

March 7, 1967

H. GÖTT ETAL

3,307,715

TURNING AND SHIFTING MACHINE FOR GRATE MATS

Filed Aug. 21, 1964

6 Sheets-Sheet 1

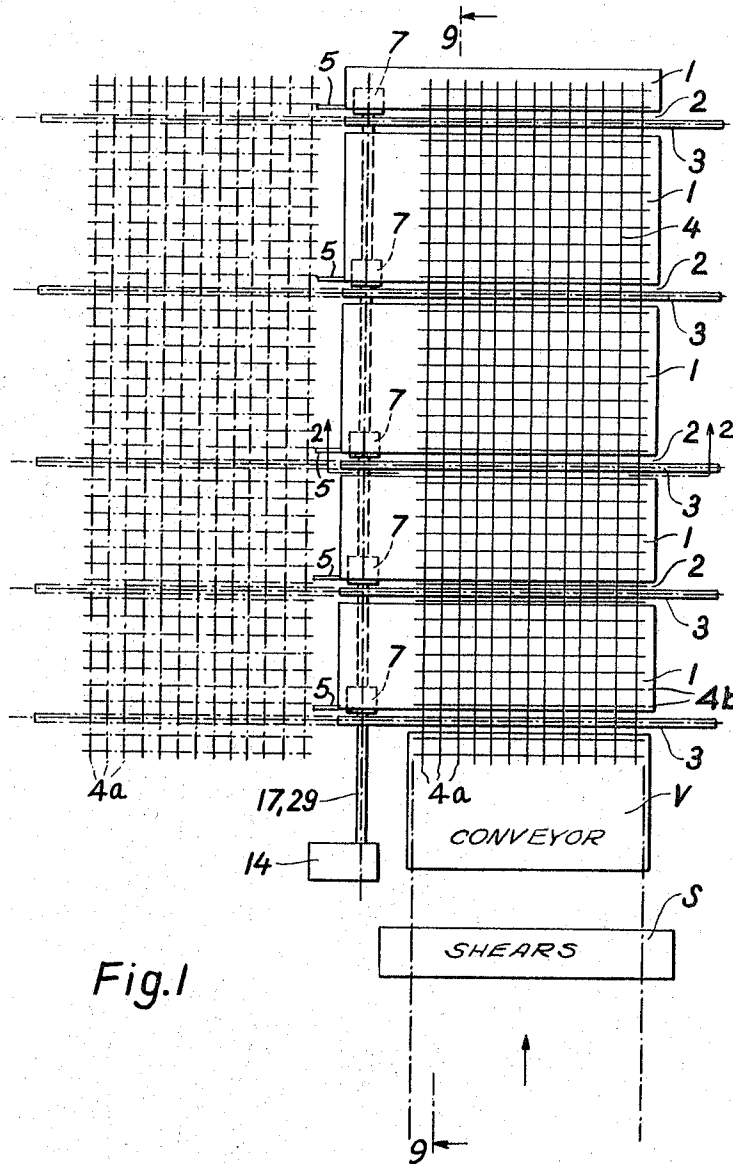


Fig. 1

INVENTORS:

Hans Gött and
Josef Ritter,

BY

Ernest A. Marmorek,
ATTORNEY.

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H. GÖTT ETAL

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6 Sheets-Sheet 2

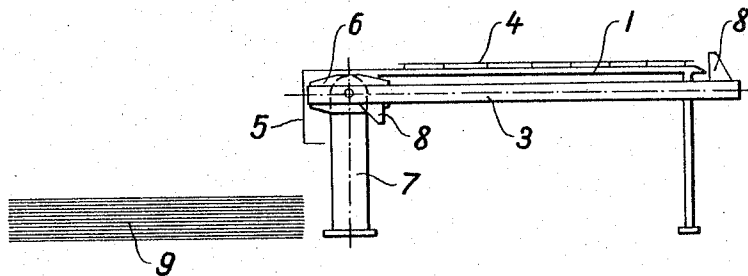


Fig. 2

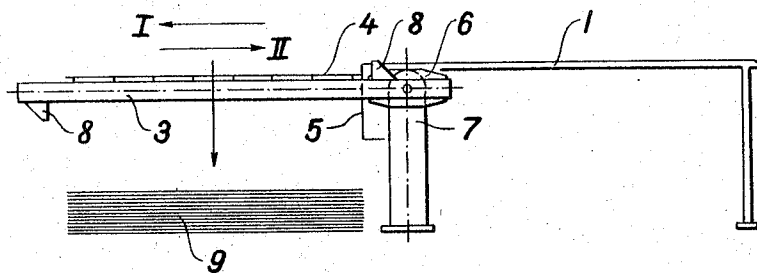


Fig. 3

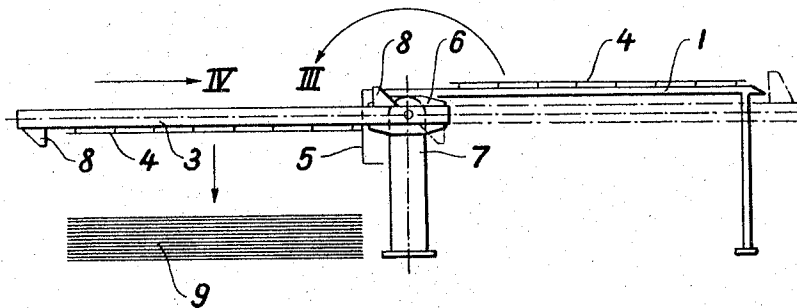


Fig. 4

INVENTORS

Hans Gött and
Josef Ritter,

BY

Edward A. Marmorek,

ATTORNEY.

March 7, 1967

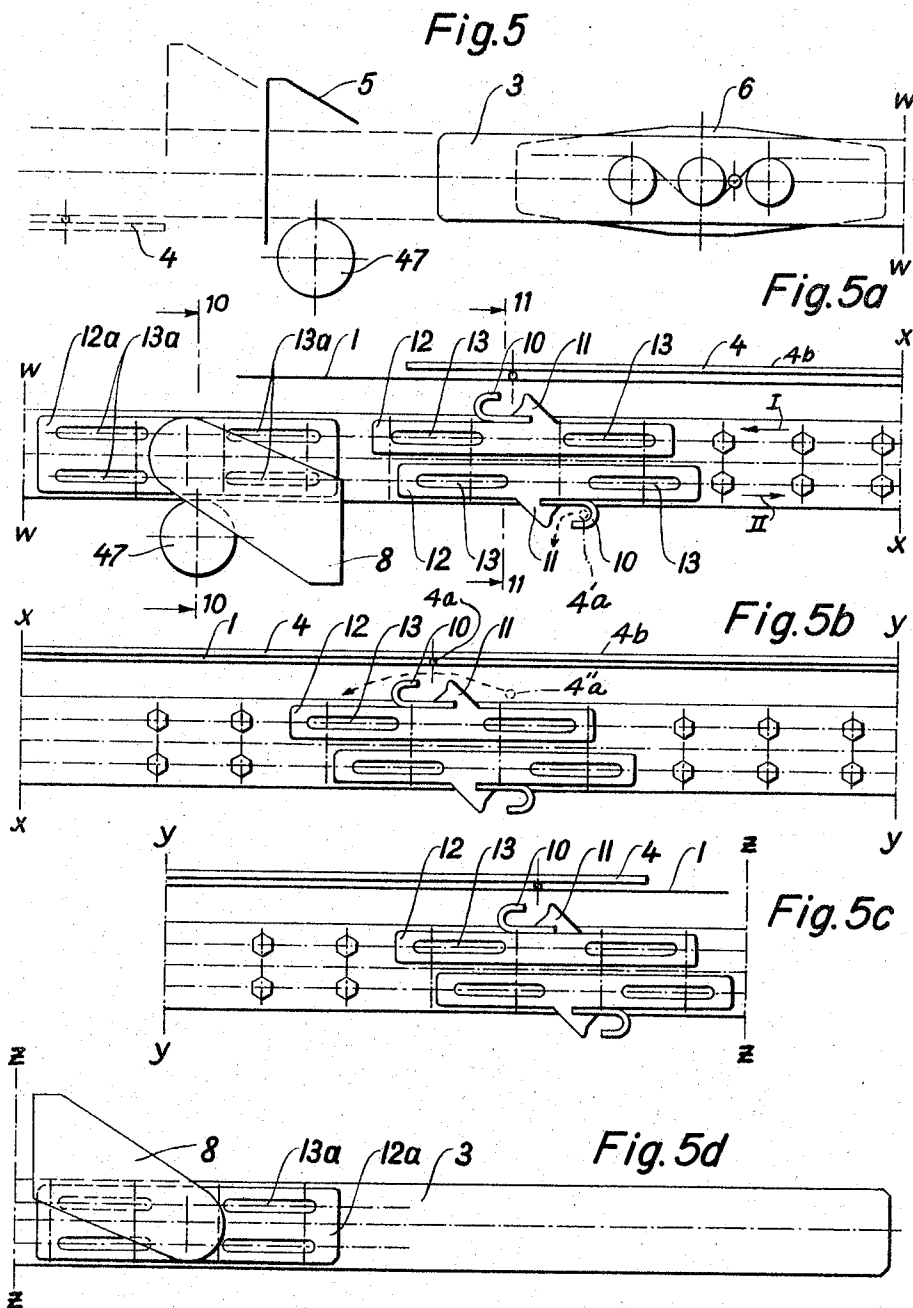
H. GÖTT ETAL

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TURNING AND SHIFTING MACHINE FOR GRATE MATS

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6 Sheets-Sheet 3



INVENTORS:

Hans Göttling
Josef Ritter,

BY

Ernest D. Morrison,

ATTORNEY.

March 7, 1967

H. GÖTT ETAL

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TURNING AND SHIFTING MACHINE FOR GRATE MATS

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6 Sheets-Sheet 4

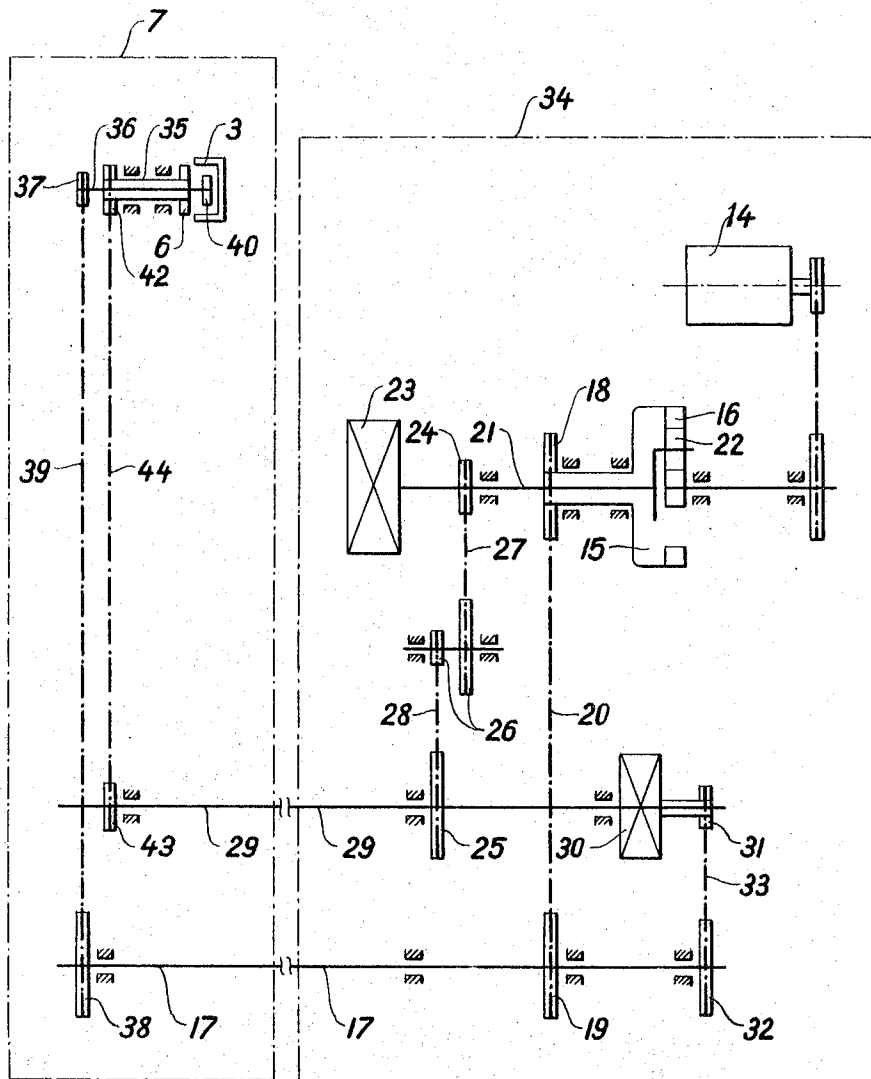


Fig. 6

INVENTORS

Hans Gött and
Josef Ritter,

BY

Edward D. Marunich,
ATTORNEY.

March 7, 1967

H. GÖTT ET AL

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TURNING AND SHIFTING MACHINE FOR GRATE MATS

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6 Sheets-Sheet 5

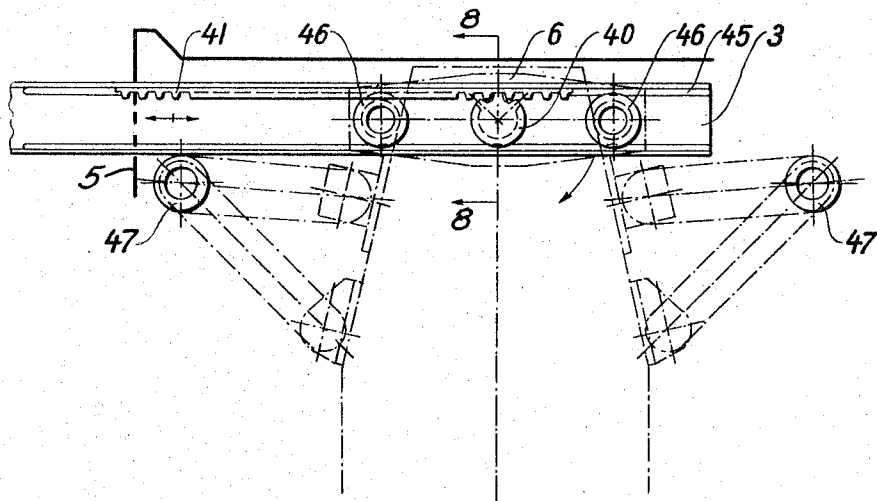


Fig. 7

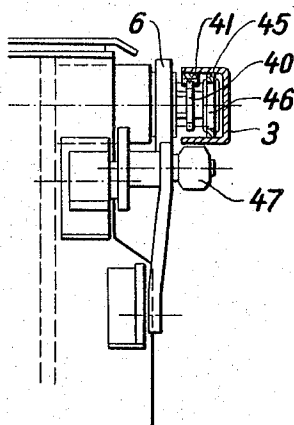


Fig. 8

INVENTOR S:

Hans Götteland
Josef Ritter,

BY

Ernest A. Marchant,

ATTORNEY.

March 7, 1967

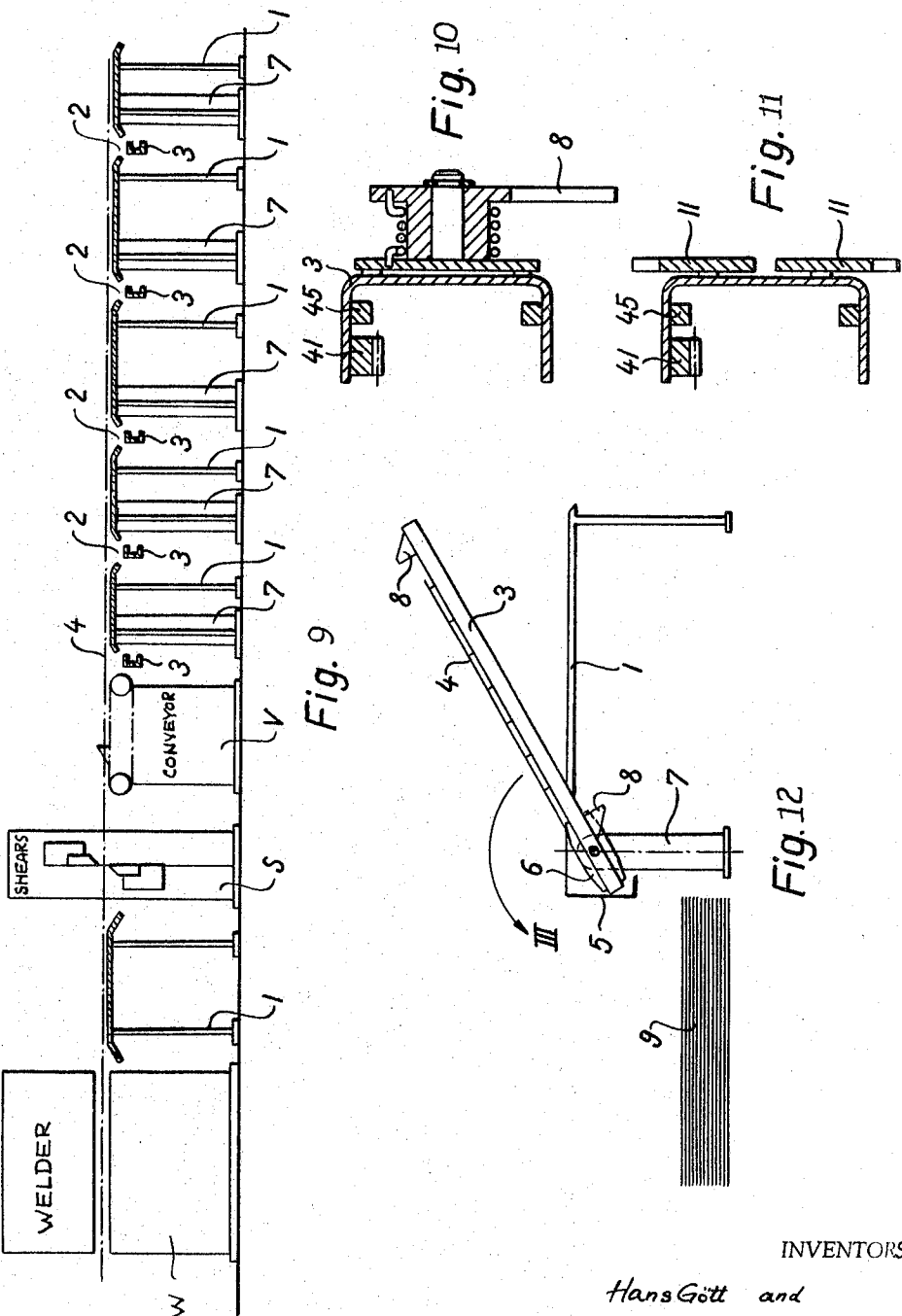
H. GÖTT ET AL

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TURNING AND SHIFTING MACHINE FOR GRATE MATS

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6 Sheets-Sheet 6



INVENTORS:

Hans Gött and
Josef Ritter,

BY

Ernest A. Marmorek,
THEIR ATTORNEY.

1

3,307,715

TURNING AND SHIFTING MACHINE FOR GRATE MATS

Hans Gött and Josef Ritter, Graz, Styria, Austria, assignors to EVG Entwicklungs- u. Verwertungsgesellschaft m.b.H., Styria, Austria, a firm

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A 7,067/63

7 Claims. (Cl. 214—6)

The invention relates to stacking, and relates more particularly to the stacking of elongated flat objects which call for the reversed stacking of every second object in the pile; still more particularly, the invention relates to the stacking of grate mats of the type used as armoring of reinforcements in reinforced concrete.

Grate mats of the type that are often used as reinforcements in reinforced concrete, usually comprise one series of longitudinal rods on one side, and a second series of transverse rods on the other side. The grate structures are manufactured continuously by automatic welding machinery, and upon their discharge from the automatic machinery are either cut into mats of predetermined lengths and stacked, or are wound into reels.

The instant invention deals with the first of these alternatives, namely where the grate structures are cut into predetermined lengths and stacked. During stacking, it has been found advantageous, primarily for the sake of saving space, to reverse every second mat in the stack: by this arrangement, the longitudinal rods of two superposed mats adjoin each other, and in the next pair of superposed mats the transverse rods adjoin each other. The rods of one mat of such a pair are disposed side by side with the rods of the other side of the pair. In such an arrangement, almost twice as many mats may be stacked in a pile of the same height as compared to a pile in which all the mats are stacked in the same manner, without reversing, for instance, all of the mats having the longitudinal rods on the bottom and the transverse rods on the top.

In a space-saving pile of the type mentioned, it may be assumed that the lowest mat has its longitudinal rods at the bottom and the transverse rods at the top. For the space-saving stacking, the next mat would need to have the transverse rods at the bottom and conversely the longitudinal rods on top, so that the transverse rods of the upper mats may be positioned in the spaces between the transverse rods of the lower mat. The third mat, on the other hand, will need to be positioned like the first mat, namely, its longitudinal rods will be at the bottom, so that they can be positioned between the spaces of the longitudinal rods on top of the second mat. The fourth mat will again be positioned like the second mat. Thus, the mats will be stacked in the pile from the bottom to the top in a predetermined succession.

The mats are discharged from a continuously operating automatic welding machine or welder W, and emerge from the welder in the same position, usually with the longitudinal rods at the bottom and the transverse rods at the top. For stacking in the above-mentioned space-saving manner, it is therefore necessary to turn each second mat for 180°.

This turning of every second mat nowadays is often carried out by hand, although semi-automatic equipment has become known for assigning the task of turning at least in part to machines. Semi-automatic equipment of this type involves the use of a revoluble drum which has two vertically spaced guides for mats; one mat is first introduced, axially of the drum, at the entrance side of the drum into the lower guide, and then the drum is rotated for one-half of a full turn; thereafter, the next

2

mat is introduced into the now lower situated other guide; and subsequently both mats are discharged axially of the drum at an exit side opposite to the entrance side, and the pair of mats deposited onto the stack.

The lifting into the drum of each mat, and the lifting out of the drum of a pair of mats, is done by hand. As each mat of this type may weigh about 150 lbs. or more, the pair of mats to be lifted out of the drums will weigh about 300 lbs., requiring at least two workmen, and usually more than two, for the manual handling of the mats. Owing to the journalling of the drum and to the need for accommodating changes in the mat dimensions depending on the particular job for which the mats are intended, it would be difficult to carry out the feeding, and discharging of mats, in connection with the drum, mechanically. Equipment of this type has a further disadvantage that in the longitudinal direction a large amount of space is needed, as the welder, the drum, and the stacked piles need to be aligned in the longitudinal direction.

It is accordingly among the principal objects of the invention to provide machinery for the automatic shifting and turning of welded mats for the space-saving stacking thereof.

It is another object of the invention to provide machinery which will in a space-saving manner stack mats emerging from the welder without any need of manual labor.

It is a further object of the invention to provide a machine that will receive all the mats from the welder and stack them in a predetermined succession of obverse and reverse positions.

It is still another object of the invention to provide such a machine that will receive all the mats from the welder and will laterally shift one mat, thereafter will return to its original position, then will turn the next mat and subsequently again will return to its original position.

Further objects and advantages of the invention will be set forth in part in the following specification and in part will be obvious therefrom without being specifically referred to, the same being realized and attained as pointed out in the claims hereof.

With the above and other objects of the invention in view, the invention consists in the novel construction, arrangement and combination of various devices, elements and parts, as set forth in the claims hereof, one embodiment of the same being illustrated in the accompanying drawings and described in the specification.

In the accompanying drawings,

FIG. 1 is a fragmentary schematic plan view of a turning and shifting machine, in accordance with the invention;

FIG. 2 is a vertical sectional view, taken on the line 2—2 of FIG. 1, showing a mat on the tables at rest;

FIG. 3 is a sectional view, similar to FIG. 2, but showing the arms with the mat shifted laterally;

FIG. 4 is a sectional view, similar to FIG. 2, but showing the arms and the mat turned for one-half of a full turn;

FIG. 5 (including FIGS. 5a, 5b, 5c and 5d) is a large-scale elevational view of one of the arms;

FIG. 6 is a schematic view of a driving mechanism;

FIG. 7 is a fragmentary elevational view, showing the head of a transfer mechanism, and the arm thereof;

FIG. 8 is a fragmentary sectional view 8—8 of FIG. 7;

FIG. 9 is a sectional view, taken on the line 9—9 of FIG. 1;

FIG. 10 is a sectional view taken on the line 10—10 of FIG. 5a;

3

FIG. 11 is a sectional view taken on the line 11—11 of FIG. 5a; and

FIG. 12 is a sectional view, similar to FIG. 4, but showing the arm tilted during its rotational movement.

In carrying the invention into effect in one of the embodiments which has been selected for illustration in the accompanying drawings and for description in this specification, and referring now particularly to FIG. 1, there are provided shears S which receive from the welder (not shown) in the direction of the arrow a grate structure. The shears S cut the grate structure into grate mats 4 of predetermined length, and each mat 4 is fed by a conveyor V in the same direction. The welder, the conveyor V, as well as the shears S, are of well-known conventional construction; and the welder controls synchronously the shears S and the conveyor V. The mat 4 has longitudinal rods 4a and transverse rods 4b.

Table means, such as a series of aligned tables 1, are arranged, which are aligned in the direction of mat discharge from the welder, and of mat feeding, as indicated by the arrow in FIG. 1. The tables 1 are separated by intertabular spaces 2. A group of transfer mechanisms is provided, and each includes an arm 3 that is supported on a support 7. Each support 7 furthermore supports a head 6, and each arm 3 is shiftable laterally relative to its head 6, and is turnable therewith through an arc of about 180°, as will be explained later on.

The arms 3 are so arranged that, as best shown in FIGS. 2-4, their upper surfaces at rest are disposed below the upper surfaces of the tables 1. Each mat 4 that emerges from the welder W will slide on the tables 1, as it is fed into the receiving station, shown on the right side in FIG. 1. During the feeding movement into the receiving station, the mat 4 will slide over and thus bypass the arms 3.

As soon as the mat 4 has reached the predetermined length, it will be severed by the shears S, and will be fed into the receiving station by the conveyor V.

Thereafter, the arms will move the mat 4 from the receiving station (wherein the mat 4 is shown in solid lines in FIG. 1), to a discharge station at the left side of the receiving station (wherein the mat 4 is shown in broken lines in FIG. 1). The movement may either be a lateral shift, or a turning through 180°, by the arms 3; and subsequently the arms will be shifted back laterally into the receiving station.

As previously stated, for each arm 3 there is provided a support 7 that has a head 6 which cooperates with the arm 3. Each arm 3 is so journaled relative to the head 6 that it can be shifted laterally between the receiving and discharge stations relative to the head 6, but cannot turn relative to the head 6. Actually, during turning, as explained later on, the arms 3 and heads 6 turn together.

The arms 3 are movable in a predetermined cycle of succession of four steps.

FIRST STEP

In the first step, the arms 3 are shifted laterally from the receiving to the discharge station (FIGS. 1 and 2, direction I). During this lateral shifting, the lugs 8, which resiliently (FIG. 10) project upwardly (FIG. 5d) beyond the upper surfaces of the arms 3, and also project upwardly beyond the upper surfaces of the tables 1, engage and push the mat 4 in the direction I with the arms 3. During this shifting, the heads 6 remain at standstill.

Upon completion of this first step of the cycle, the mat 4 has been removed off the tables 1 laterally into the discharge station, and is supported by the arms 3 above the pile or stack 9.

SECOND STEP

In a second step of the cycle, there follows a return shifting stroke of the arms 3, wherein the arms 3 are shifted laterally (in the direction II) from the discharge

4

station back to the receiving station, where the arms 3 will come to rest in the spaces 2 between the tables 1. During this return stroke, the mat 4 will abut against abutments 5 that are formed on the tables 1, whereby it will be prevented from participating in the return stroke movement, while the arms 3 move away from underneath the mat, permitting the mat 4 to drop onto the stack 9 below.

During this return stroke, the longitudinal rods of the mat 4 with which the mat 4 rests on top of the arms 3, will be engaged and upwardly lifted by noses 11 that are formed on the arms 3 (see FIG. 5). The purpose of this lifting by the noses 11 is to raise each longitudinal rod, as the arms 3 are withdrawn from underneath the mat 4, over a hook 10, so as to prevent engagement between any longitudinal rod of the mat 4 and any hook 10. The hooks 10, as will be explained later on, are adjustably positioned near the top of the arms 3, for a purpose to be set forth below. During the aforesaid retraction of the arms 3, an engagement of the longitudinal mat rods and the hooks 10 must be avoided, and this is accomplished by the noses 11 in the manner discussed.

The mat 4 which has last been added to the pile 9 has its longitudinal rods below and its transverse rods above its median plane.

Subsequently, there will be fed onto the tables 1 the next mat 4, which also has, at least in the receiving station, the longitudinal rods at the bottom and the transverse rods at the top.

THIRD STEP

During the ensuing third step of the cycle, this mat will be turned around for one-half of a turn, so that in the discharge position its transverse rods will be at the bottom and its longitudinal rods on top. In the third step, the arms 3 will turn (in the direction III, FIG. 4) through an arc of about 180°, and when the arms 3 come to a halt in the discharge position the mat 4 will be suspended, in the aforesaid reverse position, above the stack 9. During the turning movement of the arms 3, the hooks 10 will engage the longitudinal rods of the mat 4 in such a manner that the mat 4 will be lifted off the tables 1 during the turning movement of the arms 3. At first, the longitudinal rods of the mat 4 will be positioned in the spaces between the noses 11 and the hooks 10. As the angle of inclination of the arms 3 increases during the turning, however, the longitudinal rods will slide deeper into the hooks 10 and will be held therein. Upon the completion of this turning stroke, as previously stated, the mat 4 will be suspended by the arms 3 above the pile 9.

FOURTH STEP

During the fourth and last step of the cycle, the arms 3 will be shifted laterally from the discharge station back to the receiving station (in the direction IV, FIG. 4). During this translatory movement the mat 4 will again abut against the abutments 5 of the tables 1; by this abutment, the mat 4 will be stopped from moving in the direction IV, and the hooks 10, during the movement in the direction IV, will be disengaged from the longitudinal rods of the mat 4, thereby removing the suspension of the mat, permitting the mat to descend by gravity onto the pile 9. The mat 4 in this position has the transverse rods at the bottom and the longitudinal rods at the top, and the transverse rods of the bottom will be placed side by side to the top transverse rods of the mat below, thereby making for space-saving stacking.

A new cycle may now begin, commencing with the afore-described first step.

The afore-described hooks 10 may be replaced either by permanent magnets or by electromagnets, for temporarily connecting the mat 4 to the arms 3, for the purpose described.

As the arms 3 are turned around for 180° during each complete cycle, the lugs 8 and the noses 11 and hooks

5

10, or their equivalents must, as best shown in FIG. 5, be arranged anti-symmetrically near the top and bottom of the arms 3. Where the welder W produces mats with different mesh, the noses 11 and hooks 10 will need to be adjusted to the particular mesh. For this purpose, the hooks 10 and noses 11 are mounted on slides 12 which have slots 13 for the adjustable mounting by means of screws or the like, on the arms 3. In a similar manner, the sprung lugs 8 are carried on slides 12a that have slots 13a for the adjustable mounting on the arms 3.

As best shown in FIGS. 1 and 9, the mat 4 will be delivered from the welder W to the shears S, then upon having been cut by the shears S to the proper length, they will be conveyed by the conveyor V onto the tables 1 to the right (FIG. 9) of the conveyor V. In that position, the arms 3, as shown in FIG. 9, are disposed below the mat 4 and only the lugs 8 disposed on the right hand side of the mat 4 will project upwardly beyond the right hand side of the mat 4. This is best illustrated in FIGS. 2 and 4, 5c and 5d, wherein the mat 4 is shown resting on the top surface of the table 1, and the right hand side lugs 8 project upwardly beyond the vertical extension of the mat 4. Thus, for the lateral shifting to the left (the "first step" described earlier), the lugs 8 will be able to engage the right hand side (FIG. 1) edge of the mat 4 to shift it to the left.

As best shown in FIG. 2, after the mat 4 has been conveyed onto the tables 1, there will be a space between the right hand side edge of the mat 4 and the left side abutment edge of the noses 8 that project upwardly from the arms 3. In this position, one of the longitudinal wires 4a will be positioned above the opening of the hook 10, as shown in FIG. 5b. The arms 3 during the ensuing leftward shifting will first move leftward alone during an idling interval without making contact with the mat 4 until the nose 8 abuts against the right hand side edge of the mat 4, for thereafter continuing the leftward shift together with the mat 4. During this idling interval movement of the arms 3, each arm 3 will at the end be positioned relative to the aforesaid longitudinal wire 4a in such a manner that the hook 10 and the nose 11 will now be to the left of the aforesaid longitudinal wire 4a, so that the relative position of said longitudinal wire 4a will relative to the arm 3 be positioned at 4'a, as shown in FIG. 5b. During the continued leftward shifting movement of the arms 3 together with the mat 4, the longitudinal wires will remain in the position 4'a relative to the arms 3.

During the subsequent return shifting of the arms 3 to the right (the "second step" described earlier), the right hand side edge of the mat 4 will abut against the abutments 5 (see FIGS 1-5 and 12), and the mat 4 thus will not participate thereafter in the right hand movement. During the continued right hand movement of the arms, however, the longitudinal wires 4a will slide from the position 4'a over the noses 11, as schematically indicated in broken lines in FIG. 5b, thereby avoiding entry into the hook 10.

For turning of a mat through 180°, on the other hand (the "third step" described earlier), the arms 3 during their counter-clockwise (FIGS. 4, 12) turning will make contact with the underside of the mat. The longitudinal wire 4a will be in the position shown in FIG. 5b, as the arms commence their turning movement. As the arms reach the mat 4 from below, the longitudinal wires 4a will, owing to the inclination in which the arms 3 are then stationed, be positioned opposite the opening between the hook 10 and the nose 11, and will enter into that opening, and during the continued turning of the arms 3 will descend into the hook 10. From this position the longitudinal wire 4a will be removed only after the turning has been completed, and the arms 3 are shifted to the right again (in the "fourth step" described earlier). During that shift to the right, the mat 4, now hanging from the hooks 10, will again abut against the abutments 5 and

6

will be removed out of the hooks, as illustrated at 4'a in FIG. 5a. The longitudinal wires will be pushed out of the hooks, and be guided by the curved surface of the noses 11 opposite the hooks 10 to drop completely out of the engagement with the arms 3. From there the mats will descend by gravity onto the pile 9.

THE DRIVING MEANS

All the arms 3 are moved in unison, that is simultaneously and in step, by driving means which include an electromotor 14 (FIG. 6). The motor 14 is a reversible motor, so that it can drive in either direction of rotation, and is controlled in a conventional manner from the welder.

In the exemplification of FIG. 6, the motor drives, by means of conventional driving elements such as pulleys, a chain, or a V-belt or a similar transmission, a planetary gear 15. The outer toothed rim 16 of the planetary gear 15 is connected by means of a chain 20 and sprocket gears 18 and 19, or similar transmission elements, to a first drive shaft 17. A sprocket gear 32 is mounted on the first drive shaft 17. The planetary gear 15 is disposed on a shaft 21, and the shaft 21 is driven by the planetary pinions 22. A brake 23 is mounted on the shaft 21 and is operative to brake the shaft 21 releasably. The shaft 21, furthermore, is in positive driving connection with a second drive shaft 29 by means of sprocket wheels 24, 25 and 26, and sprocket chains 27 and 28.

A clutch 30 is mounted on the second drive shaft 29 which carries a sprocket wheel 31. The first drive shaft 17, on the other hand, carries a sprocket wheel 32, and a sprocket chain 33 interconnects the sprocket wheels 31 and 32. When the clutch 30 is actuated, the drive shafts 17 and 29 will be interconnected by means of the sprocket wheels 31 and 32 and the chain 33.

Conventional means (not shown) are provided intermediate the brake 23 and the clutch 30 to couple them in such a manner that, when the brake 23 is actuated and holds the shaft 21 at standstill, the clutch 30 will be de-energized, so as to disconnect the two drive shafts 17 and 29 from each other. Conversely, when the brake 23 is de-energized permitting the shaft 21 to turn, the clutch 30 will be activated, thereby establishing the positive driving connection between the drive shafts 17 and 29.

The motor 14, the brake 23, the clutch 30, the planetary gear 15, and the other transmission elements just described, together form a drive mechanism 34. The first and second drive shafts 17 and 29 lead from said drive mechanism 34 to all of the individual supports 7 (see FIG. 6).

In the upper portion of each support 7 there are journaled two coaxial shafts, namely a hollow outer turning shaft 35, and an inner shifting shaft 36. The first drive shaft 17 is in positive driving connection with the shifting shaft 36, by means of sprocket wheels 37 and 38 and a sprocket chain 39. Similarly, the second drive shaft 29 is in positive driving connection with the turning shaft 35, by means of sprocket wheels 42 and 43 and a sprocket chain 44.

The inner shifting shaft 36 carries on its end a pinion 40 which engages permanently a rack 41 (FIGS. 7 and 8) of the arm 3.

The hollow outer turning shaft 35, on the other hand, has its end connected with the head 6.

During the aforesaid first, second and fourth steps, namely the lateral shifting steps, the brake 23 will hold the shaft 21 immovable, so that the planetary pinions 22 cannot rotate about the axis of the shaft 21. (They can only spin each about its own axis.)

The electromotor 14 will drive the center pinion of the planetary gear 15, and the rotation of the center pinion will be transmitted by the planetary pinions 22 to the outer toothed rim 16, and from there by way of the transmission elements 18, 19 and 20 to the first drive shaft 17, thereby rotating the shaft 17. The first drive shaft 17

will drive the inner shifting shaft 36 and therewith will drive the pinion 40 thereof. The pinion 40 will laterally shift the rack 41, and thereby will laterally shift the arm 3. The arm 3 carries a straight guide 45 (FIGS. 7, 8) which engages guide rolls 46 that are mounted on the head 6. The support 7, furthermore, has guide rolls 47, one on each side, to support the arm 3 in either station.

During the aforesaid shifting movement of the arm 3, the head 6, owing to the connection between the head 6 and the turning shaft 35, is at standstill. The turning shaft 35 is at standstill because of its connection to the second drive shaft 29 which, in turn, will be at standstill during the first, second and fourth steps. As stated before, during these steps the shaft 21 is held still by the brake 23 and, as the shaft 21 is connected by the elements 24 to 28 to the second drive shaft 29, the second drive shaft 29 is held fast thereby, causing the standstill of the turning shaft 35 and therewith of the head 6.

During the second and fourth steps, the motor 14 will be driven in the reverse direction as compared to that of the first step.

For the third step, namely the turning (direction III, FIG. 4), the brake 23 will be de-energized and simultaneously the clutch 30 to be actuated, so as to couple the drive shafts 17 and 29 by means of the transmission elements 31 to 33. Owing to this connection between the drive shafts 17 and 29, the two coaxial shafts 35 and 36 will move simultaneously throughout a turn of 180°. This is accomplished as follows:

As the outer toothed rim 16 is connected to the drive shaft 17 by means of the transmission elements 18-20, the outer toothed rim 16 cannot turn freely and the planetary pinions 22 will be forced to roll off on the outer toothed rim 16, and the planetary pinions 22 will drive the shaft 21 which, in turn, is connected to the second drive shaft 29 by means of the transmission elements 24-28, and will thus drive the second drive shaft 29. The drive shaft 29 will rotate the turning shaft 35, and the head 6 which is connected thereto. The aforesaid connection between the shafts 17 and 29, by means of the elements 31-33, will bring about that the pinion 40, during the turning through 180° of the head 6, will also turn through 180°. This arrangement prevents the occurrence of any relative movement between the pinion 40 and the head 6.

Instead of the transmission elements described herein, such as sprocket wheels and sprocket chains, other equivalent transmission elements, such as belts or cables and pulleys, gearings and the like, may instead be used.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent, is as follows:

1. A machine for stacking and turning alternate grate mats so as to provide a compact stack, comprising in combination elongated table means positioned in a receiving station for receiving grate mats, a group of transfer

mechanisms disposed adjacent said table means and each including a support comprising a turnable head and an arm, shifting means operable for shifting said arm relative to said head between said receiving station and a discharge station disposed at one side of said receiving station, said head guiding said arm during shifting, turning means operable for turning said arm with said head for about 180° from said receiving station to said discharge station, said shifting and said turning means, respectively, moving said arms in unison in a predetermined succession including moving said arms from said receiving station to said discharge station alternatively by shifting and turning them, respectively, thereby transferring a mat from the receiving to the discharge station, and subsequently shifting said arms from said discharge station to said receiving station, and abutment means operable to engage the mat when the arms are returned by shifting to the receiving station, whereby the mat will be restrained from moving with the arms and will drop onto the stack.

2. In a machine, as claimed in claim 1, said arms including holding means adapted to hold the mat during movement from said receiving station to said discharge station.

3. In a machine, as claimed in claim 1, said arms including holding means adapted to hold the mat during movement from said receiving station to said discharge station, said holding means comprising adjustably positionable suspension means adapted to suspend the mat during turning, and adjustably positionable lugs adapted to engage and to move the mat during lateral shifting from the receiving to the discharge station.

4. In a machine, as claimed in claim 1, said driving means comprising for each arm two coaxial shafts supported by said support, one of said shafts being a turning shaft driving the head for turning the arm, and the other shaft being a shifting shaft driving the arm for shifting it.

5. In a machine, as claimed in claim 4, said two coaxial shafts being operable to be coupled during said third step for synchronous turning of the head and arm.

6. In a machine, as claimed in claim 4, said driving means comprising a reversible electric motor operable to be in driving connection alternatively simultaneously with both said coaxial shafts of each support and, respectively, with said shifting shafts for the shifting of said arms.

7. In a machine, as claimed in claim 6, and brake means operable for braking said turning shaft during the shifting of the arms.

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GERALD M. FORLENZA, *Primary Examiner.*

MORRIS TEMIN, *Examiner.*

J. E. OLDS, *Assistant Examiner.*