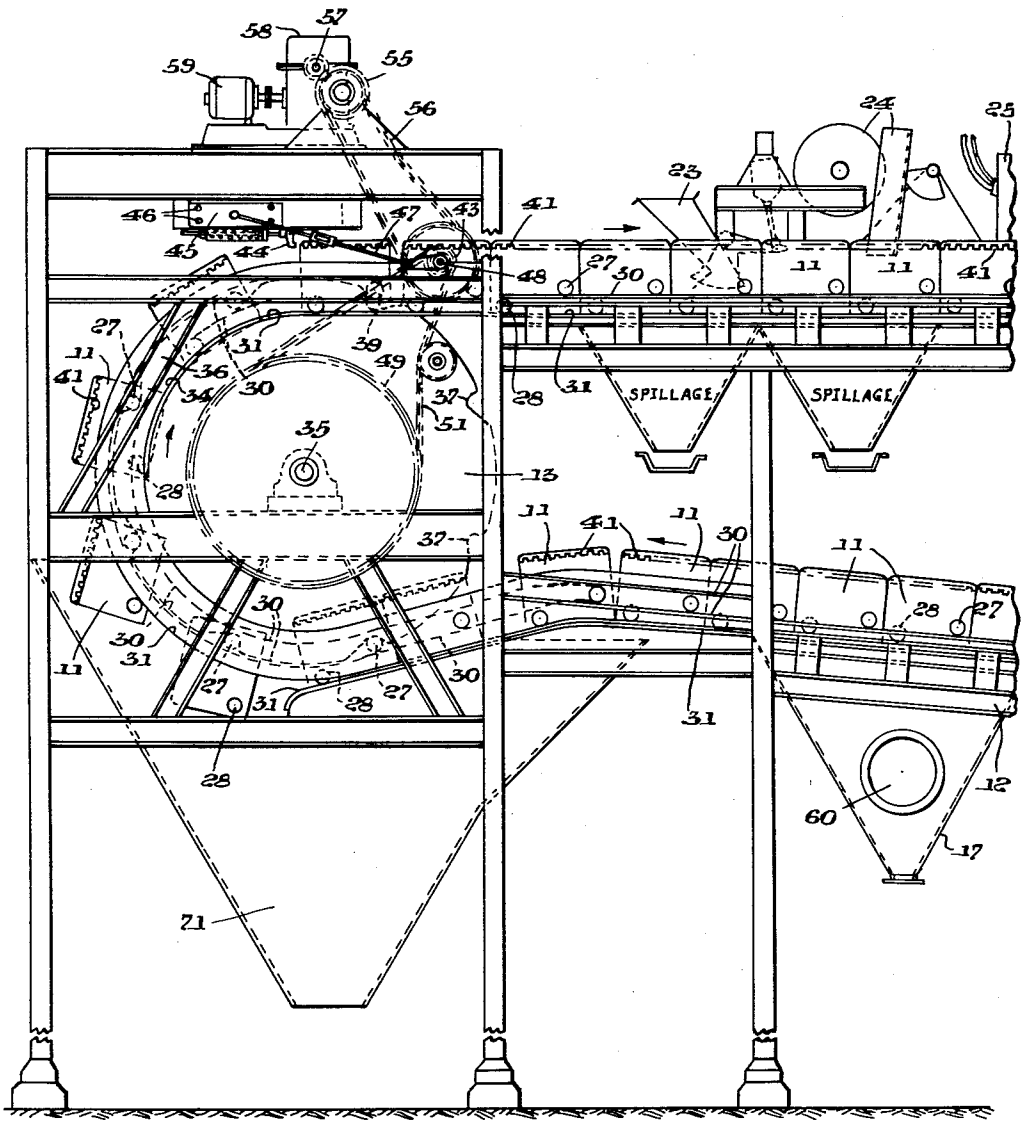


Fig. 2.

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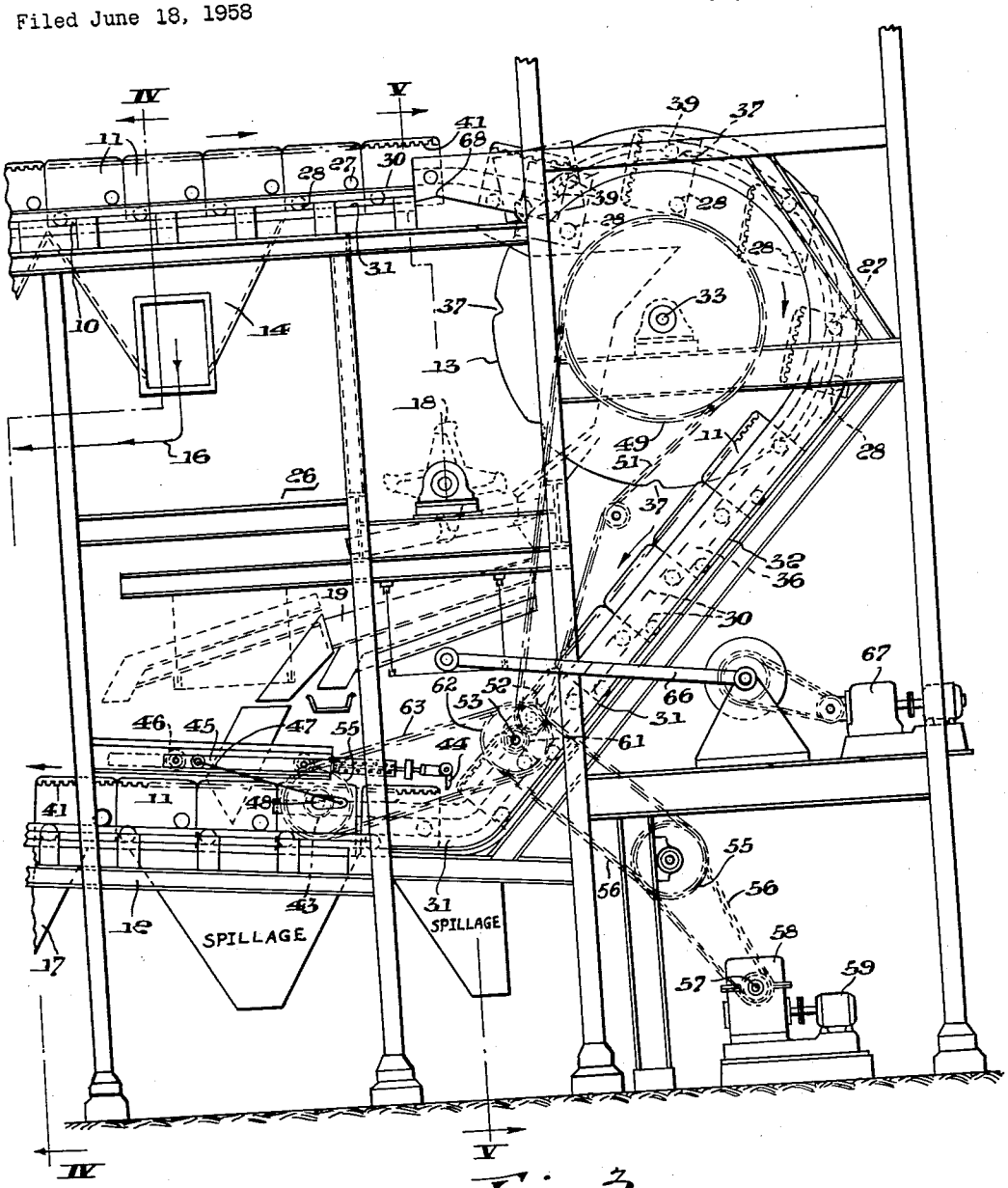


Fig. 3.

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COMBINED CONTINUOUS SINTERING AND COOLER MACHINE

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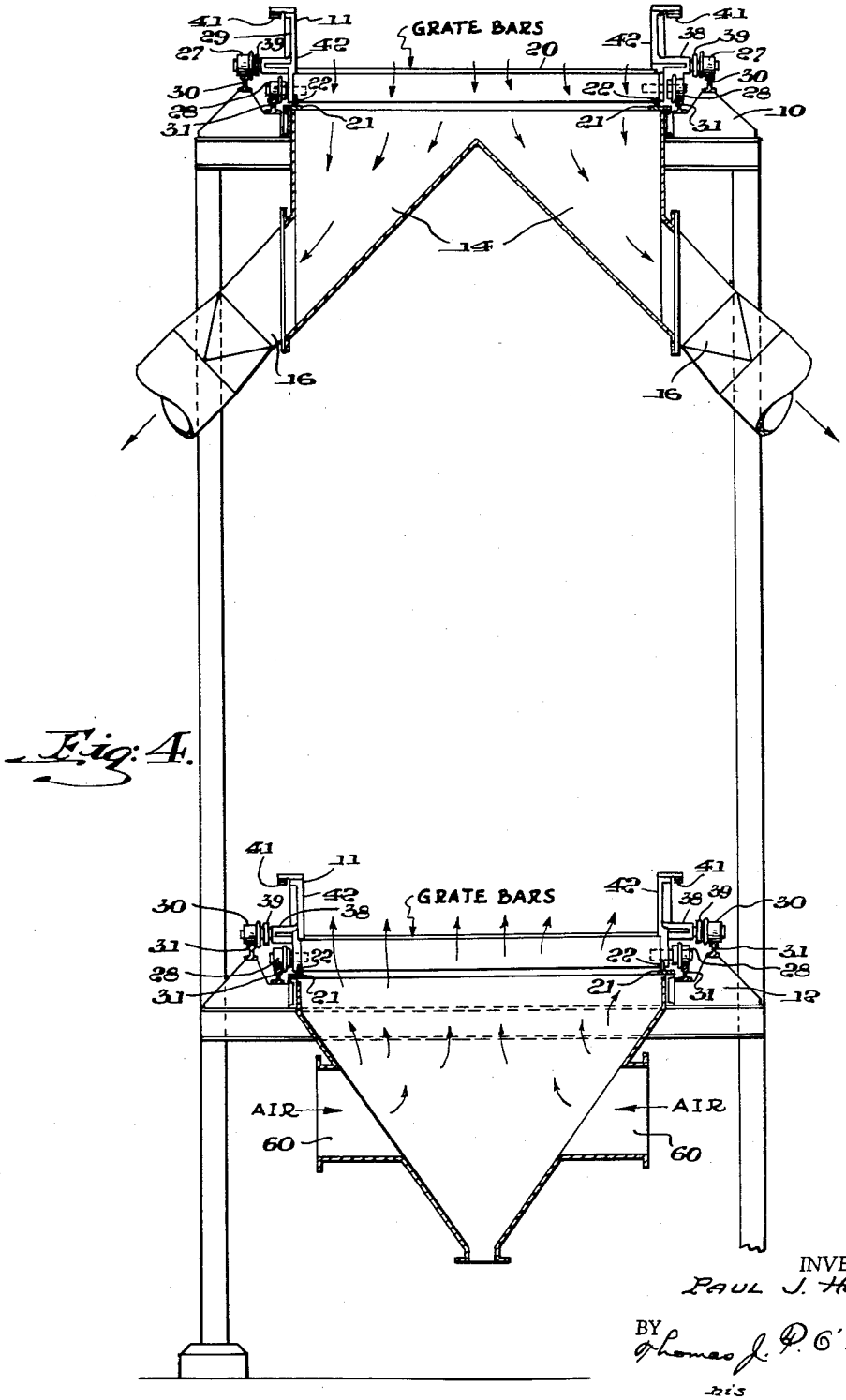


Fig. 4.

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COMBINED CONTINUOUS SINTERING AND COOLER MACHINE

Filed June 18, 1958 6 Sheets-Sheet 5

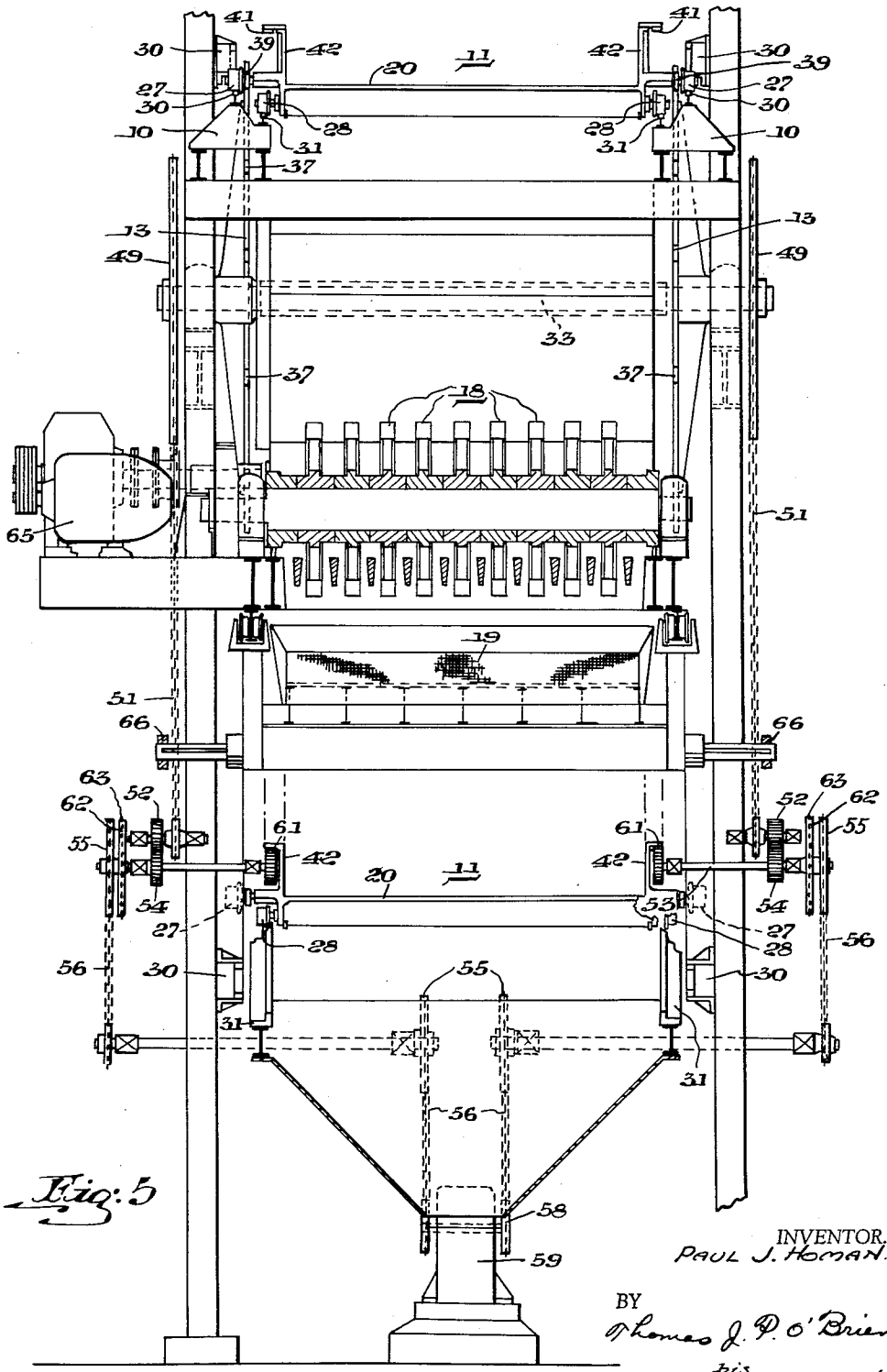


Fig. 5

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COMBINED CONTINUOUS SINTERING AND COOLER MACHINE

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Fig. 6.

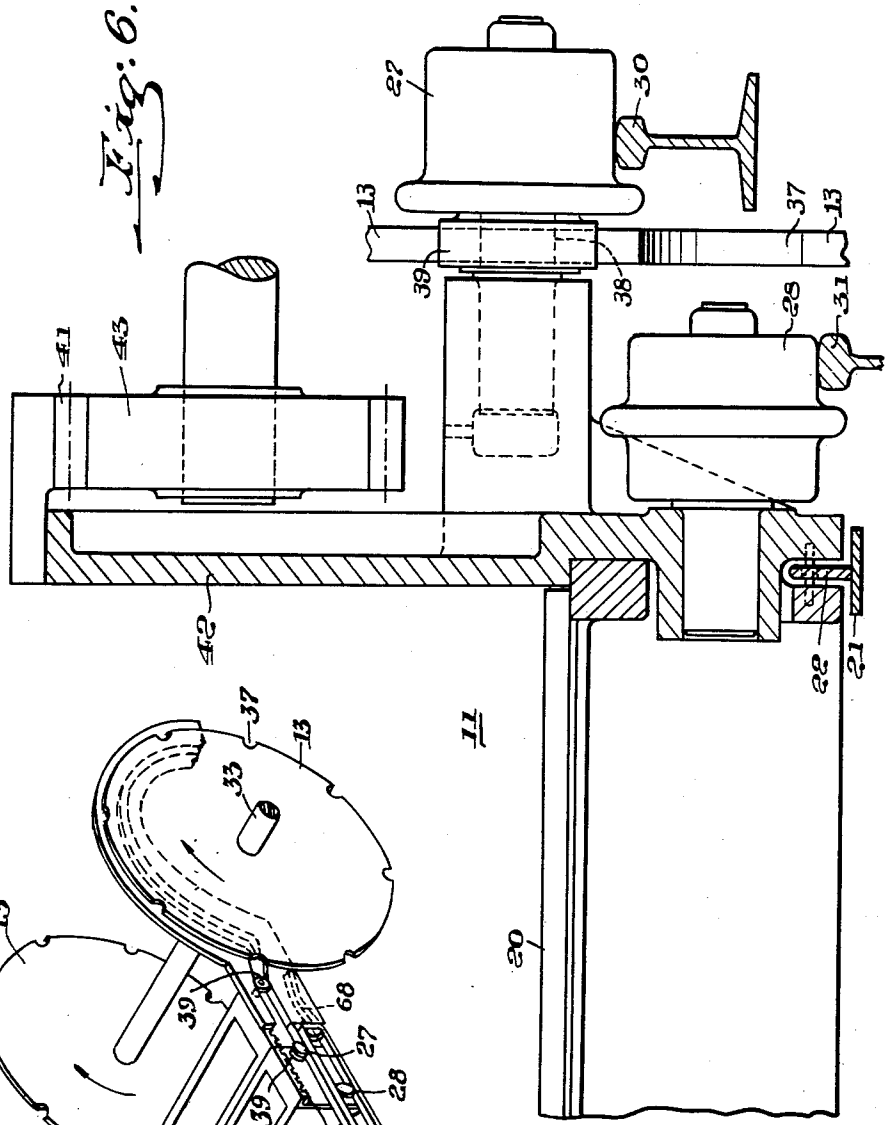





Fig. 7.

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United States Patent Office 2,987,307 Patented June 6, 1961



2,987,307

# COMBINED CONTINUOUS SINTERING AND COOLER MACHINE

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Filed June 18, 1958, Ser. No. 742,809
7 Claims. (Cl. 266—21)

The present invention relates to improvements in an apparatus for combined continuous sintering and cooling of material, and more particularly, to continuous sintering machines of the modern type constituted of an endless train of pallets movable in side by side abutting relation successively along upper and lower strands, and provided with crushing and screening means for delivery of crushed and screened hot sinter from the sintering pallets to sinter cooler pallets.

The primary object of the present invention is the provision of a machine of the aforesaid modern type having as a novel and important characteristic a mode of construction and operation which very greatly simplifies, and reduces the cost of, such sintering plants and their general operation.

Modern sintering plants incorporate separate machines in tandem for continuous sintering and cooling of the sinter with a crusher and screen intermediate the discharge end of the sintering strand and the feed end of the cooling strand for more effective and high capacity operation in sintering and cooling. Both machines usually require an endless loop of moving pallets. The sintering operation utilizes the top strand only of the sintering machine, and the sinter cooler likewise utilizes the top strand only for cooling. The lower strands of both machines are utilized only for returning empty pallets. The ratio of working pallets to empty pallets is about 40 to 60 for both machines.

The present day modern equipment and most general method of sintering involves the use of a crusher and screen between the sintering machine and the cooler, whereby the hot sinter discharges by gravity from the sintering machine, through the crusher, over the screen, and then on to the cooler. These machines are usually built in tandem, with the result that a very long and high plant is necessary.

In accordance with the present invention, there is provided for the purpose of capacity a continuous sintering crushing and cooling combination machine which utilizes the top strand for the sintering operation, the intermediate area, and the bottom or return strand for the cooling operation.

Hot sinter is discharged from the top strand directly into a crusher and screen located in the area between the upper and lower strands for delivery to the bottom strand. The screen sizes the sinter, placing the ±¾ size on the bottom strand and the fines being withdrawn from the machine and recycled to mix with new material to be sintered on the top strand.

Air is pulled down through the top sintering strand by one set of fans while air is blown up through the lower cooling strand by another set of fans.

The drive of the upper sintering strand is at the feed end and is synchronized with a drive at the opposite end of the strands for moving the pallets on the lower strand, so that the machine is fully and mechanically synchronized.

The pallets run on a continuous track for both strands but the pallets do not turn upside down to enter the lower strand as they do now on the present day modern machine. Instead, they return on the lower return track or strand in an upright position, so that the grate bars are above and supported by the tracks in both strands for both cooling and sintering.



For this, means are provided at the hot sinter discharge end of the strands for tilting the pallets, as they leave the upper strand, toward the area between the upper and lower strands, to discharge the hot sinter for crushing, and for restoring the pallets to upright position as they enter the lower strand, and means are provided at the cool sinter discharge end of the strands for tilting the pallets, as they leave the lower strand, toward the area outside the strands, to discharge the cooled sinter from the machine, and for restoring the pallets to upright position as they enter the upper strand.

A particular advantage of the present machine is that a substantial saving in cost of construction and operation is realized, as most of the present day tandem type of cooler equipment is eliminated, and great savings are accomplished in the plant itself, due to a reduction in length and height of plant area, reduction of material handling equipment, and simplification of operation.

The machine as shown having 130 pallets, with 100 working and 30 empty, has the same capacity of present day modern machinery which requires 260 pallets for the sintering and cooling operation, with 104 working and 156 empty. The saving of 130 pallets in a sintering and cooling plant not only represents a substantial amount in initial investment, but also represents a substantial amount in reduced maintenance cost.

In addition to the above, a substantial savings is realized due to the elimination of the dual equipment, such as the machine frame, drive, foundations, controls, electrical equipment, material handling equipment, mechanical equipment, etc., required by the present type of tandem sinter machine and cooler.

In addition to the general objects recited above, the invention has for further objects such other improvements and advantages in construction and operation as may be found to obtain in the apparatus and mode of operation hereinafter described or claimed.

In the accompanying drawings, forming a part of this specification, and showing, for the purpose of exemplification, the best mode contemplated by the inventor for carrying out the invention, but without limiting the claimed invention specifically to such illustrative instance or instances:

FIG. 1 is a schematic side elevational view of a combined continuous sinter and cooler machine embodying the present invention.

FIG. 2 is a vertical side elevational view of the left-hand side end of the machine of FIG. 1 showing on an enlarged scale the drive and feed of the upper strand and the discharge operation for the cooled sinter from the lower strand.

FIG. 3 is a like view illustrating the right-hand side of the machine of FIG. 1 and showing on an enlarged scale the discharge of the upper strand to the crusher and screen, and the drive of, and feed back of the crushed hot sinter into, the pallets in their restored upright position on the lower strand.

FIG. 4 is a vertical cross sectional view taken on the line 4—4 of FIG. 3, to show the trackways and wheels for the pallets, the pusher racks at the tops of the ends of the pallets, and the outlet wind boxes for the burner gases from the upper sinter strand and the air inlet wind boxes for the lower cooler strand.

FIG. 5 is a vertical cross sectional view taken on the line 5—5 of FIG. 3, to show the relationship of the crusher and screens to the tilting means between the two strands and the driving mechanism and hold back pinion for the lower strand.

FIG. 6 is an enlarged vertical cross sectional view showing the collars and pinion and rack mechanism for the pallets.

FIG. 7 is a perspective view more clearly showing the

transfer of the pallets from the upper grate rail **30** to grooves **37** in sprockets **13**.

In its present embodiment, the invention is incorporated in an ore sintering machine with conventional elements including a crusher and screen between the strands, and in the preferred embodiment of the invention the machine also includes in its construction novel mechanism for tilting and restoring the pallets to upright position during their transfer at the opposite ends of the machine from one strand to the other, and twin pairs of tracks for each strand, with idler collars on the pallets and a pair of sprockets at each end of the machine for coaction with the idler collars to control the progress of movement of the pallets from each strand to the other for progressive discharge of clinker to the lower strand for cooling after crushing and progressive transition of the pallets between the strands. For convenience, the present invention will be confined to this use of the invention. The invention is not limited in all its aspects to this preferred embodiment of the invention, since much of the advantage of the invention is attained with the use of different means for tilting and restoring the pallets at each end of the machine, and with discharge of the cooled clinker to the interior rather than the exterior of the upper and lower strands for take-off of the finished product. Hence, the invention is not limited in all its aspects to the specific means disclosed as the best mode of operation hereinafter described and claimed.

As shown on the drawings, the machine incorporates in its construction the following conventional elements commonly employed in the modern art for combined continuous sintering and cooling, namely: a continuous sinter machine of the endless conveyor type comprising an upper strand **10** with pallets **11**, and a lower strand or run **12** with pallets **11**, sprockets **13**, at each end of the machine, wind boxes **14** below the strands for off-flow of burnt gases from the pallets undergoing sintering in the upper strand to a stack **15** through a gas flue line **16** and exhausters **80**, and wind boxes **17** for inflow of cooling air from blowers **90** to the bottoms of the pallets undergoing cooling of the sinter or clinker in the lower strand, as well as a crusher **18** and screen **19** for crushing and screening the hot sinter or clinker from the upper strand before cooling the same in the lower strand.

The wind boxes are sealed by wear bars **21** and seal bars **22**, FIGURES 4 and 6, in the conventional manner, and the upper sinter strand is provided with a hearth layer feed hopper **23**, a sinter material feeder **24** in the form of a sinter mix roll feeder for supply of material to be sintered, as well as an ignition furnace **25**.

The elements of the structure thus far described is typical of the elements of this type of sintering plant and hence, need not be described in further detail.

In previous practice, for full capacity and most efficient operation, two machines in tandem with a crusher and screen in between, has been adopted as standard to make full use of the upper strand of the first machine for sintering, and the upper strand of the second machine for cooling.

In accordance with the present invention, this principle of operation for full capacity and efficiency is carried out in a single machine by continuing the full use of the upper strand of the machine for sintering and by crushing the sinter cake in the intermediate area and thereby making full use of the pallets in the lower strand for cooling the crushed hot sinter from the upper strand.

Accordingly, the usual form of crusher and screen as used heretofore in tandem is located instead in the intermediate area **26** between the upper strand and the lower strand, at the ends thereof at which the pallets leave the upper strand with hot sinter. This entails tilting the pallets or their grates toward the intermediate area **26** for discharge of the hot sinter from the pallets, as they leave the upper strand, into the crusher and screen in the intermediate area **26** for crushing and screening the material before it is fed back into the pallets in the lower strand, and entails restoring the pallets, or their grates, to upright or horizontal position to receive the crushed sinter from the upper strand for cooling of the sinter as the pallets move into and along the lower strand. It also entails tilting the pallets, or their grates, either into the intermediate area **26** or to the area outside the strands at the opposite end of the machine for discharge of the cooled sinter as the pallets leave the lower strand to enter the upper strand and entails restoring the pallets or their grates to upright or horizontal position for sintering as they move again into and along the upper strand.

For tilting and restoring the pallets, or their grate bars, each pallet is provided with a pair of front and rear wheels **27**, **28**, on each end **29**, FIGURE 4, and each strand is provided with twin pairs **30**, **31** of rails over which the front **27** and rear **28** wheels ride to support the pallets for sliding movement over the wind boxes of the upper and lower strands. The front wheels **27** at each end of the pallets are located at a higher level than the rear wheels **28**, and ride on one pair of tracks **30** over each strand. The rear wheels **28** at each end of each pallet ride over the other pair of tracks **31** which are located at a lower level over each strand. The upper pair of tracks **30** are endless, being looped at each end of the strands at the opposite ends of the machine. The lower pair of tracks **31** are interrupted at each end of the machine so that the pallets, or their grates **20**, can tilt by gravity at each end of the machine, to discharge the hot sinter to the crusher **18** in the interior area **26** as the pallets leave the upper strand **10** with the hot sinter or clinker, and to discharge the cooled sinter from the pallets **11** either to the exterior of the strands, or to the interior **26**, at the cool end of the machine as the pallets leave the lower strand **12**.

The lower pairs of tracks **31** in the lower strand **12** are inclined **32** upwardly, FIGURE 3, around the hot end of the machine to a horizontal level below the axes **33** of rotation of the sprockets **13**, but above the lower periphery of the sprockets **13**, to be in a position to support the rear wheels **28** of the pallets as they leave the sprocket **13** and thereby begin to restore the pallets to upright horizontal position as they enter the lower strand **12**. At the cool end of the machine, FIGURE 2, the lower tracks **31** of the upper strand **10** are constituted a curved portion **34**, downwardly around the axis **35** of rotation of each sprocket **13**, to engage the lower rear wheels **28** as they ride above the axis **35** of sprocket **13** to restore the pallets **11** to horizontal for the upper strand **10**. At each of the hot **33** and cool **35** ends of the machine the upper tracks **30** of the lower strand **12** extend upwardly around the axis **33**, **35** of rotation of the pallets at those ends of the machine to overlap the upper tracks **30** in the upper strand **10**, and the upper tracks **30** of the upper strand **10** extend downwardly around said axis **33**, **35** of rotation to overlap the upper tracks **30** in the lower strand **12**, to form a confined guideway **36** for the front wheels **27** of the pallets **11** during the rotation of the pallets from one strand to the other by the sprockets **13**.

To control the progressive movement of the pallets from each strand to the other, a pair of sprockets **13** are provided at each end **33**, **35** of the machine to rotate on said axes **33** of rotation. The sprockets **13** are provided with grooves **37** to rotatably support the pallets **11** tilting during their progress from one strand to the other while permitting the tilting and restoring of the pallets. For this, FIGURES 4 to 6, each shaft or hub **38** for the upper front wheels **27** of the pallets are provided with a freely rotatable collar **39** to seat in the grooves **37** of the sprockets **13**. The sprockets **13** thus support the pallets **11** while allowing them to tilt and restore to upright position during their transition from one strand to the other.

The pallets **11** move along the strands **10**, **12**, in successive abutting relation. For this, the pallets **11** are pro-

vided, FIGURES 2, 4, 6, with a rack 41 along the tops of the ends 42 of the pallets 11 which are driven by separate pusher pinions 43 at the entrance ends of the upper and lower strands. To engage the pallet racks 41 with such pusher pinions 43 as the pallets leave the sprockets 13, retractable pushers 44 are provided, FIGURES 2, 3, 5, at each end of the machine to engage the rear sides of the ends 42 of the pallets as they leave the sprockets 13 and push the entering pallets forward into abutting relation with the preceding pallet until the pusher pinion 43 engages the rack 41 of the entering pallet. These retractable pushers 44 are reciprocated by slides 45 which ride on wheels 46. The slides 45 are each operable by a crank 47 driven by a drive shaft 48 which also drives the pusher pinions 43 to push the pallets along the upper and lower strands to engage their racks 41 with the pinions 43. The sprockets 13 are likewise driven, through a sprocket 49, chain 51, and pinions 52, by drive shafts 48, 53, that drive the pusher pinions 43 and cranks 47. The drive shafts 48, 53 for the upper and lower strands are driven in unison through the sprockets 55 and chain 56 connection with main drive shafts 57 operable through reduction gearing 58 by means of electric motors 59 which are synchronized to move the pallets 11 on the sinter strand 10 in synchronism with the pallets 11 on the cooling strand 12.

Since the pallets slide down by gravity, from the sprockets 13 at the hot discharge end 35 of the upper sinter strand to the entrance end of the cooling strand 12, they might tend to jar the pallets that are already ahead on the cooling strand 12 if left to fall freely by gravity without restraint. To eliminate this, the drive shaft 53 for the sprockets 13 for the hot end 33 of the machine is provided with a hold back pinion 61 which meshes with the racks 41 of the pallets 11 just ahead of the crank driven pusher 44 and pusher pinion 43 to hold back the descent of the pallets 11.

As shown in FIGURE 5, this drive shaft 53 is connected by sprockets 55 and chains 56 with the motor 59, and carries a pinion 54 in mesh with the pinion 52 to drive the chain and sprocket drive for the sprocket 13 at the cool end of the machine and is also connected by a sprocket wheel 62 and chain 63 and sprocket 55 with a shaft 48 for driving the crank pusher 44 and pusher pinion 43 for the cooling strand.

The crusher is rotated by a separate motor drive 65, FIGURE 5, and the screens are of the conventional shaker screen type which are driven through an eccentric 66 by means of a further separate motor drive 67.

The ore in adjacent pallets 11 sinters together as a single mass, and the pallet charges are cracked apart as they leave the upper strand 10 to ride on the sprockets 13, to tilt to discharge the sinter for crushing of the sinter in the intermediate area 26 before the sinter is refilled in the pallets in the lower strand for cooling, a hump 68 is provided in the rails of the lower track 31 at the discharge end of the sinter strand, to cause the rear side of the pallets 11 to rise as they pass over the hump 68 and thereby shear the cake in adjacent pallets apart.

To avoid wear and weight on the rim or perimeter of the sprockets 13 as a result of the pallet parts riding on the rim or perimeter of the sprockets 13, until the grooves 37 rotate into position to grasp the collars 39 of the pallets, the ends of the rails of both the upper and lower tracks are inclined to carry such weight and thus avoid wear of the rims of the sprockets until the grooves 37 arrive in position to receive the collars 39. The collars being freely rotatable on the pallets, the collars merely rotate freely countercurrently to the direction of rotation of the sprockets 13, thus avoiding weight and wear on the sprockets 13.

In operation, the motors 59 are operated in synchronism to drive the sprockets 13, pusher pinions 43, and pusher rams 44 in unison so that the pusher pinions 43 for the strands 10 and 12 make one revolution per pallet length, and the sprockets 13 rotate 45° as said pinions 43 make one revolution. The pallets 11 move continuously along each strand 10 and 12 and around each end 33, 35 of the machine in timed sequence. During this movement, a hearth layer is laid continuously by hopper 23 and a mixture to be sintered laid on top of the hearth layer by the mix roll feeder 24, which is thereafter ignited by the furnace 25. The burner gases flow down through the sinter mix on, and through, the pallet grates 20 to the wind boxes 14, from which the hot gas flows through the flue line 16 to the stack 15. After the pallets ride the hump 68, the grooves 37 of the sprockets 13 at the hot end 33 of the machine pick up the collars 39 of the pallets 11. These collars 39 are on the same shaft 38 as the front wheels 27 of the pallets. As the sprockets 13 rotate they support the pallets 11 while the front wheels 27 ride through the guideway 36 formed by the looped overlapping upper tracks 30. The pallets being supported only on the shafts 38 of their front wheels 27 during their transition by the sprockets 13, the rear portion of the pallets descend by gravity, pivoting around the axis 38 of the front wheels 27. This tilts the grate 20 toward the interior area 26, and the hot sinter cake drops into the crusher 18. From the crusher 18 the ground sinter cake is screened in 19 to separate the fines from the coarse, to aid the cooling in the lower strand 12. The coarse particles are fed back into the pallets 11 in the lower strand by chutes and the fines are withdrawn from the area 26 by a conveyor which sends them back to be mixed with fresh ore to be fed to the sinter strand by the mix roll feeder 24. During this time, the pallets 11 on the sprockets 13 leave the sprockets as their rear wheels 28 ride on the top of the inclined part 28, 32 of the lower strand tracks, which elevates them to horizontal upright position. The descent of the pallets is controlled by the re-engagement of the pallet racks 41 with the hold back pinion 61. Pallets which have passed this pinion 61 slide on toward the last preceding pallets on the cooling strand 12 which is being pushed forward by the pusher pinion 43. The pusher ram 44 pushes each next pallet 11 to enter the cooling strand 12 up against the last previous one as it moves away from pusher pinion 43, so that the next following pallet is positively pulled into driven engagement with the pusher pinion 43.

As the pallets move up along the tracks 31 in the lower run 12 they first receive the oversize of the crushed sinter from the screen 19, which sinter is thereafter cooled as the pallets 11 move up the tracks over the wind boxes 17. For this, air from blowers enters the wind boxes 17 from air flues 60. Thence the air passes up through the gates 20 of the pallets on the lower strand 12 and through the ground sinter cake. The air leaves the top of the bed on the pallets and passes out into the surrounding atmosphere through the intermediate area 26.

At the discharge end of the cooling strand, the upper wheels 27 on each pallet enter the guideway 36 formed by the overlapping upper tracks 30 of the upper and lower strands 10 and 12, and the collars 39 are picked up by the grooves 37 of the sprockets 13 which carry the pallets 11 up to within reach of the pusher ram 44 which pushes the pallets forward into side by side contact with the preceding pallet until the pinion 43 engages the rack 41 on the pallet so pushed forward. During this time, the rear wheels leave the lower tracks 31, and the pallet tilts downward, pivoting around the axis 38 of the shaft which carries the collars 39 and the forward wheels 27, thus discharging the finally cooled sinter product into the discharge hopper 71 for removal as the end product from the machine. As the pallets are carried up above the axis 35 of the sprocket 13, the curved portion 34 of the lower rails 31 urge the rear half of the pallets upward around the axes 38 of the collars 39 to restore the grates of the pallets to upright horizontal position for engagement with the pusher ram 44.

The invention in its broader aspects is also useful with other means than the ones shown for transferring, tilting and pushing the pallets, and with other means for screening and crushing the hot sinter cake. For instance, the invention in its broader aspects, as well as in its best mode of operation, is also of utility without screening the crushed sinter cake before cooling, and is also of utility without passage of the fines from the chute of the screen **19** to the pallets in the cooling strand **12** after the filling of the pallets with the oversize from the screen **19**.

The invention as hereinabove set forth is embodied in a particular form of construction but may be variously embodied within the scope of the following claims.

I claim:

1. Apparatus for continuous sintering and cooling, comprising: an upper strand of wind box means; a lower strand of wind box means underneath the upper strand of wind box means; pallets movable in side by side abutting relation successively across the top of said upper strand; pallets movable in side by side abutting relation successively across the top of said lower strand in the opposite direction to the movement of the pallets in the upper strand; means for layering sinter material on the pallets in said upper strand; means for igniting the top of the material on the pallets in said upper strand; means for exhaust of hot gases from the wind box means of the upper strand; means for transferring pallets containing sinter successively from the upper strand to the entrance end of the lower strand including means for tilting the pallets toward the intermediate area between the upper and lower strands as they leave the upper strand for discharge of hot sinter from the pallets in the intermediate area above the pallets in the lower strand, and means for restoring the discharged pallets to upright position as they enter the lower strand; a crusher disposed in the intermediate area between the upper and lower strands in position to receive hot sinter from the pallets as they tilt and to discharge the crushed sinter to the restored pallets in their upright position at the entrance end of the lower strand; means for introducing cooling air into the wind box means of the lower strand to cool the crushed sinter in the pallets during their successive movement thereacross, and means for transferring pallets containing cooled sinter successively from the lower strand to the upper strand in advance of the means for layering sinter material thereon, including means for tilting the pallets as they leave the lower strand for discharge of cooled crushed sinter from the pallets in the lower strand, and means for restoring the discharged tilted pallets to upright position as they enter the upper strand, and in which the transfer means comprises curved loops of an endless upper trackway, the means for tilting comprises a rotatable bearing eccentrically disposed on each pallet for supporting the pallets on the curved loops, whereby the pallets tilt by gravity when so supported on the loops of said endless trackway, and the means for restoring the pallets to upright position comprises an interrupted trackway for both strands that engages another member on the pallets which, in conjunction with said endless trackway, maintains the pallets upright in the upper and lower strands, and which trackway has extensions at the entrance ends of the upper and lower strands to elevate the pallets around the axis of said eccentrically disposed bearing on the pallets to restore the pallets to upright position.

2. Apparatus as claimed in claim 1, and which includes rotatable sprockets with peripherally spaced supporting parts for rotatably supporting the pallets on the axis of their said eccentrically disposed bearings for time controlled movement of the pallets during their transfer from each strand to the other.

3. Apparatus for continuous sintering and cooling, comprising: an upper strand and a lower strand underneath the upper strand, each strand comprising two pairs of tracks with pallets movable in side by side abutting relation successively along the tracks by means of a set of front and rear wheels at each of the opposite ends of the pallets with the front wheels riding on one pair of the tracks and the rear wheels riding on the other pair of tracks and with one of the wheels of the set eccentric to the center of gravity of the pallets; means for layering sinter material on the pallets in said upper strand; means for igniting the material on the pallets in the upper strand; means for exhaust of the sinter gases from the upper strand; sprockets with peripherally spaced supporting parts in position for rotatably engaging a part on the axis of the eccentric wheels of the sinter containing pallets for tilting the pallets toward the intermediate area between the upper and lower strands for discharge of hot sinter from the pallets into the intermediate area above the pallets in the lower strand as they leave the upper strand and for control of the movement of the tilted pallets from the sinter strand toward the cooling strand underneath; cam tracks extending from the periphery of the lower part of said sprockets to the tracks in the lower strand for restoring the tilted pallets to upright position as they slide by gravity from the sprockets to the lower strand; a crusher disposed in the intermediate area between the upper and lower strands in position to receive hot sinter from the pallets leaving the upper strand as they tilt and to discharge the crushed sinter to the restored pallets in their upright position at the entrance of the lower strand; means for introducing cooling air to the crushed material in the pallets in the lower strand; sprockets with peripherally spaced supporting parts in position for rotatably engaging a part on the axis of the eccentric wheels of the cooled sinter containing pallets for tilting the cooled sinter pallets as they leave the lower strand for discharge of cooled, crushed sinter toward an area beyond the lower strand and for control of the movement of the tilted, cooled pallets from the cooling strand toward the sinter strand; and cam tracks extending from said sprockets to the upper strand tracks for restoring the cooled tilted pallets to their upright position in advance of their entry to the upper strand before the means for layering material thereon.

4. Apparatus as claimed in claim 3 and which includes racks on the pallets for driving engagement with driving pinions for pushing the pallets along the strands, a driving pinion in each strand for rotatable driving engagement with the racks to push the same along the strands, and a sliding pusher in each strand for pushing each pallet into rack meshing relation with the driving pinions for the strands.

5. Apparatus as claimed in claim 3 and which includes racks on the pallets for driving engagement with driving pinions for pushing the pallets along the strands, a driving pinion in each strand for rotatable driving engagement with the racks to push the same along the strands, a sliding pusher in each strand for pushing each pallet into rack meshing relation with the driving pinions for the strands, and a hold-back pinion for rotatably engaging the racks as they slide down the cam tracks to enter the lower strand, for prevention of jar of the pallets in the lower cooling strand by the free gravity movement of the pallets toward the cooling strand.

6. Apparatus as claimed in claim 3 and which includes racks on the pallets for driving engagement with driving pinions for pushing the pallets along the strands, a driving pinion in each strand for rotatable driving engagement with the racks to push the same along the strands, a sliding pusher in each strand for pushing each pallet into rack meshing relation with the driving pinions for the strands, a hold-back pinion for rotatably engaging the racks as they slide down the cam tracks to enter the lower strand, for prevention of jar of the pallets in the lower cooling strand by the free gravity movement of the pallets toward the cooling strand, and a hump in one

of the pair of tracks in the upper strand over which each pallet rides in advance of the sprocket at the hot end of the sinter strand, for shearing the sinter cake in the pallets from the cake in the next following pallet on the upper strand.

7. Apparatus as claimed in claim 3 and which includes racks on the pallets for driving engagement with driving pinions for pushing the pallets along the strands, a driving pinion in each strand for rotatable driving engagement with the racks to push the same along the strands, a sliding pusher in each strand for pushing each pallet into rack meshing relation with the driving pinions for the strands, a hold-back pinion for rotatably engaging the racks as they slide down the cam tracks to enter the lower strand, for prevention of jar of the pallets in the lower cooling strand by the free gravity movement of the pallets toward the cooling strand, a hump in one of the pair of tracks in the upper strand over which each pallet rides in advance of the sprocket at the hot end of the sinter strand, for shearing the sinter cake in the pallets from the cake in the next following pallet on the upper strand, and means for rotatably driving the sprockets, driving pinions, and sliding pushers in synchronism.




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