

March 26, 1963

E. HABICHT ETAL

3,082,855

MATERIAL HANDLING SYSTEM

Filed May 8, 1958

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FIG. 1

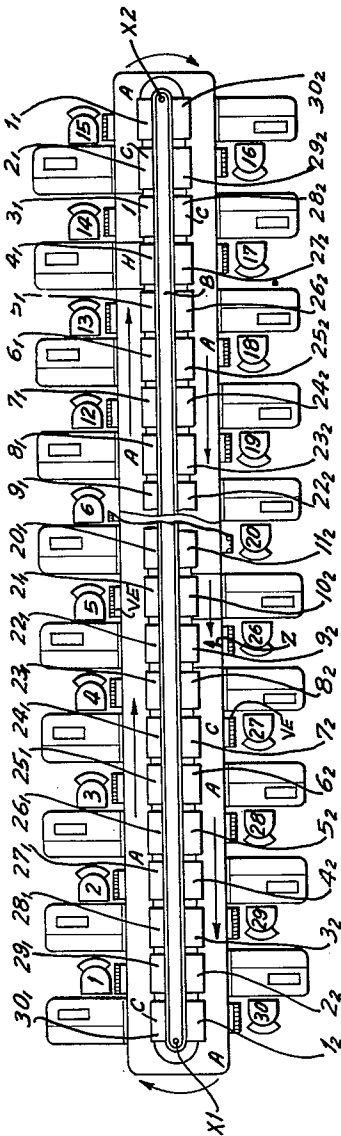
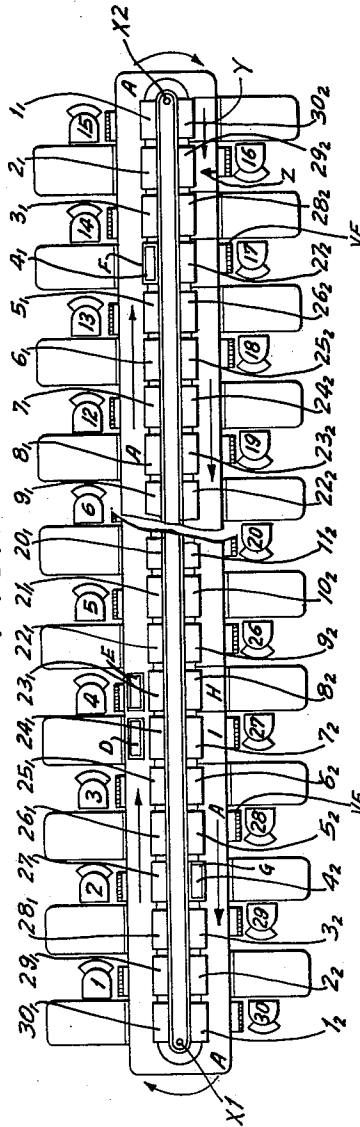


FIG. 2



INVENTORS
Ernst Habicht and
BY Georg Meinas
Michael S. Striker
Attorney

March 26, 1963

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Fig. 3

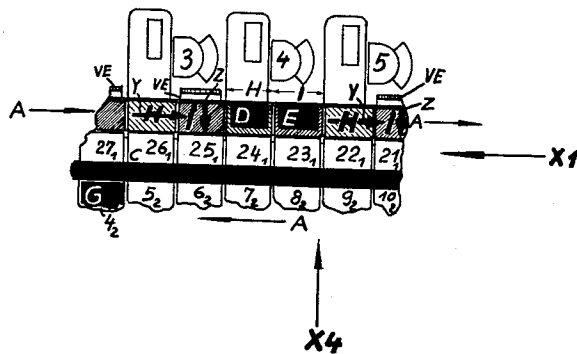
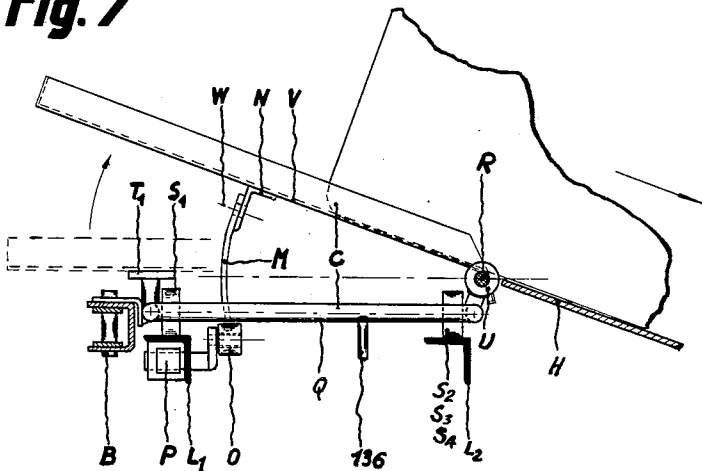


Fig. 7



INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY.
Michael S. Striker

March 26, 1963

E. HABICHT ETAL

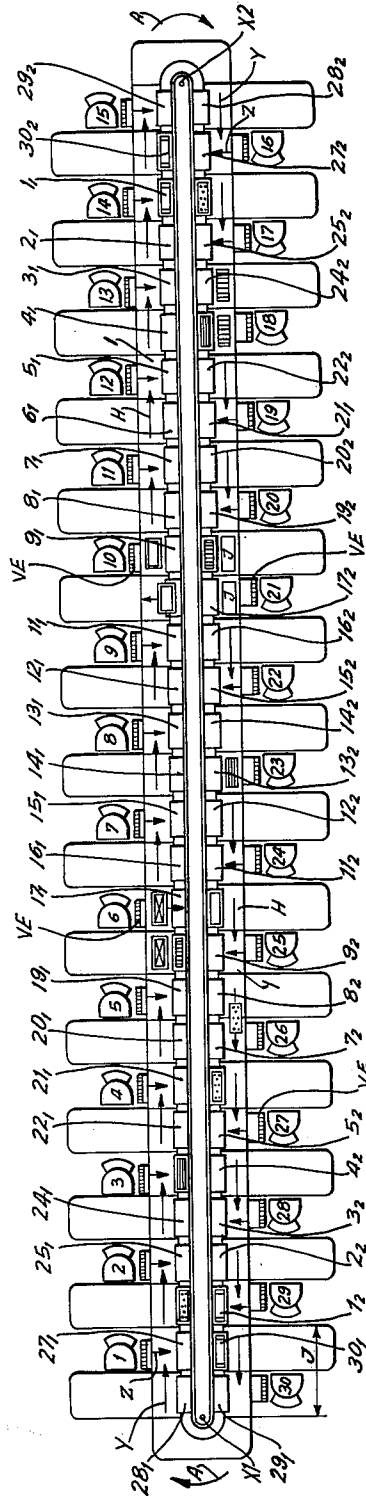
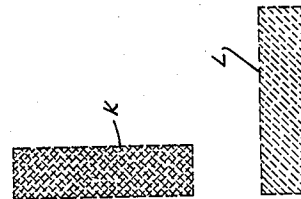
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FIG. 4



INVENTORS
Ernst Habicht and
BY Georg Meinas
Michael S. Striker
Attorney

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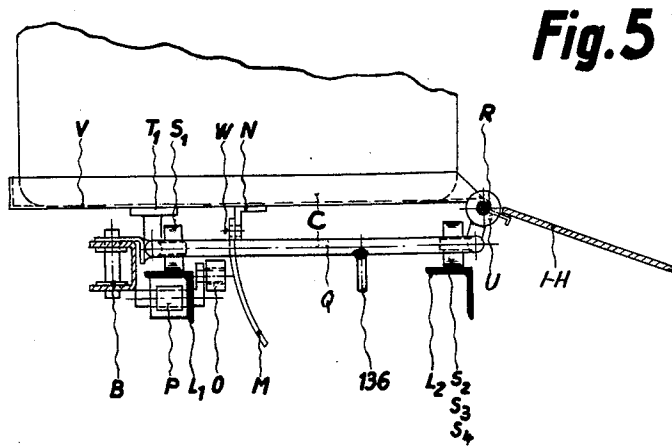
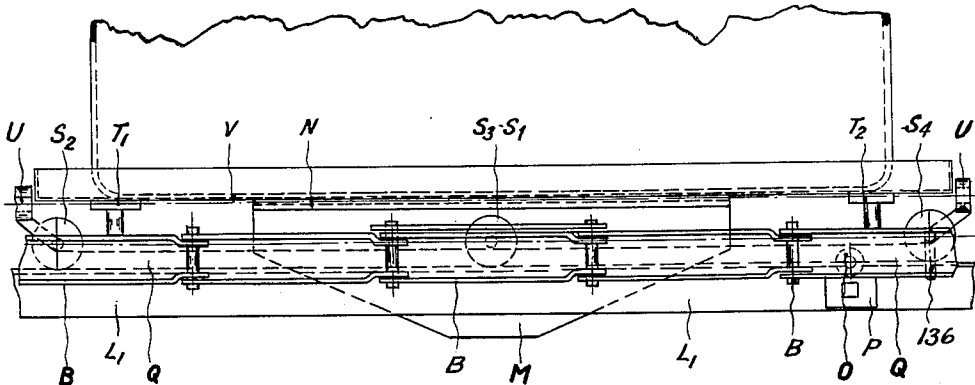


Fig. 6

INVENTORS

BY ERNST HABICHT
GEORG MEINAS

ATTORNEY.
Michael S. Striker

March 26, 1963

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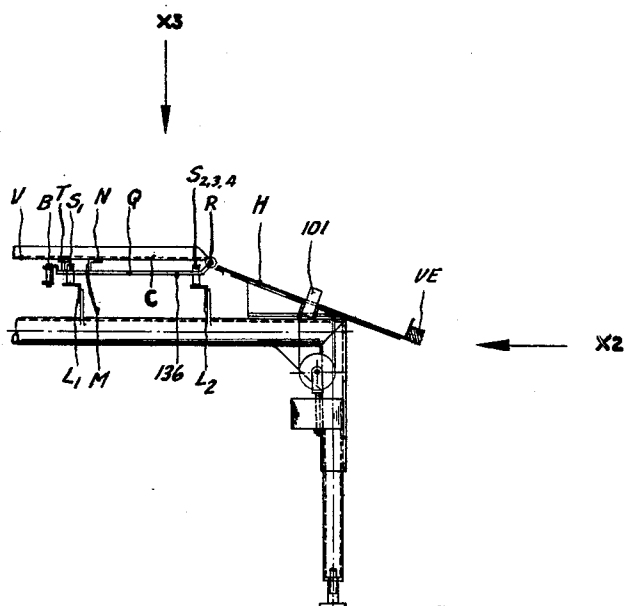


Fig. 8

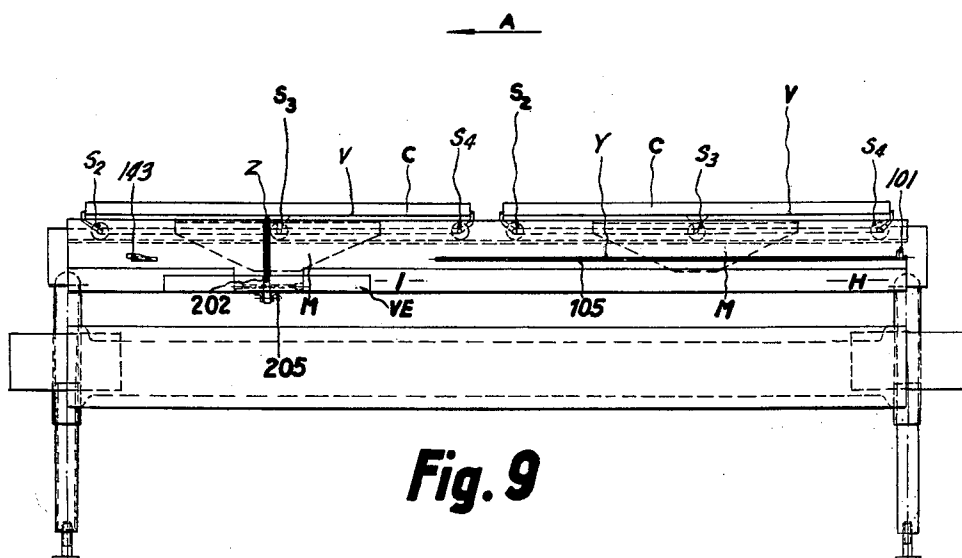


Fig. 9

INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY.
Michael S. Striker

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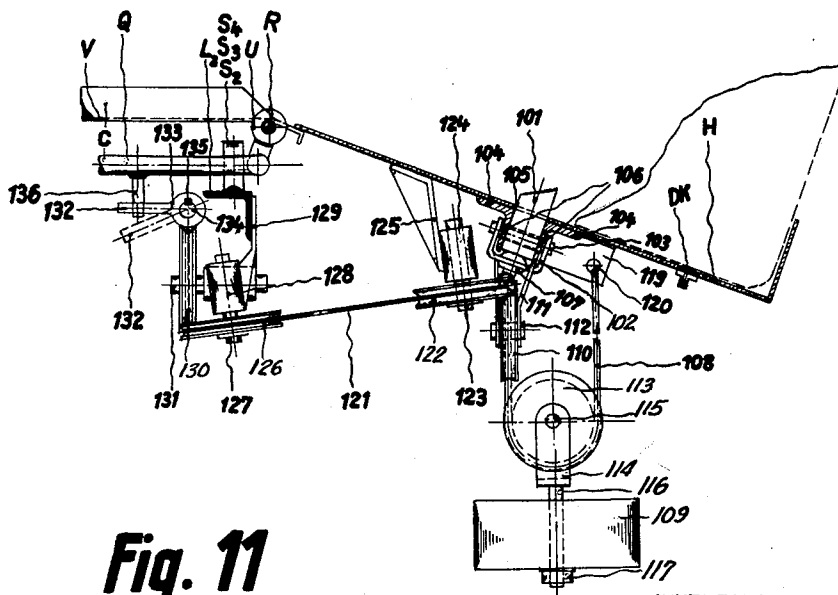


Fig. 11

INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY,
Michael S. Striker

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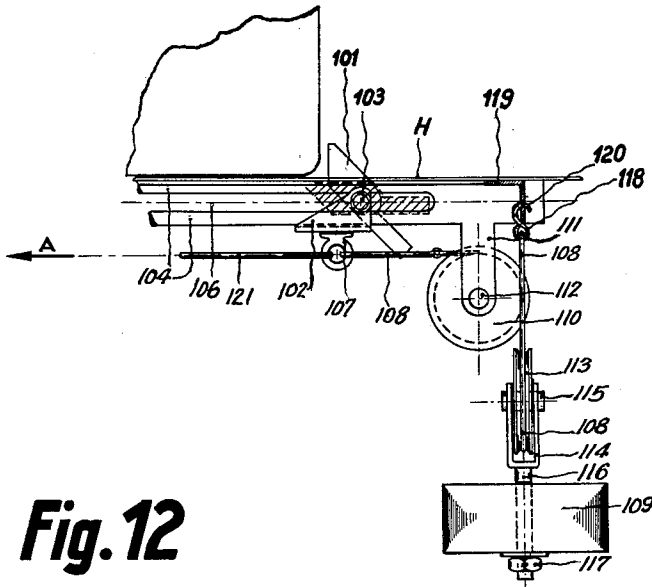
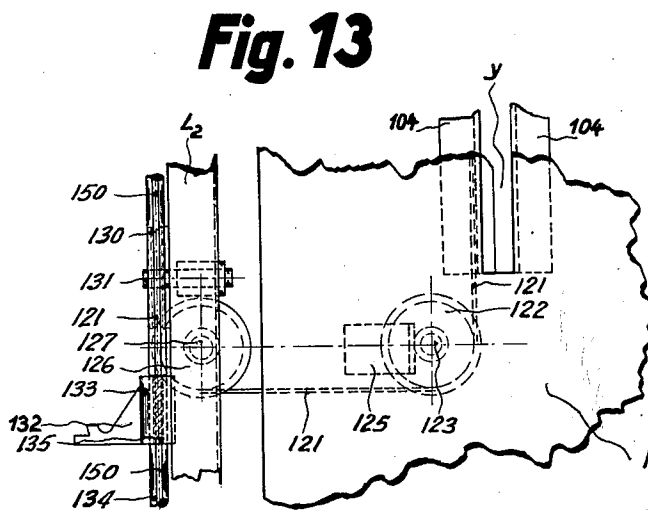


Fig. 12



INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

AT TORNEY.

Michael S. Striker

March 26, 1963

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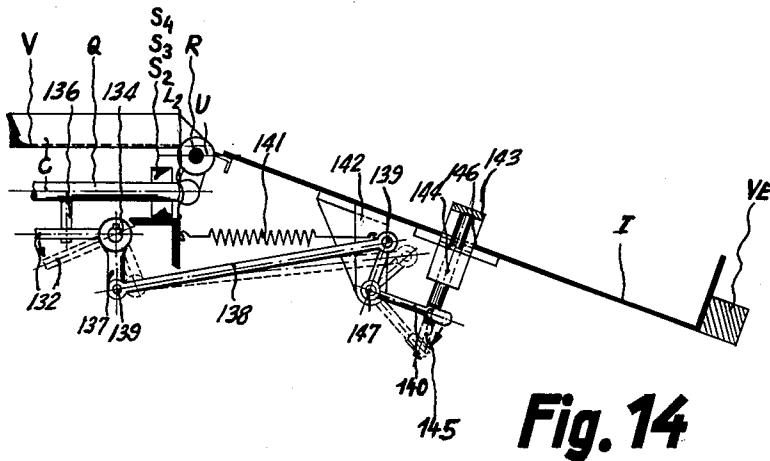
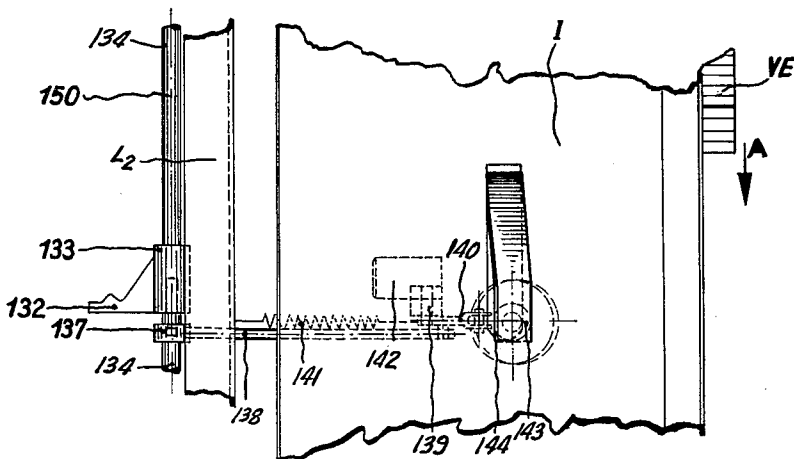


Fig. 15

INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY.
Michael S. Striker

March 26, 1963

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Fig. 16

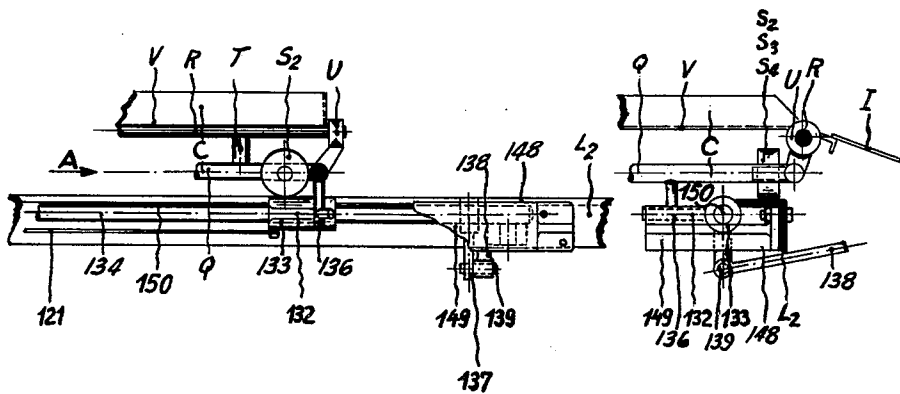
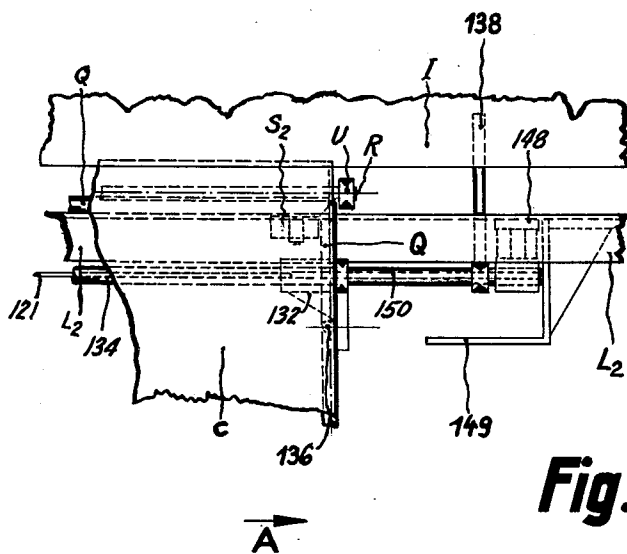


Fig. 17

INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY.
Michael S. Striker

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ATTORNEY:
Michael S. Striker

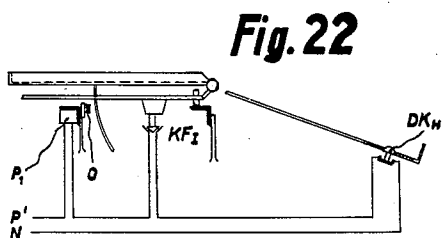
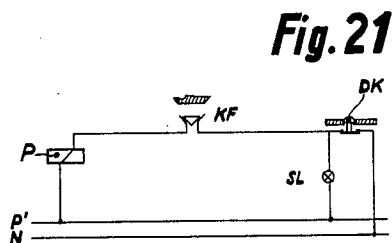
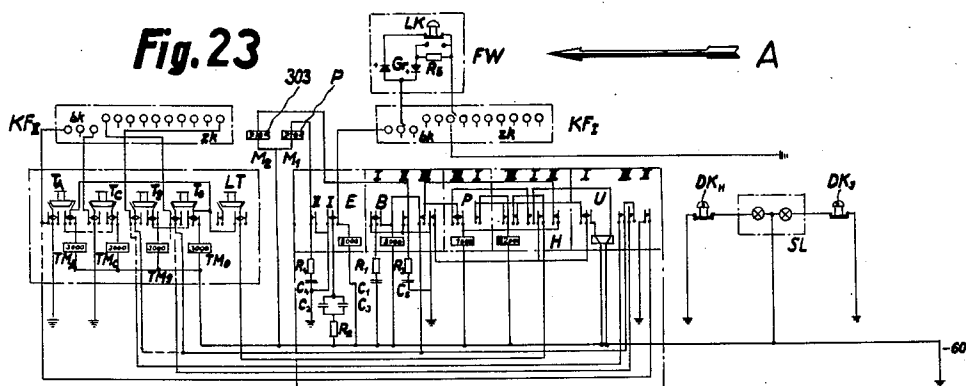
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INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY.
Michael S. Striker

March 26, 1963

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Fig. 25

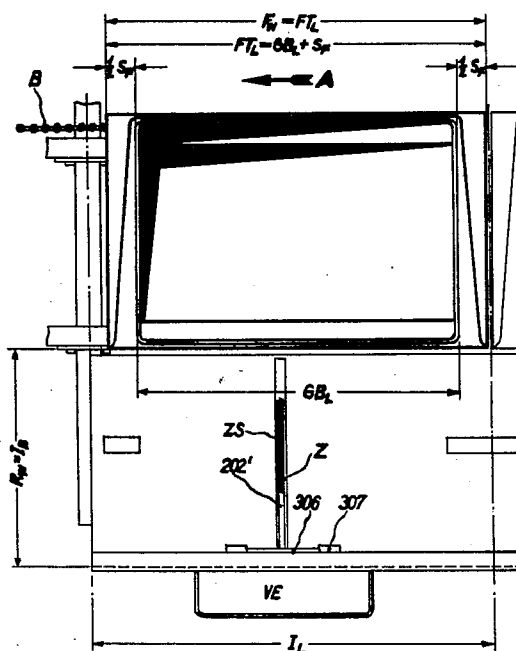
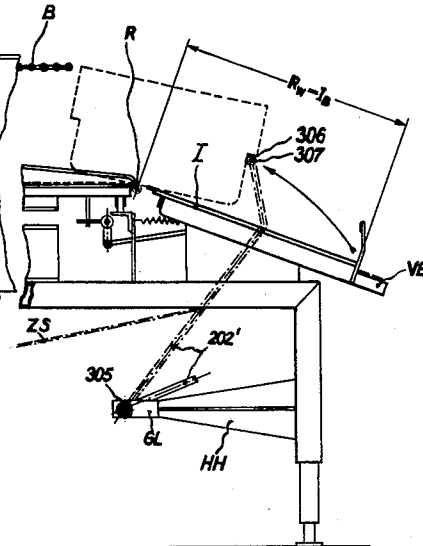


Fig. 26



INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY,
Michael S. Striker

March 26, 1963

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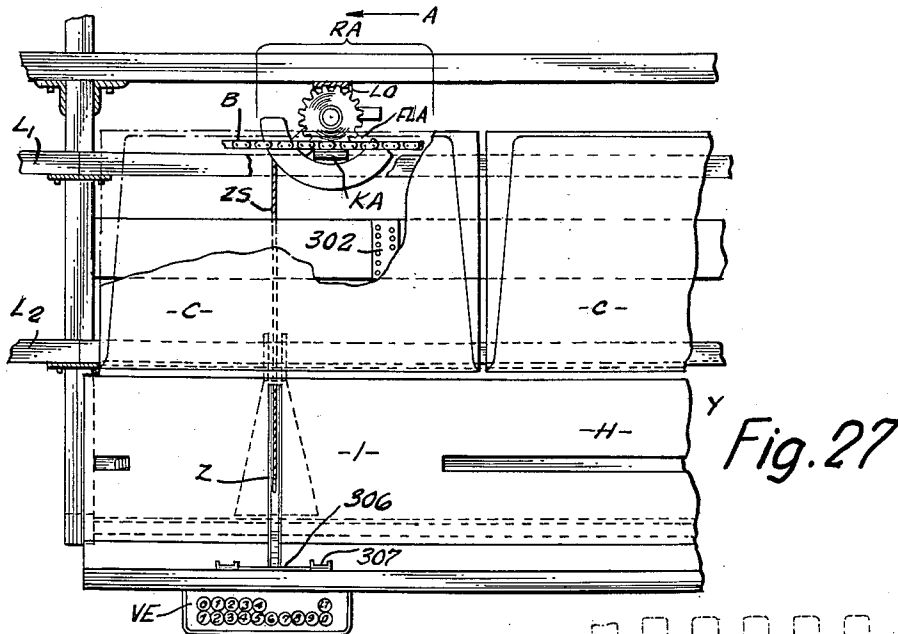
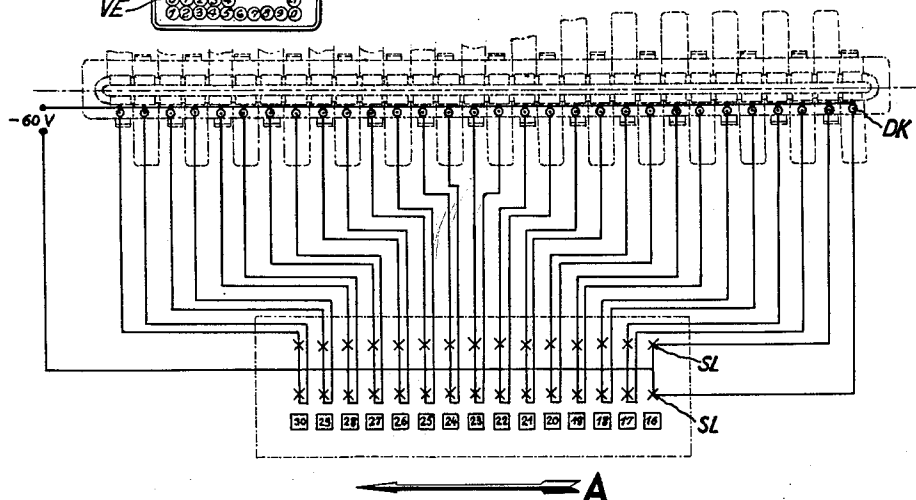


Fig. 20

INVENTORS.
BY ERNST HABICHT
GEORG MEINAS

ATTORNEY,
Michael S. Striker

March 26, 1963

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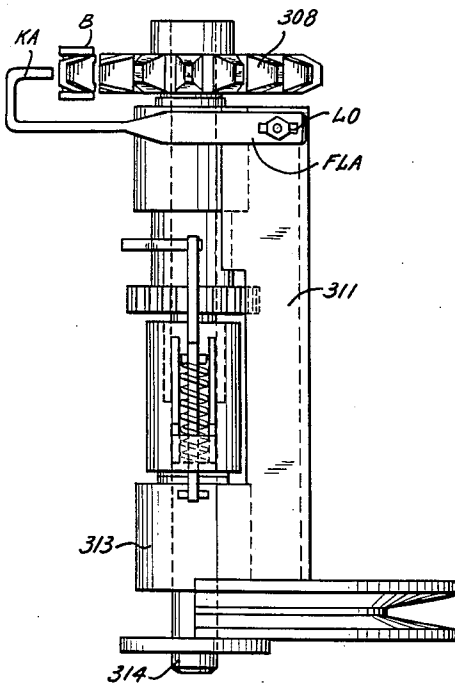


FIG. 28

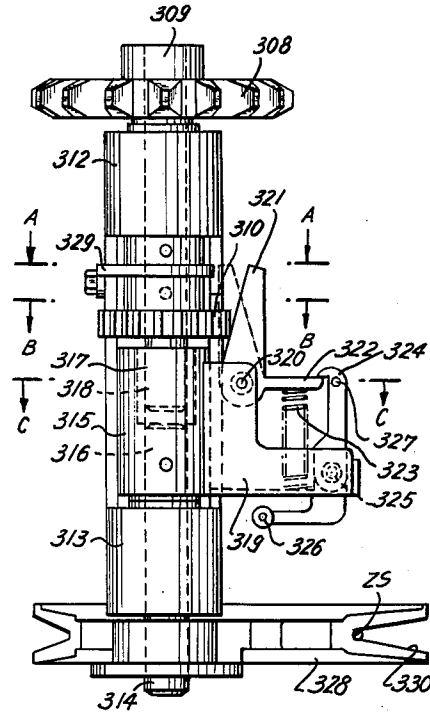


FIG. 29

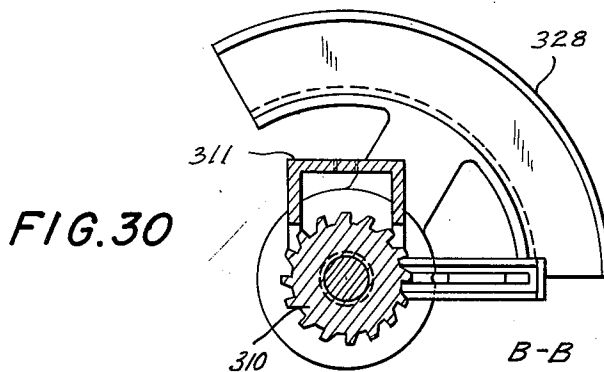


FIG. 30

BY

INVENTORS
Ernst Habicht
Georg Meinas

Michael S. Striker
Att.

March 26, 1963

E. HABICHT ET AL
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FIG. 32

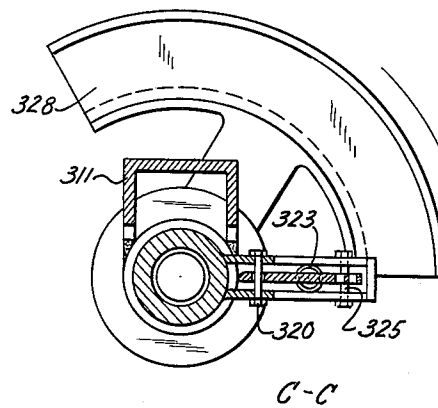


FIG. 31

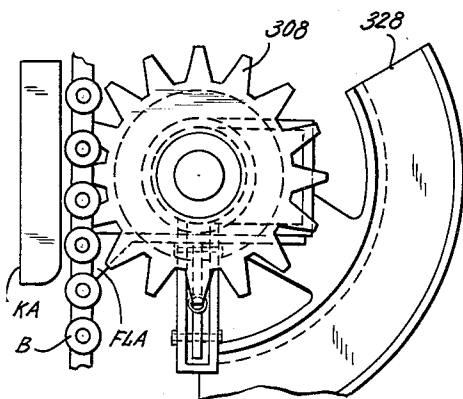
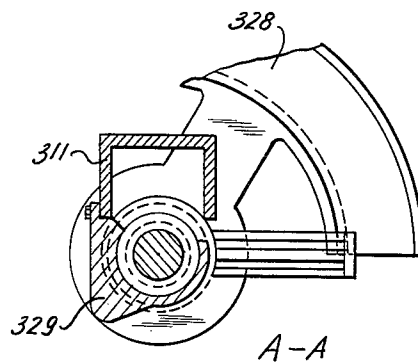


FIG. 33



INVENTORS
Ernst Habicht
Georg Meinas
BY
Michael S. Striker
Att'y

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MATERIAL HANDLING SYSTEM

Ernst Habicht, Bielefeld, Germany (Ingolstädter Landstr. 3, 8042 Schleissheim, near Munich, Germany), and Georg Meinas, Hillegossen, near Bielefeld, Germany (Lindwurmstrasse 115/II, 8 Munich 15, Germany)

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18 Claims. (Cl. 198-19)

The present invention relates to material handling systems.

More particularly, the present invention relates to that type of material handling system wherein a conveyor distributes material to a plurality of work stations and receives material from the work stations to deliver the material to other work stations or to remove the material from the system.

Material handling systems of this type at the present time have several disadvantages. Thus, the known systems are extremely complex and they require a large amount of material to be in continuous movement, which results in a considerable waste of energy and time. Moreover, known material handling systems are subject to unavoidable bottlenecks.

One of the objects of the present invention is to provide a material handling system which is relatively simple and which at the same time is capable of efficiently delivering material to a relatively large number of work stations as well as receiving the material from a relatively large number of work stations.

Another object of the present invention is to provide a material handling system capable of maintaining only a limited amount of material in movement at any given time so that the energy required to move the material is maintained at a minimum and so that a minimum amount of time and work is required to keep the material in movement.

A further object of the present invention is to provide a material handling system capable of automatically eliminating bottlenecks.

An additional object of the present invention is to provide a material handling system which automatically prevents material from being transported to a location which is already occupied with material.

Still another object of the present invention is to provide a material handling system of the above type which can easily be supervised in its entirety from a single station.

A still further object of the present invention is to provide a material handling system which occupies a relatively small space and at the same time is capable of serving a relatively large number of work stations in relation to the relatively small space which is occupied by the entire system.

It is also an object of the present invention to provide a material handling system in which the material which is worked on is transported in containers or receptacles which need never be raised or moved by the operators at the several work stations. It is also an object of the present invention to provide a material handling system in which all components are capable of operating in precise synchronism with each other and in which long fluid conduits are unnecessary so that faulty timing resulting from such long fluid conduits can be avoided.

With the above objects in view the present invention includes a material handling system wherein a plurality of work stations are located along a predetermined path. In accordance with the present invention a conveyor means extend along the path along which work stations are located, and this conveyor means includes a first series of carriers for the several work stations, respectively, which move along the above path and a second

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series of carriers for the several work stations, respectively, the second series of carriers being located after the first series of carriers and also moving along the above path. Thus, the conveyor means includes only two carriers for each work station, and the two carriers of each work station are separated from each other by the carriers of the other work stations so that no two carriers for a single work station are next to each other. The material handling system of the present invention also includes a receiving area located at each work station for receiving a container from a carrier which belongs to the particular work station, and at each work station there is a discharge area from which a container is delivered to a carrier of another work station, these carriers of the conveyor means being adapted to carry the containers. The conveyor means includes a plurality of carriers in addition to those which belong to the several work stations, and there is located at a part of the path of movement of the conveyor means an additional receiving station which cooperates with the additional carriers to receive therefrom excess containers which were not delivered to any of the receiving areas at the several work stations. Each of the operators at the several work stations is capable of selecting a carrier which corresponds to another work station to have the container with the work pieces which have already been operated on by a particular operator picked-up by the carrier of another station and delivered to this other station, and in the event that the two carriers which correspond to the next station are already occupied there is provided an automatic control for delivering the container to one of the additional carriers which delivers the container to the additional receiving area.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary schematic plan view of the material handling system of the present invention showing the relationship between the carriers of the conveyor means and the several work stations;

FIG. 2 shows the system of FIG. 1 with containers located at certain parts of the system;

FIG. 3 fragmentarily illustrates on an enlarged scale part of the structure shown in FIG. 2, FIG. 3 showing how several containers cooperate with the station 4;

FIG. 4 is a schematic plan view of the entire material handling system of the present invention showing several containers having various positions with respect to the work-stations and with respect to the conveyor means;

FIG. 5 is a fragmentary partly sectional transverse elevational view taken transversely to the direction of movement of the conveyor means and showing details of the conveyor means as well as of the structure which cooperates with the conveyor means for causing a container to be delivered therefrom to a receiving area at a given work station;

FIG. 6 is a front elevational view of the conveyor means of the invention showing fragmentarily a unit of the conveyor means, FIG. 6 showing the structure as seen in the direction of arrow X4 of FIG. 3;

FIG. 7 shows the structure of FIG. 5 in a different position wherein the conveyor means has been actuated to deliver a container to a receiving area;

FIG. 8 is a fragmentary transverse elevational view of the conveyor means of the invention, FIG. 8 additionally showing part of the structure for moving a con-

tainer from a receiving area at each work station to a discharge area thereof;

FIG. 9 fragmentarily illustrates the structure of FIG. 8 as seen in the direction of arrow X2 of FIG. 8;

FIG. 10 is a plan view of the structure of FIG. 9, FIG. 10 being taken in the direction of arrow X3 of FIG. 8;

FIG. 11 is a transverse fragmentary sectional view taken in the direction of arrow X1 of FIG. 3 and showing the details of the structure for moving a container from a receiving area to a discharge area at each work station;

FIG. 12 is a fragmentary elevational view of the structure as seen in the direction of arrow X2 of FIG. 8 and showing additional details of the structure for moving a container from a receiving area to a discharge area at each work station;

FIG. 13 is a fragmentary plan view of the structure of FIGS. 11 and 12, as seen in the direction of arrow X3 of FIG. 8, and in FIG. 13 the platform on which the containers are located when they are not on the conveyer means is shown in a horizontal plane for the sake of clarity;

FIG. 14 is a fragmentary transverse sectional view showing the structure which is actuated by a container at a discharge area of each work station for preventing a second container from being delivered to the discharge area when there already is a container at the discharge area;

FIG. 15 is a plan view of the structure of FIG. 14 and shows the structure as seen in the direction of arrow X3 of FIG. 8;

FIG. 16 is a fragmentary elevational view of the structure of FIGS. 14 and 15 for moving a container from a receiving area to a discharge area at each work station;

FIG. 17 is a plan view of the structure of FIGS. 14-16;

FIG. 18 is a fragmentary elevational view taken transversely with respect to the direction of movement of the conveyer means and showing the structure for moving a container from a discharge area at each work station to the conveyer means;

FIG. 19 is a view on an enlarged scale of the structure of FIG. 18 for moving a container from a discharge area to the conveyer means;

FIG. 20 is a schematic illustration of part of the wiring for a central control station which has lamps which indicate the presence or absence of containers at the several work stations;

FIG. 21 fragmentarily and diagrammatically illustrates part of the wiring which controls the movement of the containers to and from the conveyer means;

FIG. 22 also is a fragmentary schematic illustration of the wiring which controls the movement of a container from the conveyer means to a work station;

FIG. 23 is a wiring diagram of the electrical structure which controls the operation of the components of the material handling system of the present invention;

FIG. 24 is a transverse elevational view taken transversely to the direction of movement of the conveyer means and showing another embodiment of a structure for moving a container from a discharge area at each work station to the conveyer means;

FIG. 25 is a fragmentary plan view of part of the conveyer means and part of a work station of the present invention, FIG. 25 showing the dimensional relationship between various components of the system of the invention;

FIG. 26 is a schematic transverse elevational view of the structure of FIG. 25, FIG. 26 also showing the dimensional relationship of the components of the structure which move a container from a discharge area to the conveyer means;

FIG. 27 is a broken away plan view of part of the material handling system of the present invention show-

ing the structure of FIG. 24 for moving a container from a work station to the conveyer means;

FIG. 28 is a side elevational view of the moving structure which actuates the movement of a container shown in FIG. 24;

FIG. 29 shows the structure of FIG. 28 as seen from the left side of FIG. 28;

FIG. 30 is a sectional plan view taken along the line B-B of FIG. 29 in the direction of the arrows;

FIG. 31 is a top plan of the structure of FIG. 28;

FIG. 32 is a sectional plan view of the structure of FIG. 29 taken along the line C-C of FIG. 29 in the direction of the arrows; and

FIG. 33 is a sectional plan view of the structure of FIG. 29 taken along line A-A of FIG. 29 in the direction of the arrows.

The material handling system of the present invention is capable of handling all types of materials such as textiles, leather, plastics, metals, liquids, and the like. The system of the present invention includes a conveyer means which moves continuously and which does not have any cyclical movement which is in any way related to the operations which are carried on at the several work stations. According to the present invention only a limited amount of material is maintained in movement by the system at any given time.

General Description

The layout of the material handling system of the present invention and the manner in which it operates is illustrated in FIGS. 1-4. As may be seen from FIG. 1, the material handling system of the present invention includes a plurality of work stations which in the illustrated example are numbered 1-30. These work stations start at the upper left of FIG. 1 and advance to the right up to station No. 15, and then they continue at the lower right of FIG. 1 and continue to the left up to station No. 30. These work stations are located along an endless path, and a conveyer means moves along this path to deliver the material to the work stations and to receive material from the work stations. The conveyer means includes an elongated endless sprocket chain or the like B which is driven by a pair of sprocket wheels located at the turning points W₁ and W₂ shown in FIG. 1, a suitable electrical driving motor, which is not illustrated, being located beneath one of the turning points W₁ and W₂ and cooperating through a suitable gear transmission with one of the sprocket wheels for turning the same so as to continuously advance the endless chain B with the upper run thereof, as viewed in FIG. 1, moving to the right as indicated by the upper arrows A and with the lower run of FIG. 1 moving to the left, as viewed in FIG. 1, as indicated by the lower arrows A. The conveyer means further includes a plurality of carriers C which are connected with the chain B for movement therewith along the endless path which is surrounded by the several work stations. In accordance with the present invention only two carriers C are provided for each work station. Thus, the carriers 1₁ and 1₂ cooperate with the work station 1, the carriers 2₁ and 2₂ cooperate with the work station 2, etc. Thus, there are provided in the conveyer means of the present invention a first series of carriers for the several work stations, respectively, and a second series following the first series, so that only two carriers are provided for each work station, and these two carriers of each work station are separated from each other by all of the carriers for the other work stations. The several carriers and the several work stations may be provided with any suitable indicia such as the numbers shown in FIG. 1 for identifying the carriages and the work stations. Furthermore, it will be noted that while the numbers of the work stations progress from the left to the right at the upper part of FIG. 1 and from the right to the left at the lower part of FIG. 1, the numbers of the

carriers progress in the opposite direction from the right to the left at the upper part of FIG. 1 and from the left to the right at the lower part of FIG. 1.

The numbers of the carriages are visible to the operators at the several work stations as the carriages move by the work stations, and the conveyer means operates at a steady fixed predetermined speed in a continuous uninterrupted manner so that each carriage in a given time moves once through the entire endless path along which the conveyer means is located.

An elongated continuous platform which is described in greater detail below surrounds the conveyer means and is located between the latter and the several work stations. At each work station this platform provides a receiving area H which receives containers delivered from a carriage to each work station and a discharge area I from which a container is discharged from each work station to the conveyer means. Thus, FIG. 1 shows at the work station 14 the receiving area H and the discharge area I of the work station 14, and all of the work stations are provided with similar receiving and discharge areas. It will be noted that the total length of the receiving and discharge areas H and I at each work station equals the length of each work station along the path of movement of the conveyer means, and furthermore each pair of succeeding carriers C have a length equal to the length of the areas H and I.

One of the important features of the present invention is the limitation of the amount of material which is in movement at any given time. FIG. 2 illustrates the limitation of the amount of material for the work station 4. Thus, as may be seen from FIG. 2, there is a container D and a container E at the receiving and discharge areas of the work station 4, and at the same time there is a container F on the carrier 4₁ of the conveyer means and another container G on the carrier 4₂ of the conveyer means. Therefore, at this time both of the carriers 4₁ and 4₂ are occupied by containers for the work station 4 and simultaneously both the receiving and discharge areas of the work station 4 are occupied. Therefore, the containers F and G cannot be delivered to the receiving area of the work station 4, and with the structure as shown in FIG. 2 the system is provided with the maximum amount of material which it can handle for the work station 4. Thus, assuming that there are a given number of work pieces or a given amount of material in one of the containers D-G, then the maximum amount of material which can be handled by the system of the invention for any given work station is four times the amount of material or number of work pieces in one of the containers which holds the material or work pieces which are operated upon at a particular work station.

The manner in which the material moves is shown for the work station 4 on an enlarged scale in FIG. 3, the container F which is on the carrier 4₁ being omitted from FIG. 3. Thus, as can be seen from FIG. 3 the containers which are delivered to the several stations such as the stations 3 and 5 of FIG. 3 are moved from the receiving areas H at these stations to the discharge areas I, and this movement takes place at each work station as soon as the discharge area of each station is unoccupied, as will be apparent from the description below. The container at each discharge station I of the several work stations moves as shown by the arrows in FIG. 3 toward the conveyer means to be discharged from the work station to the conveyer means in a manner described in greater detail below.

The operators at the several work stations do not remove the containers from the system. Each operator only takes material or a work piece from a container, performs the particular operation on the material or work piece, and then returns the material or work piece to a container. Although the operator may work on the material or work pieces while a container which holds these work pieces is at the position H or the position I, in al-

most all cases the work will be performed on the material or work pieces in a container which is located at the discharge station I beside the operator at each work station. Thus, the operator never lifts a container and removes it from the system and there cannot be at any given time more than four containers for a given work station in the material handling station of the present invention.

At each of the work stations each operator is provided with a selector device VE, and this selector device is of an electrical construction and includes a plurality of switches capable of being selectively actuated by each operator. Thus, when the operator at the work station 4 of FIG. 2 completes the operations on the material or work pieces in the container E, he will close a selected switch of his selector device VE, this switch bearing a number which is the same as the number of the work station to which the work pieces or material are to be delivered from the work station 4. When the operator at the work station 4 closes this particular switch which corresponds to one of the other work stations, then the container E will in a manner described below be discharged from the work station 4 to one of the two carriages C for the next work station which receives the material from the work station 4 and then in a manner described below the container D will automatically be shifted over to the discharge area I previously occupied by the container E, and one of the containers F and G will be automatically delivered to the receiving area of the work station 4. The continuous platform surrounding the conveyer means and providing the receiving and discharge areas for the several work stations is inclined downwardly from the conveyer means and at its lower limit the platform carries a mounting plate on which the selector device VE for each work station is mounted.

The manner in which the entire system operates is illustrated in FIG. 4. As may be seen from FIG. 4 a pair of containers are located at the receiving and discharge areas, respectively, of the work station 6. Assuming that the workpieces or material operated on at the work station 6 are then to be delivered to the work stations 17 and that the operator at the work station 6 has closed the switch 17 of the selector device VE, then when the carrier 17₁ is located at the discharge area of work station 6, as shown in FIG. 4, the container at this discharge area will automatically move onto the carrier 17₁ to be carried thereby to the work station 17 and to be automatically delivered from the conveyer to the receiving area of the work station 17. In the event that the carrier 17₁ is already occupied, then the movement of the container at the discharge area of work station 6 to the carrier 17₁ is automatically prevented in a manner described below, and when the carriage 17₂ becomes located at the discharge area of the work station 6 the container at the latter discharge area will be automatically moved onto the carrier 17₂ to be conveyed by the latter to the work station 17. Thus, the selector devices VE eliminate a considerable amount of waiting time on the part of the operators. The operators need only press the switch corresponding to the next work station, and the work is automatically carried to this next work station. While waiting for work to be carried away from the discharge area at any work station the operator may continue to work on workpieces in a container located at the receiving area of the particular work station. As soon as a container is delivered to the conveyer from the discharge area of a work station, the container at the receiving area of the work station moves automatically to the discharge area thereof. Thus, referring to FIG. 4, the container at the discharge area of work station 6 will move onto the carrier 17₁ and immediately thereafter the container at the receiving area of the work station 6 will move to the discharge area of the work station 6, so that if the carriers 6₁ or 6₂ are occupied by containers for the work station 6, one of these

containers will be automatically delivered to the receiving area of the work station 6 which is now vacant. The illustrated example of FIG. 4 shows that the carrier 6₁ is empty while the carrier 6₂ is occupied, and the container on this carrier 6₂ will be automatically delivered to the receiving area of the work station 6 as soon as the container at this receiving area of the work stations in the position of the parts shown in FIG. 4 is shifted to the right to the discharge area of the work station 6.

Assuming, for example, that in the above example both of the carriages 17₁ and 17₂ are occupied so that the container at the discharge area of the work station 6 cannot move onto the carriers 17₁ or 17₂, the structure of the invention operates to eliminate a bottleneck which might otherwise occur. The stations 1 and 30 are not work stations in the sense that operations are performed on the material or the workpieces at the stations 1 and 30. These stations 1 and 30 are located at the left end of the system, as viewed in FIG. 4, and serve to provide this system with fresh material or workpieces to be processed at the several work stations as well as to eliminate from the system excess containers which cannot be delivered to the next work station for the time being.

When the operator at the work station 6 closes the switch 17 of his selector device VE and assuming that the carriages or carriers 17₁ and 17₂ are occupied, then the electrical system in a manner described below automatically causes the container at the discharge area of the work station 6 to be received by one of the carriers 30₁ or 30₂ to be delivered to the collection area J which is the receiving area for the station 30. The carriers 1₁ and 1₂ serve the same purpose so that for the left end of the system there are more than two carriers provided for removing excess containers from the system, these excess containers being temporarily prevented from moving to the next work station, and also the additional areas at the end of the system serve to receive fresh material which moves onto the carriers for a particular work station where the operations are started. Therefore, with the case where the carriers 17₁ and 17₂ are occupied so that the container at the discharge area of work station 6 cannot move to one of these carriers, either the carriers 30₁ or 30₂ or the carriers 1₁ or 1₂ will automatically receive the container at the discharge area of the work station 6 and deliver this excess container to the area J, and this way a bottleneck is avoided.

The continuous platform which surrounds the conveyor means and is located between the latter and the several work stations is uninterrupted except for the elongated slots Y which form part of the structure for shifting a container from a receiving area at each work station to the discharge area thereof and the slots Z which form part of the structure for moving the containers from the discharge areas at the several work stations to the conveyor means, as is described in greater detail below.

FIG. 4 shows several different operations taking place in the material handling system of the present invention. At the work station 10 in FIG. 4 a container with material or workpieces therein is being delivered from the carrier 10₁ of the conveyor means to the receiving area H of the work station 10, and FIG. 4 shows at the discharge area I of the work station 10 a container which has just been moved to this discharge area I from the receiving area H. Furthermore, FIG. 4 shows another container on the carrier 10₂ of the conveyor means which moves with the conveyor means and remains in reserve for the work station 10 to be delivered automatically to the receiving area thereof as soon as this receiving area is unoccupied and the carrier 10₂ reaches the unoccupied receiving area. When the operator at work station 10 completes his work on the workpieces or material in the container at the discharge area I of the work station 10 the operator will select at the selector device VE the next work station to receive the container from the work

station 10 and the carrier of the next work station will automatically receive the container from the work station 10 and deliver to the next work station. Thus, whichever of the two carriers belonging to the next work station are unoccupied and reach the work station 10 after the operator at the work station 10 actuates the selector device VE will receive the container from the discharge area I of the work station 10.

At the work station 26 in FIG. 4 a container is being moved from the receiving area H to the discharge area I, and it will be noted that the carriers 26₁ and 26₂ are both occupied with containers for the work station 26. Thus, inasmuch as the carrier 26₂ will be the first to reach the receiving area H of the work station 26 after this receiving area H has become unoccupied, it will be the container from the carrier 26₂ which will be delivered to the receiving area H of the work station 26, and container on the carrier 26₁ will remain in reserve for the work station 26. In the illustrated example, after the operations has been performed upon the workpieces or material at the work station 26 the containers with the workpieces or material are to be delivered to the work station 6, and it will be noted that a container which was previously at the discharge area I of the work station 26 has just been moved onto the carrier 6₂ and is on its way to the work station 6. Assuming that the workpieces or material are to be delivered to the work station 17 after being worked upon at the work station 6 and that before the carrier 6₂ reaches the work station 6 the container at the discharge area thereof has been moved onto the carrier 17₁ and the container at the receiving area H thereof has been shifted to the discharge area I thereof, then when the carrier 6₂ reaches the receiving area H of the work station 6, the container on the carrier 6₂ will be automatically moved from the conveyor means to the receiving area H of the work station 6. It will be noted that the carrier 6₁ is empty, a container having just been delivered from this carrier 6₁ to the receiving area H of the work station 6. The operator at the work station 26 selects the work station 6 on his selector device VE, and if by the time carrier 6₁ reaches the work station 26 the operator at the latter work station has completed the operations on the material or workpieces in the container at the discharge area I of the work station 26 and has again selected the work station 6 on his selector device, then this container will be moved from the discharge area I of the station 26 onto the empty carrier 6₁ to be delivered therefrom to the receiving area of the work station 6 as soon as this receiving area becomes unoccupied.

At the work station 18 in the example illustrated in FIG. 4 there are containers at the receiving and discharge areas, respectively, and moreover it will be noted that the carrier 18₂ has just passed the work station 18 and is occupied by a container which could not be delivered to the work station 18 because the receiving area thereof is occupied. Moreover, there is another container on the carrier 18₁, so that in the illustrated example both of the carriers for the work station 18 are occupied and both the receiving and the discharge areas of the work station 18 are occupied. Therefore, under these conditions work cannot be moved from any other work station to the work station 18, and the system carries the maximum amount of material which it can carry for the work station 18. The carriers 18₁ and 18₂ will be occupied by the containers thereon until the receiving area at the work station 18 becomes unoccupied. Assuming that the work station 18 receives the workpieces or material from the work station 21 and that the operator at the work station 21 has completed his operation on the workpieces or material which are then to be moved to the work station 18, it is evident that under these circumstances the container will not be picked-up from the discharge area of the work station 21 by either of the carriages 18₁ or 18₂

for the time being, and it is furthermore apparent that the work must be moved away from the work station 21 so that this work station can receive additional work from another work station. Under these conditions the selector device VE at the work station 21 which has been actuated by the operator at this work station to select one of the carriers 13₁ or 13₂ automatically cancels this selection and automatically selects one of the carriers 30₁ and 30₂ or one of the carriers 1₁ and 1₂, and one of these four carriers will pick-up the work intended for work station 18 from the discharge area of work station 21 and will deliver this work to the receiving area J of the work station 30. The supervisor for the entire operation is located at the work station 30 and he is provided with a signalling device such as a group of lights on a suitable board which indicates to him that both of the areas at the work station 18 are occupied so that the work cannot be delivered from the work station 21 to the work station 18, and the excess work for the work station 18 is stored by the supervisor at the area L shown in FIG. 4. Ordinarily two carriers will not be sufficient to carry away the excess workpieces or material, and for this reason the carriers of the work station 1 as well as the carriers of the work station 30 serve the purpose of removing from the system excess work which for the time being cannot be delivered to the next work station. The fresh material or workpieces which are to be newly introduced into the material handling system are located at the area K which is nearest to the work station 1, so that the work station 1 serves to introduce materials into the system, while the work station 30 serves to remove from the system both excess material which momentarily cannot be delivered to the proper work station and finished material is also removed from the system at the work station 30. As soon as the supervisor at the work station 30 sees from his signal board that the receiving area H of the work station 18 is unoccupied he will return from the area L the excess container received from the work station 21 to the discharge area of the work station 30 and the supervisor will select with the selector device VE of the work station 30 the station 18 so that when the first unoccupied carrier for the work station 18 moves to the discharge area of the work station 30 this container which previously could not be delivered to the work station 18 will be picked-up at the work station 30 and will be delivered to the area of the work station 18 which receives the work material. The new material from the area K is placed on the discharge area I of the work station 1 by the supervisor and the supervisor selects the work station which is to first work on the fresh material by operating the selector device at the work station 1, and as soon as a carrier which belongs to the first work station to operate on the fresh material is unoccupied and reaches the discharge area of the work station 1, this fresh material will be picked-up and delivered to this work station. The carriers 1₁ and 1₂ cooperate with the work station 30 to deliver containers on these carriers 1₁ and 1₂ to the work station 30, so that there are additional carriers capable of removing all excess containers from the system, and in this way at any one time there is only a limited amount of material in movement. Of course, the discharge area of the work station 30 may also be used to introduce new work pieces or material into the system.

The supervisor may transfer the excess containers to the area L by hand, or any suitable subsidiary conveyors may be provided for this purpose, and any arrangement may be provided for bringing from the area L the excess containers which are to be re-introduced into the system. Ordinarily the area L will be located very close to the system, as illustrated in FIG. 4, although, if desired, this area L may be at an entirely different location with suitable arrangements for bringing material or workpieces to and from the area L. The same is true of the area K which ordinarily is located directly next to the system as

shown in FIG. 4 and the supervisor may bring workpieces or material from the area K to the discharge areas of the work stations 1 and/or 30 by hand or any suitable conveyor may be provided for this purpose.

It will be noted from FIG. 4 that the discharge area of the work station 23 is occupied by a container while the receiving area thereof is unoccupied, and the carriers 23₁ and 23₂ are occupied by containers for the work station 23. In the example illustrated in FIG. 4 the carrier 23₂ will reach the work station 23 before the carrier 23₁, so that the container on the carrier 23₂ will be received at the receiving area of the work station 23 while the container on the carrier 23₁ will remain in reserve.

Of course, it is not essential that all of the work stations be operating at the same time. The material handling system can be used for workpieces or material which in the illustrated example require up to 28 different operations to be performed at 28 different work stations, which is to say all of the work stations except the work stations 1 and 30 in the illustrated example, but at the same time the material handling system operates very efficiently with less than the maximum number of work stations in use at any one time. The maximum number of work stations 28 applies only to the example illustrated in FIG. 4. There is actually no limit to the number of work stations which may be used with the system of the invention and the work stations 1-30 are illustrated in FIG. 4 only by way of example.

Container Movement From Conveyor to Work Stations

The structure for moving the containers from the conveyor means to the receiving areas H of the several work stations is illustrated in FIGS. 5-7. Referring now to FIGS. 5-7 it will be seen that the conveyor means includes a pair of rails L₁ and L₂ which extend along the path of movement of the conveyer means, and the conveyer means furthermore includes the carriages Q which support the plates V which form the bottom walls of the carriers C. The carriages Q are in the form of frames which turnably support at one side three rollers S₂, S₃ and S₄ which ride on the rail L₂, and its other side in alignment with the intermediate roller S₃ the frame Q turnably carries a roller S₁ which rides on the inner rail L₁. With this arrangement the conveyor means is capable of negotiating the turn at the ends W₁ and W₂ and at the same time rides on the straight portions of the rails located between the ends of the system. The carriage Q carries at its opposite ends and at the outer periphery of the conveyer means a pair of bearings U which carry an elongated rod R which extends in the direction of movement of the conveyor means and which serves to pivotally connect the plate V of each carrier C to the carriage Q for turning movement about the axis of the rod R. At its underside each plate V carries a bracket N and the bracket N has connected thereto by suitable bolts W or the like a cam M, this cam M being curved along a cylinder whose axis is in coincidence with the axis of the rod R. The rail L₁ fixedly carries at each work station an electromagnet P whose armature carries a cam actuating member O in the form of a roller. When the electromagnet P is unenergized the armature thereof locates the roller O in the position illustrated in FIG. 5. It will be noted that FIG. 5 also shows the chain B of the conveyor means which is driven by the motor or the like for maintaining the conveyor means in continuous movement. The chain B is also illustrated in FIGS. 6 and 7.

When a carrier for a particular work station is occupied by a container for the work station and when the receiving area H of the particular work station is also unoccupied, then just before this carrier reaches the work station the electromagnet P is automatically energized in a manner described below so as to shift the cam actuating roller O to the right to the position of FIG. 5 to that of FIG. 7, and the cam actuating member is now located in the path of movement of the cam M to cooperate with the latter

for raising the plate V from the position of FIG. 5 to that of FIG. 7 so that by gravity the container with the workpieces therein will slide down from the carrier to the receiving area H of the particular work station. As soon as the container reaches the receiving area H it actuates a switch at this receiving area so as to open the circuit of the electromagnet P, and the electromagnet becomes unenergized so that its armature returns under the action of a suitable spring, for example, from the position of FIG. 7 to that of FIG. 5. In a manner which is described below, there are electrical contacts beneath the conveyor means at each work station as well as other contacts carried by each carriage so that when these contacts engage each other just before a carrier for a particular work station reaches this station and assuming that the receiving area H thereof is unoccupied the electromagnet P of this work station will become energized to provide the automatic delivery of the container from the carrier to the work station in the manner shown in FIGS. 5-7 and described above.

FIGS. 5 and 7 also show a driving member 136 in the form of a rigid pin fixed to and extending downwardly from the carriage Q, this driving member forming part of the structure for shifting a container from the receiving area H to the receiving area I of the work stations.

Container Movement From Receiving to Discharge Areas

The structure which automatically moves a container from the receiving area H of each work station to the receiving area I thereof (FIG. 10) is illustrated in detail in FIGS. 8-17. FIG. 10 as well as FIG. 11 shows the switch DK located at the receiving area H of each work station to be engaged by a container for opening the circuit to the electromagnet P referred to above in connection with FIGS. 5-7.

FIGS. 8-10 show the selector device VE diagrammatically, and these figs. illustrate how this selector device is mounted at the lower limit of the platform which surrounds the conveyor means and is located between the latter and the work stations. Also, FIGS. 8-10 show the pusher member 101 which pushes a container from the receiving area H at each work station to the discharge area I. FIGS. 9 and 10 show the elongated slot 105 which forms the guideway for the pusher 101 in the direction of the elongated cutout Y referred to above, this cutout Y and the slot 105 being the same. FIGS. 9 and 10 further show a contact member 143 which is engaged by a container at the discharge area I to prevent another container from being moved to the discharge area when it is already occupied, as described below, and FIGS. 9 and 10 also show the lever 202 in the elongated slot Z, this lever serving to move a container from the discharge area to the conveyor in a manner described below.

Referring now to FIGS. 11-13, it will be seen that the platform carries at its underside at each area H a pair of elongated angle irons 104 located along the opposite edges of the slot 105. The pusher member 101 is traversed intermediate its ends by a pin 103 which extends through a pair of elongated parallel slots 106 formed in the angle irons 104 which are fixed to the platform, and in this way the pin 103 cooperates with the slots to guide the pusher member 101 for movement along the slot Y. At its ends which extend beyond the slot 106, the pin 103 is connected with a channel member 102 which is slidable along the angle irons 104, this member 102 having a bottom wall extending across the space between the angle irons and having a pair of side walls extending upwardly along the exterior surfaces of those sides of the angle irons which are formed with the slots 106. Thus, the movement of the channel member 102 along the angle irons 104 will result in movement of the pusher member 101 along the slot Y, and it will be noticed from FIG. 12 that the pusher member 101 extends at its right end downwardly beyond the right end of channel member 102. This arrangement causes the pusher mem-

ber 101 to engage the right edge of the channel member 102, as viewed in FIG. 12, to limit the turning movement of the member 101 in a clockwise direction, as viewed in FIG. 12, but on the other hand when the pusher member 101 is moved to the right, as viewed in FIG. 12, and engages an object on the platform the pusher member 101 is capable of turning in a counterclockwise direction to move beyond such an obstacle. The channel member 102 fixedly carries at its underside an eye 107 to which a pair of cables 102 and 108 are connected.

Referring now to FIGS. 11 and 13, it will be seen that the cable 121 extends from the eye 107 around a substantially horizontal pulley 122 which is supported for turning movement on a shaft 123 carried by a bearing member 124 which is in turn supported on a bracket 125 fastened to the underside of the platform. From the pulley 122 the cable 121 extends around a second pulley 126 carried by a shaft 127 which is supported in turn by a bearing 128 which is carried by a bracket 129 fixed to the rail L₂. From the pulley 126 the cable 121 passes around a pulley 130 which is carried by a shaft 131 which is in turn supported by a bearing fixed to the bracket 129, and the end of the cable 121 is fastened to a driven member 132. This driven member 132 cooperates with the driving member 136 referred to above. The driven member 132 has a sleeve portion 133 which is slidable along a shaft 134 which is supported for turning movement at its ends in a pair of brackets 148 carried by the rail L₂ (FIG. 17), and the turnable shaft 134 carries an elongated key 150 which is received in a keyway of the sleeve portion 133 of the driven member 132 so that this member 132 can slide axially along the shaft 134 but is constrained to turn therewith.

Assuming that a container is located at the receiving area H of a work station and that the pusher 101 is at the right end of the elongated slot Y, as shown in FIG. 10, then when the driven member 132 is in a horizontal plane it will be located in the path of movement of a driving member 136 of a carriage Q of the conveyor means, and this driving member 136 will engage the driven member 132 to shift the same along the shaft 134, and in this way the pulley cable 121 will be moved along the pulleys 122, 126 and 130 so as to turn these pulleys, and through the connection of the cable 121 with the eye 107 the channel member 102 together with the pusher member 101 will be advanced to the left, as viewed in FIG. 12, so as to push a container from the area H to the discharge area I.

A suitable means is provided for urging the pusher member back to its starting position, and this means takes the form of a cable 108 which is also fixed to the eye 107, as mentioned above, and this cable 108 passes around a pulley 110 supported by a shaft 112 which is carried by an extension 111 of the angle iron 104. A pair of these extensions 111 are provided on each angle iron and these extensions 111 support the pulley 110 in the manner shown in FIGS. 11 and 12. From the pulley 110 the cable 108 passes around a second pulley 113 and the end of the cable 108 is connected with a hook 118 which is hooked into an opening 120 of an angle iron 119 fastened to the underside of the platform at an end of the angle irons 104. The pulley 113 is carried by a shaft 115 which is in turn connected with a bifurcated member 114 which carries a weight 109, this weight 109 being formed with a bore passing therethrough and receiving a pin 116 which is fixed to and extends downwardly from the member 114 and which pivotally carries at its bottom end a nut 117 which holds the weight 109 on the pin 116. In this way, the weight 109 acts through the pulleys 110 and 113 and the cable 108 to return the pusher member 101 automatically to its starting position.

Referring now to FIGS. 14 and 15, it will be seen that the contact member 143 at the discharge area I of each work station has an upwardly directed convex surface which rises upwardly from the top surface of the plat-

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form in the direction of movement of a container from the area H to the area I, so that the container slides onto the contact member 143 and simultaneously depresses the latter. The contact member 143 is fixed to the top end of an elongated pin 144 which extends through the platform and which is guided for axial movement by a sleeve 146 which is fixed to the platform at its underside. The bottom end of the pin 144 fixedly carries another pin 145 which is located in a slot at the right end of a bell crank 140 which is pivotally mounted at 147 on a bracket 142 and which is pivotally connected at its end distant from the pin 145 to the end 139 of a link 138 which is in turn pivotally connected at 139 with a lever 137 which is fixed to the shaft 134 which has been referred to above and which is turnably supported in the bearings 143 carried by the rail L₂.

Thus, when a container rides over the contact member 143 and depresses the latter, the bell crank 140 will turn in a clockwise direction, as viewed in FIG. 14, from the solid to the dotted line position, and the result is that the link 138 will be pulled to the right, as viewed in FIG. 14, so as to turn the lever 137 in a counterclockwise direction, and as a result the shaft 134 will also turn in a counterclockwise direction, so that the driven member 132 will turn from the solid to the dotted line position thereof shown in FIG. 14. The result is that the driven member 132 is turned out of the path of movement of the driving member 136. A spring 141 is connected at one end to the rail L₂ and at its opposite end to a part of the link 138 for urging the structure shown in FIG. 14 to the solid line position thereof shown in FIG. 14.

After a container has been pushed in the above described manner from the receiving area H to the discharge area I of a work station, it is apparent that the container itself will actuate the linkage shown in FIG. 14 to move the driven member 132 out of engagement with the driving member 136, and at this time the weight 109 will act to automatically turn the pusher member to its starting position, the pusher member sliding along the underside of another container which in the meantime may have been placed at the receiving area H as soon as the latter became unoccupied.

Thus, the cable 121 together with the pulley it passes around forms a motion transmitting means for transmitting the motion of the driven member 132 to the pusher member 101. It is apparent that when the weight acts to return the pusher member 101 to its starting position the driven member 132 will be returned along the shaft 134 to its starting position, but the angular position of the shaft 134 will always be determined by the contact member 143. As long as there is a container at the discharge area I, the contact member 143 will be depressed by this container so as to automatically maintain the driven member 132 in an angular position where it will not be located in the path of movement of the driving members 136 of the several carriages. On the other hand, as soon as the discharge area becomes unoccupied, the spring 141 acts to immediately locate the driven member 132 in the path of movement of the next driving member 136, so that a container at the receiving area H will be automatically shifted to the discharge area of any work station as soon as this discharge area thereof becomes unoccupied.

A means is provided for automatically moving the driven member 132 downwardly out of engagement with the driving member 136 in the case where there is no longer a container at the discharge area I and at the same time there is no container at the receiving area H to be moved to the discharge area I of each work station. This structure is shown in FIGS. 16 and 17. Thus, a substantially wedge-shaped member 149 is fixed to the rail L₂, and this member 149 is located in the path of movement of the driven member 132. The arrangement is such that if a container does not depress the contact 143 so as to turn the driven member 132 downwardly away from the member 136 then the forward edge of the driven mem-

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ber 132 engages the member 149 to be turned downwardly by the latter, and, as is shown at the right hand part of FIG. 16, the member 149 is formed with a cutout 149' through which the driving member 136 freely passes after the driven member 132 has been turned downwardly away from the driving member 136.

Any suitable means may be provided for permanently maintaining the contact member 143 in a depressed position which maintains the driven member 132 of any work station out of the path of movement of the driving members 136. Thus, each operator may be provided with a suitable weight which he places on the contact member 143 to maintain the latter depressed when the operator leaves the work station so that in this way the driven member 132 will be maintained out of the path of movement of the driving member 136, or any suitable locking device may be provided for releasably holding the contact member 143 in a depressed position. Of course, those work stations which are not being used have their contact members 143 depressed at all times. When a work station is to be used the operator unlocks the member 143 or removes the weight therefrom, so that the structure will operate to automatically shift a container from the receiving area H to the discharge area I in the manner described above.

Container Movement From Discharge Areas to Conveyer

One embodiment of a structure for moving the containers from the discharge areas at the work stations to the conveyer means is illustrated in FIGS. 18 and 19, and another embodiment of such a structure is illustrated in FIGS. 24-33.

Referring now to FIGS. 18 and 19, it will be seen that a plate 201 is fixedly carried by the platform beneath each discharge area I, and the plate 201 carries a pivot pin 205 which serves to pivotally support the lever 202 which has a top end 203 located above the platform, the lever 202 extending through the slot Z and being movable therealong from the solid to the dotted line position indicated in FIGS. 18 and 19. At its top end 203 the lever 202 fixedly carries a cross arm 204 which extends along and engages the container. The bottom end of the lever 202 is pivotally connected at 210 to a link 208 which is in turn pivotally connected at 209 to the bifurcated end 207 of the piston rod of a piston slidable in a cylinder 206, and this cylinder 206 communicates with a source of hydraulic liquid under pressure and suitable conduits with suitable valves cooperate with the cylinder 206 to reciprocate the piston therein so as to provide the desired movement of the lever 202.

When the operator at one of the work stations actuates the device VE to select the next work station, then when there is an unoccupied carriage for this next work station and it becomes located at the discharge area having the container for the next work station an electrical circuit is automatically closed and operates on the hydraulic system so as to shift the piston in the cylinder 206 downwardly to the right, as viewed in FIGS. 18 and 19, with the result that the lever 202 turns in a counterclockwise direction to move the container onto the carrier for the next work station. As soon as the carrier which has just received a container from the discharge area has moved beyond this discharge area the circuit opens and the parts return to their solid line position shown in FIGS. 18 and 19.

Although the embodiment shown in FIGS. 18 and 19 is capable of producing the desired results, nevertheless this construction has several disadvantages so that it is actually preferred. Thus, when the relatively large number of working stations are taken into consideration, it becomes apparent that there are necessarily a large number of hydraulic fluid lines which must be provided and maintained, and this complex hydraulic system is not only costly but has unavoidable losses in pressure which prevent the structure from operating at all times with

the precision which is desired. Also, with the embodiment of FIGS. 18 and 19, as the container moves upwardly to the conveyer when its center of gravity passes over the outer periphery of the conveyer the container simply tilts under its own weight downwardly onto the conveyer and its heavy parts are carried by the container, the result is a considerable impact and noise, which also is undesirable.

The structure shown in FIGS. 24-33 overcomes these drawbacks and FIGS. 24-33 show the preferred structure for moving the containers from the discharge areas of the several work stations to the conveyer means.

Referring now to FIGS. 24-26, there is provided at each work station a unit RA which is described below particularly in connection with FIGS. 28-33 and which serves to actuate the cable ZS for turning the lever 202' which is pivotally supported at 305 on a member GL carried by a bracket HH which is supported at each work station on the structure which carries the entire assembly. The lever 202' is movable in the same way as lever 202 along the slot Z, and at its top end the lever 202' carries a cross arm 205 which is provided at its outer ends with the rollers 307.

As may be seen from FIG. 24, there is connected to the underside of each carriage Q an electrical assembly 301 which carries contacts which are different for the different carriages. There is also provided at each work station an electrical assembly 302 which carries a plurality of contacts, this assembly being shown in plan view fragmentarily in FIG. 27. When the operator at a particular work station selects the next work station by actuating a selected switch of the device VE, then in a known way the electrical assembly 302 at the work station is actuated to cause its contacts to move in such a way that the contacts of the assembly 302 which belong to the selected next work station which has been selected by the operator move upwardly to become located in the path of movement of the contact of the particular carriage which belongs to the next selected work station, so that when this carriage arrives the contacts of the carriage will engage the selected contacts of the assembly 302 to close a circuit for actuating the structure for moving the container from the discharge area onto the selected carrier. Of course, if a container is already on this carrier, then a switch which is actuated by the container already on the carrier is opened and is maintained opened by the container on the carrier so as to prevent the circuit from being completed so that the structure will not operate to move a container from the discharge area to the conveyer means. In the same way, the unit 301 at the underside of each carriage Q is provided with contacts which cooperate with contacts at the work station to which the particular carriage belongs to energize the cam actuating roller O referred to above so that the container on the carrier will be automatically delivered to the receiving area of the work station to which the particular area belongs, in the manner described above. However, as will be pointed out below, if there already is a container at this receiving area then a switch which is actuated by the container prevents the circuit from closing to energize the electromagnet which moves the cam actuating roller to its operating position. The unit 302 is adjustably mounted on the assembly so that its position along the work station may be adjusted.

The lever 202' when it turns from the solid to the dotted line position indicated in FIG. 26 engages with its cross arm 306 and rollers 307 the container to move the latter onto the conveyer. The container is provided at its side which is engaged by the lever 202' with a downwardly directed shoulder ST against which the rollers 307 bear, and the width of this shoulder is at least as great as the diameter of the rollers so that the latter are maintained in reliable engagement with the shoulder. As the lever 202' turns in a counterclockwise direction, as viewed in FIGS. 24 and 26, it does not simply slide

the container upwardly along the platform in the direction of the arrow RR shown in FIG. 24. Instead, in addition to moving the container toward the conveyer means, the lever actually raises the right end of the container, as viewed in FIGS. 24 and 26 so that the container is in a substantially horizontal position by the time its left end has reached the conveyer means, and the lever 202' pushes the substantially horizontal container onto the conveyer means so that with this arrangement the container cannot tilt by itself so as to strike downwardly against the conveyer means with all of the disadvantages resulting from such action.

When it is remembered that the conveyer means is continuously moving, it is apparent that the parts must have a certain dimensional relationship so as to be able to operate properly, and this dimensional relationship is illustrated in FIG. 25. Thus, assuming that the conveyer means moves at a certain constant speed, then in a predetermined time a point on the conveyer means will move through a distance F_W which is equal to the length of one of the plates of each carriage which carries a container. Thus, FIG. 25 shows the distance F_W as being equal to the length FT_L , this latter length being the length of the carrier C in the direction of movement of the conveyer. In accordance with the present invention the carrier C is provided at its opposite ends with substantially wedge-shaped portions which serve to guide the container to and from the carrier, and at its inner edge the carrier is provided with an upwardly directed flange which limits the movement of the container so that the latter cannot move transversely across and beyond the carrier. This upwardly directed flange as well as the wedge-shaped portions at the ends of each carrier C may be provided with a coating of yieldable resilient materials such as foam rubber or the like.

Assuming that each container has in the direction of movement of conveyer means a length GB_L , then it is apparent that the difference between the length of the carrier FT_L and the length of the container GB_L will be equal to a distance S_F , this distance S_F being equal to the total lengths in the direction of movement of the conveyer means of the wedge-shaped portion at the ends of each carrier C. Thus, FIG. 25 shows that each wedge-shaped portion has a dimension in the direction of movement of the conveyer means which is equal to one half S_F . In accordance with the present invention the distance S_F is equal to at least one tenth of the total length FT_L of the carrier C.

Referring to FIGS. 25 and 26, it will be seen that the platform has a width I_B which is equal to the distance R_W from the rod R to the lower limit of the platform where the selector devices VE are located. There is a particular relationship between the distance R_W and the dimension S_F which controls the size of the parts and which controls their design. Thus, by dividing the dimension S_F into the distance R_W it is possible to determine how fast the lever 202' must be moved with respect to the movement of the conveyer means so as to be able to locate the container on the conveyer means within the necessary time period.

For example, assuming that the distance R_W is equal to 400 mm., and furthermore if it is assumed that the distance S_F is equal to 80 mm., then the outer top end of the lever 202' must move along its arc at a speed which is five times the speed of movement of the conveyer means in order to properly locate the container on the conveyer means within the necessary period of time, this speed of movement of the lever 202' in relation to the speed of movement of the conveyer means being determined by dividing 400 by 80.

These factors will determine the size of the parts of the unit RA which will now be described.

Referring to FIGS. 24 and 28-33, it will be seen that the chain B which is driven from a suitable motor or the like so as to move the conveyor means meshes with a

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sprocket wheel 308. This meshing relationship between the sprocket wheel 308 and the chain B being shown in FIG. 27 as well as in FIGS. 24, 28 and 31. The sprocket wheel 308 is carried by a shaft 309 to which the sprocket wheel 308 is fixed, and this shaft 309 is turnable in a bearing 312 which is fixedly carried by a stationary channel member 311 which is fixed to and supported by the frame work of the machine. The shaft 309 extends downwardly through the bearing 312 and fixedly carries beneath this bearing a gear 310 which is thus coaxial with and turns with the sprocket wheel 308. Just above the gear 310 the channel member 311 fixedly carries a cam 329 (FIG. 33) which is stationary and which serves a purpose described below. The bottom end of the shaft 309 extends clearly into a sleeve 317 in which the shaft 309 freely turns, this sleeve 317 being coaxial with the shaft 309. Thus, FIGS. 24 and 39 show the bottom end portion 318 of the shaft 309 located within the sleeve 317.

The top end portion 316 of a shaft 314 also extends into the sleeve 317, and suitable set screws, pins 315 or the like serve to fix the shaft 314 at its end portion 316 to the sleeve 317 so that the sleeve 317 together with the shaft 314 are constrained to turn together while being maintained coaxial with the shaft 309. A bearing 313 is carried by the channel member 311 beneath and coaxially with the bearing 312, and the shaft 314 extends through the bearing 313 to be supported for turning movement by the latter, and at its bottom end portion the shaft 314 fixedly carries a sector-shaped member 328 at whose outer periphery is formed as a portion 330 of a V-pulley. The cable ZS is connected at one end to the sector 328 and is pivotally connected at its opposite end to the lever 202' at 304.

The sleeve 317 fixedly carries a pair of parallel plates 319 between which a motion transmitting member 321 is pivotally supported at 320, and this member 321 is in the shape of a bell crank and has an arm 322 extending to the right from the pivot 320, as viewed in FIG. 29. The plates 319 support the bottom end of a coil spring 323 whose top end engages the underside of the arm 322 so that this spring 323 urges the motion transmitting member 321 into engagement with the gear 310. The plates 319 are also provided with a pivot pin 325 which serves to pivotally support between the plates a catch member 324 whose top end hooks onto the arm 322 to prevent the spring 323 from turning the motion transmitting member 321 into engagement with the gear 10. A weight 326 is located at the bottom end of the lever 324 to urge the latter in a counterclockwise direction, as viewed in FIGS. 24 and 29.

Adjacent its top end, the catch member 324 is provided with an opening 327, and the armature of an electromagnet 303 has a hook-shaped end which extends into this opening 327 so that this armature of the electromagnet 303 is hooked onto the catch member 324.

When the contacts of the unit 301 of a carriage selected by the operator at a given work station engage the contacts of the unit 302 which have been moved into an operative position by the selection of the operator, then the electromagnet 303 will become energized so as to cause its armature to be pulled to the right, as viewed in FIG. 24, and the result is that the catch member 324 moves away from the arm 322 and the spring 323 turns the motion transmitting member 321 into engagement with the gear 310, so that in this way the sleeve 317 together with all of the structure fixed to and carried thereby is connected with the gear 310 for turning movement with the latter, this gear 310 turning with the gear 308, as described above. The gear 308 turns continuously, this gear being driven by the chain B of the conveyor means. Thus, in this way the energizing of the electromagnet 303 causes the shaft 314 to turn, and as a result the sector 328 will turn so that the cable ZS will pull on the lever 202' to move a container from a discharge area I onto the conveyor means, and the parts are so designed that, for ex-

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ample where the distance R_w is five times the dimension S_F , then the top end of the lever 202' will move at five times the rate of movement of the conveyor means, and thus the container will be properly located on the carrier.

As the sleeve 317 with all of its structure turns in the above-described manner after energizing of the electromagnet 303, the motion transmitting member 321 comes into engagement with the cam 329 shown in FIG. 33, and this cam 329 serves to automatically move the motion transmitting member 321 out of engagement with the gear 310 after the sector 328 has turned through the necessary angle which causes the lever 202' to be turned through a sufficient distance, and before this time the contacts of unit 301 have moved beyond the contacts of the unit 302, so that the electromagnet 303 is unenergized. Therefore, when the cam 329 turns the motion transmitting member 321 away from the gear 310, the arm 322 will move downwardly beyond and be hooked by the upper end of the catch member 324, and the parts will be maintained in their starting position. The weight of the lever 202' is sufficient to turn the sleeve 317 together with all of the structure fixed to and carried hereby back to its rest position after the cam 329 moves the motion transmitting member 321 out of engagement with the gear 310, and at the end of the turning movement of the catch member 324 about the axis of the gear 310 back to the starting position of the catch member 324, its opening 327 automatically receives the hook-shaped end of the armature of the electromagnet 303 so that the latter is in this way again automatically engaged with the catch member 324 for moving the latter away from the arm 322 when the electromagnet 303 is again energized. If desired a suitable spring may cooperate with the arm 202' to return the latter to its starting position shown in dotted lines in FIG. 24, in the event that the weight of the arm 202' is insufficient to return the parts to their starting position. The shape of the teeth of the gear 310 is shown in FIG. 30, while the outline of the cam 329 is shown in FIG. 33.

FIGS. 28 and 31 show a structure for maintaining the chain B in engagement with the gear 308. This structure includes the guide member KA having an elongated edge parallel to and located next to the chain B on the side thereof which is directed away from the gear 308. This guide member KA is fixedly carried by channel 311, so that with this arrangement the chain B cannot move away from the gear 308, and the latter is reliably turned by the moving chain. The guide member KA has a portion FLA which is directly connected with the channel 311, and this portion FLA is formed with an elongated slot LO which receives a screw member which fixed the guide member to the channel 311, so that with this arrangement the position of the guide member with respect to the chain B can be adjusted.

Electrical System

The electrical system of the structure of the invention is illustrated in FIGS. 20-23. One half of the signal board for the supervisor is illustrated in FIG. 20 for the work stations 16-30, the other half of the signal board for the work stations 1-15 being symmetrical and identical with the structure illustrated in FIG. 20. At each work station there are provided a pair of switches DK which are respectively located at the receiving area H and the discharge area I of each work station. These switches are located in the circuits of signal lamps SL which are mounted on the signal board, and a pair of these lamps are associated with each of the numerals 16-30 as shown in FIG. 20. Thus, whenever there is a container at one of the areas, which is to say the receiving or discharge areas, of the work stations, the corresponding signal lamps indicated in FIG. 20 will be illuminated so that the operator or supervisor of the entire system can tell by glancing at his signal board which receiving and discharge areas of the several work stations are occupied and which are unoccupied. The right hand portion of FIG. 21 also

shows the manner in which a signal lamp SL is located in the circuit with the switch member DK, and the right hand portion of FIG. 23 also shows the arrangement of the switches at a work station, the switches DK_H and DK_I shown in FIG. 23 being respectively located at the receiving area HA and the discharge area I of each work station so as to illuminate the lamps SL as indicated diagrammatically in FIG. 23 and as is shown for one half of the entire system in FIG. 20.

FIG. 23 shows at FW a unit 301 which moves with each carriage, and this unit includes in its circuit which is illustrated in FIG. 23 a rectifier Gr as well as a resistance R_5 and a load switch LK, and moreover the unit FW includes a pair of springy contact fingers which are adapted to cooperate with the contact of the several units 302 referred to above and shown in FIG. 24. One of these units is shown in FIG. 23 at KF_I , and another of these units 302 is shown at KF_{II} . Each of the latter units is provided with a set of contacts xk which cooperate with one of the springy fingers of the units FW and with another set of contacts bk which cooperate with the other of the springy contact fingers. FIG. 23 also shows a magnet M_2 which is the electromagnet 303 shown in FIG. 24 for actuating the device for moving a container from a discharge area to the conveyer, and FIG. 23 also shows the electromagnet M_1 which is the electromagnet P of FIGS. 5 and 7. In FIG. 23 are also shown several keys T of a selector device VE, these keys being actuated by the operator to close the switches selectively as shown at the left of FIG. 23, and one of these keys LT is a cancelling key, the several keys T being electrically connected with magnets TM shown in FIG. 23. Furthermore, there is shown in FIG. 23 a set of relays E, B, P, U, and H, as well as the positions I, II, and III of these relays, and FIG. 23 shows several additional resistors R and condensers C. The numerals in the boxes shown in FIG. 23 indicate the resistances of the coils of the electromagnets and relays. The darkened left end of the box of the relay H shown in FIG. 23 which contain the numeral 2000 indicates a relay which is capable of opening with substantially no delay. FIGS. 21 and 22 show the manner in which the switch DK at the receiving area of each work station is located in the circuit of the electromagnet P of FIGS. 5 and 7 for opening this circuit whenever there is a container already at the receiving area so that the cam actuating roller O cannot be moved to a position where it cooperates with the cam except when the receiving area H is unoccupied. This circuit to the electromagnet P of FIGS. 5 and 7 is also closed by cooperation of a contact of the unit 301 which moves with the carriage and a contact of the unit 302 located at each work station beneath the carriages.

The load switch LK of each carriage is actuated by a container carried by the carriage, such a container opening this switch, and it is only when the load switch LK is open that the circuit to the electromagnet P of FIGS. 5 and 7 can be closed.

Insofar as the movement of a container from a discharge area to the conveyer is concerned, four situations are possible, with reference to FIG. 23. Thus, the carrier which is selected by the operator of a given work station and which is the first to reach the work station may be empty so that it is capable of receiving the container from the discharge area of the work station from which the selection is made. In this case, where the first of the selected carriers which reaches the work station is empty, the load switch LK of the carrier is not actuated by a container so that the current flows through the rectifier Tr and the magnet M_2 , which is the magnet 303 of FIG. 24, becomes energized through the relay B and in this way the electrical piston operates to energize the electromagnet 303 at the particular work station and to cause the load to be delivered from the discharge area of this work station to the selected carrier, in the manner described above.

The second possible situation is that the first of the selected carriers which reaches the work station where the selection is made is already occupied by a container. In this case the load switch LK of this carrier is actuated by the container thereon so that the circuit is interrupted, and as a result the current which flows through the rectifier cooperates with the condensers C_1 and C_5 to supply these condensers so as to prevent the magnet TM which has been energized by depression of the selected key of the device DE from being deenergized, and this selected magnet remains energized until the second of the selected carriers reaches the work station.

Thus, there is a third situation where the second of the selected carriers reaches the work station, and if the second carrier is empty it will receive the container in the manner described above.

However, there is a fourth possible situation where the second carrier which reaches the work station also is occupied, so that the work cannot be discharged to either of the carrier selected by the operator. In this case the condensers C_1 and C_5 serve to energize the relay H which causes the selection of the next work station by the operator to be cancelled and automatically energizes the carriers 30 or 1 through the relay U, so that work which cannot be delivered to either of the carriers for the next selected work station are automatically delivered to one of the carriers 1₁, 1₂, 30₁, or 30₂ to be delivered by one of these carriers to the collection area J referred to above.

It should be noted that the material handling system of the invention is capable of working with any type of material, whether the material be separate workpieces, fabrics, leathers, plastics, or even liquids.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of material handling systems differing from the types described above.

While the invention has been illustrated and described as embodied in automatic material handling systems, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A material handling system comprising, in combination, a plurality of work stations located along a predetermined path; conveyer means extending along said path and including a plurality of carriers which move along said path which are adapted to carry containers, respectively, which hold material to be worked on at said stations, said conveyer means including for each work station at least two carriers separated from each other by carriers for other work stations so that the carriers for any one station are not located next to each other and said conveyor means including at least one additional carrier; a receiving area located at each work station for receiving a container from one of the carriers and at each work station a discharge area from which a container is delivered to a carrier of said conveyer means; an additional receiving area located at a part of said path for receiving from said conveyer means excess containers when all of said receiving areas at said work stations are occupied; and means cooperating with said discharge areas and said conveyer means for moving from the discharge area of one work station a container to a carrier for another work station which is to further oper-

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ate on the material worked on said one work station, when the carriers of said other work stations are unoccupied, for moving the container from said one discharge area to said additional carrier when the carriers for the next work stations are occupied, and for subsequently discharging the container moved onto said additional carrier onto said additional receiving area.

2. A material handling system comprising, in combination, a plurality of work stations located along a predetermined path; conveyer means extending along said path and including a first series of carriers for said work stations, respectively, which move along said path and a second series of carriers for said stations, respectively, which also move along said path and said second series following said first series, said carriers being adapted to respectively carry containers which hold material to be worked on at said stations and said conveyer means including only two carriers for each work station so that the two carriers for any one work station are separated from each other by the carriers for the other work stations and are not located next to each other; a receiving area located at each work station for receiving a container from one of the carriers of said conveyor means and at each work station a discharge area from which a container is delivered to a carrier of said conveyor means, said receiving and discharge areas being located between said conveyor means and said work stations; and means located at each work station for preventing movement of a container from the receiving area of each work station to the discharge area thereof when the latter is occupied and for automatically moving a container from the receiving area of each work station to the discharge area of each work station when the discharge area of each work station is unoccupied, the amount of material which is handled by the system at any given time being limited by the number of carriers of the said conveyor means and by said receiving and discharge carriers at said work stations.

3. A material handling system comprising, in combination, a plurality of work stations located along a predetermined path; conveyor means extending along said path and including a first series of carriers for said work stations, respectively, which move along said path and a second series of carriers for said stations, respectively, which also move along said path and said second series following said first series, said carriers being adapted to respectively carry containers which hold material to be worked on at said stations and said conveyor means including only two carriers for each work station so that the two carriers for any one work station are separated from each other by the carriers for the other work stations and are not located next to each other; a receiving area located at each work station for receiving a container from one of the carriers of said conveyor means and at each work station a discharge area from which a container is delivered to a carrier of said conveyor means, said receiving and discharge areas being located between said conveyor means and said work stations; and means at each work station for selecting another work station to which a container at the discharge area of the first mentioned work station has to be delivered and for automatically moving said container to the first empty carrier belonging to the selected other work station which passes said first mentioned work station.

4. A material handling system comprising, in combination, a plurality of work stations located along a predetermined endless path; conveyer means extending along said endless path and including a first series of carriers for said work stations, respectively, which move along said endless path and a second series of carriers for said work stations, respectively, which also move along said endless path, said second series being located after said first series and said conveyor means including only two carriers for each work station so that the carriers for any one work station are separated from each other

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by carriers for the other work stations and are not located next to each other, said conveyer means including an additional plurality of carriers; a receiving area located at each work station for receiving a container from one of the carriers for each work station and at each work station a discharge area from which a container is discharged to a carrier for another work station, said receiving and discharge areas being located between said conveyor means and said work stations; an additional receiving area located at part of said path for receiving from said additional plurality of carriers containers not delivered to the receiving areas of said work stations; means cooperating with said receiving areas and said conveyor means for moving from the carriers for said work stations containers to the receiving areas of said work stations, respectively, and for moving from said additional plurality of carriers to said additional receiving area containers not delivered to the receiving areas of said work stations; means cooperating with said discharge areas and said conveyor means for moving from the discharge area of one work station a container to a carrier for another work station which is to further operate on the material worked on at said one work station, when the carriers of said other work station are unoccupied, and for moving the container from said one discharge area to one of said additional plurality of carriers when the carriers for the next work station are occupied; and means at each work station for moving a container from the receiving area of each work station to the discharge area thereof when the latter discharge area is unoccupied, the amount of material handled by the system at any given time being limited by the number of carriers of said conveyor means and the number of receiving and discharge areas.

5. A material handling system comprising, in combination, a plurality of work stations located along a predetermined path; conveyor means extending along said path and including a first series of carriers for said work stations, respectively, which move along said path and a second series of carriers for said stations, respectively, which also move along said path and said second series following said first series, said carriers being adapted to respectively carry containers which hold material to be worked on at said stations and said conveyor means including only two carriers for each work station so that the two carriers for any one work station are separated from each other by the carriers for the other work stations and are not located next to each other; indicia carried by said carriers and said work stations for identifying the two carriers which belong to each work station; a receiving area located at each work station for receiving a container from one of the carriers; and at each work station a discharge area from which a container is delivered to one of said carriers of said conveyor means, the amount of material which is handled by the system at any given time being limited by the number of carriers of said conveyor means and by said receiving and discharge areas at said work stations.

6. A material handling system comprising, in combination, a plurality of work stations located along a predetermined endless path; continuously movable conveyor means extending along said path and including a first series of carriers for said work stations, respectively, which continuously move along said endless path and a second series of carriers for said work stations, respectively, which also move continuously along said path, said second series being located after said first series and said conveyor means including only two carriers for each work station; an endless inclined platform surrounding said conveyor means and located between the latter and said work stations, said platform having for each work station a receiving area for receiving a container from the carrier of a particular work station and a discharge area from which a container is delivered to a carrier for another work station, and said platform being interrupted

only by elongated slots extending parallel to said path from the receiving area of each work station to the discharge area thereof so that an element may move along said slot to move a container from the receiving area of each work station to the discharge area thereof and said platform also being interrupted by a plurality of slots extending from the discharge areas respectively toward said conveyer means so that an element may move along each slot of each discharge area to move a container from each discharge area to a carrier of said conveyer means, and said platform having an additional receiving area for receiving containers not delivered to the receiving area of any work station, the amount of material handled at any given time by the system being limited by the number of carriers of said conveyer means and by said receiving and discharge areas at said work stations; and selector means located at each work station for selecting the carrier of said conveyer means to which a container is to be delivered from the discharge area of each work station, said selector means being carried by an element which forms the lower limit of said platform.

7. In a material handling system, in combination, conveyer means movable along a predetermined path; a platform located beside said path and including a receiving area for receiving an article from said conveyer means and a discharge area located next to said receiving area and from which an article is discharged from the platform to said conveyer means, said platform being formed with an elongated slot extending substantially parallel to said path from said receiving area of said platform to said discharge area thereof; a driven member located along said path adjacent said platform; first guide means guiding said driven member for movement along said path; a driving member carried by said conveyer means for movement therewith, said driven member being located in the path of movement of said driving member to be engaged by the latter and moved thereby along said first guide means; a pusher member extending through said slot for pushing an article from said receiving to said discharge area of said platform; second guide means cooperating with said pusher member for guiding the same for movement along said slot from said receiving area of said platform toward said discharge area thereof; and motion transmitting means connected to said driven member and said pusher member for transmitting movement of said driven member to said pusher member so that when said driving member engages and moves said driven member said pusher member will be moved along said slot to move an article from said receiving to said discharge area of said platform.

8. In a material handling system, in combination, conveyer means movable along a predetermined path; a platform located beside said path and including a receiving area for receiving an article from said conveyer means and a discharge area located next to said receiving area and from which an article is discharged from the platform to said conveyer means, said platform being formed with an elongated slot extending substantially parallel to said path from said receiving area of said platform to said discharge area thereof; a driven member located along said path adjacent said platform; first guide means guiding said driven member for movement along said path; a driving member carried by said conveyer means for movement therewith, said driven member being located in the path of movement of said driving member to be engaged by the latter and moved thereby along said first guide means; a pusher member extending through said slot for pushing an article from said receiving to said discharge area of said platform; second guide means cooperating with said pusher member for guiding the same for movement along said slot from said receiving area of said platform toward said discharge area thereof; and motion transmitting means connected to said driven member and said pusher member for transmitting movement of said driven member to said pusher member

so that when said driving member engages and moves said driven member said pusher member will be moved along said slot to move an article from said receiving to said discharge area of said platform, said motion transmitting means including an elongated flexible member connected at one end to said driven member and at an opposite end to said pusher member and a plurality of pulleys over which said flexible member is guided.

9. In a material handling system, in combination, conveyer means movable along a predetermined path; a platform located beside said path and including a receiving area for receiving an article from said conveyer means and a discharge area located next to said receiving area and from which an article is discharged from the platform to said conveyer means, said platform being formed with an elongated slot extending substantially parallel to said path from said receiving area of said platform to said discharge area thereof; a driven member located along said path adjacent said platform; first guide means guiding said driven member for movement along said path; a driving member carried by said conveyer means for movement therewith, said driven member being located in the path of movement of said driving member to be engaged by the latter and moved thereby along said first guide means; a pusher member extending through said slot for pushing an article from said receiving to said discharge area of said platform; second guide means cooperating with said pusher member for guiding the same for movement along said slot from said receiving area of said platform toward said discharge area thereof; motion transmitting means connected to said driven member and said pusher member for transmitting movement of said driven member to said pusher member so that when said driving member engages and moves said driven member said pusher member will be moved along said slot to move an article from said receiving to said discharge area of said platform; and means cooperating with said driven member for moving the latter out of engagement with said driving member when said pusher member has moved along said slot through a distance sufficient to locate an article at said discharge area of said platform.

10. In a material handling system, in combination, conveyer means movable along a predetermined path; a platform located beside said path and including a receiving area for receiving an article from said conveyer means and a discharge area located next to said receiving area and from which an article is discharged from the platform to said conveyer means, said platform being formed with an elongated slot extending substantially parallel to said path from said receiving area of said platform to said discharge area thereof; a driven member located along said path adjacent said platform; first guide means guiding said driven member for movement along said path; a driving member carried by said conveyer means for movement therewith, said driven member being located in the path of movement of said driving member to be engaged by the latter and moved thereby along said first guide means; a pusher member extending through said slot for pushing an article from said receiving to said discharge area of said platform; second guide means cooperating with said pusher member for guiding the same for movement along said slot from said receiving area of said platform toward said discharge area thereof; motion transmitting means connected to said driven member and said pusher member for transmitting movement of said driven member to said pusher member so that when said driving member engages and moves said driven member said pusher member will be moved along said slot to move an article from said receiving to said discharge area of said platform; and means cooperating with said driven member for moving the latter out of engagement with said driving member when said pusher member has moved along said slot through a distance sufficient to locate an article at

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said discharge area of said platform, said means which cooperates with said driven member for moving the latter out of engagement with said driving member including a contact member located on said platform at said discharge area thereof and engaged by an article moved to said discharge area so as to be moved in a predetermined direction by the article, and a linkage interconnecting said contact member with said driven member for moving said driven member out of engagement with said driving member when said contact member is moved through a predetermined distance by an article pushed by said pusher member from said receiving area to said discharge area of said platform.

11. In a material handling system, in combination, conveyer means move along a predetermined path; a platform located beside said path and including a receiving area for receiving an article from said conveyer means and next to said receiving area a discharge area from which an article may be moved from the platform to said conveyer means, said platform being formed at said discharge area thereof with an elongated slot extending toward said conveyer means; a moving member movably carried by said platform and extending through said slot for movement therealong towards said conveyor means so as to move an article from said platform to said conveyer means; and moving means cooperating with said moving member for moving the same along said slot toward said conveyer means.

12. In a material handling system, in combination, conveyer means move along a predetermined path; a platform located beside said path and including a receiving area for receiving an article from said conveyer means and a discharge area located next to said receiving area and from which an article may be moved from the platform back to said conveyer means, said platform being formed at said discharge area thereof with an elongated slot extending toward said conveyer means; a moving member extending through said slot and turnably supported by said platform for turning movement about an axis which extends substantially parallel to the path of movement of said conveyer means, said turning member being turnable along said slot for moving an article from said discharge area of said platform to said conveyer means; and hydraulic moving means cooperating with said moving member for acting on the same to move the latter along said slot so as to move an article from said discharge area to said conveyer means.

13. In a material handling system, in combination, conveyer means movable along a predetermined path and including a sprocket chain which moves along said path; a platform located adjacent said conveyer means for holding an article to be delivered to said conveyer means to be moved thereby; a sprocket wheel meshing with said chain to be driven by the latter; a gear fixed coaxially to said sprocket wheel for turning movement therewith; a moving member supported coaxially with said gear and sprocket wheel for free turning movement about the common axis of said gear, sprocket wheel, and moving member; a motion transmitting element carried by said moving member for turning movement therewith and supported by said moving member for movement to and from a position engaged with said gear for transmitting turning movement of said gear to said moving member when said motion transmitting member is engaged with said gear; spring means cooperating with said motion transmitting member for urging the same to a position engaged with said gear; a catch member carried by said moving member and cooperating with said motion transmitting member for holding the latter in an inactive position out of engagement with said gear; electro magnetic means cooperating with said catch member for moving the latter away from said motion transmitting member to release the latter to said spring means for movement to a position engaged with

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said gear, so that when said electro magnetic means is energized a drive will be transmitted from said sprocket wheel to said moving member; and means cooperating with said moving member to be actuated thereby for shifting an article on said platform to said conveyer means when said moving member turns.

14. In a material handling system, in combination, conveyer means movable along a predetermined path and including a sprocket chain which moves along said path; a platform located adjacent said conveyer means for holding an article to be delivered to said conveyer means to be moved thereby; a sprocket wheel meshing with said chain to be driven by the latter; a gear fixed coaxially to said sprocket wheel for turning movement therewith; a moving member supported coaxially with said gear and sprocket wheel for free turning movement about the common axis of said gear, sprocket wheel, and moving member; a motion transmitting element carried by said moving member for turning movement therewith and supported by said moving member for movement to and from a position engaged with said gear for transmitting turning movement of said gear to said moving member when said motion transmitting member is engaged with said gear; spring means cooperating with said motion transmitting member for urging the same to a position engaged with said gear; a catch member carried by said moving member and cooperating with said motion transmitting member for holding the latter in an inactive position out of engagement with said gear; electro magnetic means cooperating with said catch member for moving the latter away from said motion transmitting member to release the latter to said spring means for movement to a position engaged with said gear, so that when said electro magnetic means is energized a drive will be transmitted from said sprocket wheel to said moving member; means cooperating with said moving member to be actuated thereby for shifting an article on said platform to said conveyer means when said moving member turns; and a stationary cam located in the path of turning movement of said motion transmitting member for moving the latter out of engagement with said gear after said moving member turns through a predetermined angle.

15. In a material handling system, in combination, conveyer means movable along a predetermined path and including a sprocket chain which moves along said path; a platform located adjacent said conveyer means for holding an article to be delivered to said conveyer means to be moved thereby; a sprocket wheel meshing with said chain to be driven by the latter; a gear fixed coaxially to said sprocket wheel for turning movement therewith; a moving member supported coaxially with said gear and sprocket wheel for free turning movement about the common axis of said gear, sprocket wheel, and moving member; a motion transmitting element carried by said moving member for turning movement therewith and supported by said moving member for movement to and from a position engaged with said gear for transmitting turning movement of said gear to said moving member when said motion transmitting member is engaged with said gear; spring means cooperating with said motion transmitting member for urging the same to a position engaged with said gear; a catch member carried by said moving member and cooperating with said motion transmitting member for holding the latter in an inactive position out of engagement with said gear; electro magnetic means cooperating with said catch member for moving the latter away from said motion transmitting member to release the latter to said spring means for movement to a position engaged with said gear, so that when said electro magnetic means is energized a drive will be transmitted from said sprocket wheel to said moving member; and means cooperating with said moving member to be actuated thereby for shifting an article on said platform to said conveyer means when said moving

member turns, said means cooperating with said moving member including a lever supported adjacent said platform for tilting movement and being moveable with respect to said platform toward said conveyer means for engaging an article on said platform and moving the same to said conveyer means, and a cable interconnecting said lever with said moving member to turn said lever toward said conveyer means when said moving member turns upon energizing of said electro magnetic means.

16. In a material handling system, in combination, conveyer means movable along a predetermined path and including a plurality of carriages and a plurality of plates respectively carried by said carriages and each having a predetermined length in the direction of movement of said conveyer means, each plate having at its opposite ends a pair of wedge-shaped portions, respectively; and a platform located beside said conveyer means to support an article for movement in a direction transverse to the direction of movement of said conveyer means onto one of said plates thereof, the wedge-shaped portions at the ends of each plate guiding an article during its movement onto the plate, said wedge-shaped portions having together a total length in the direction of movement of said conveyer means which is equal to at least one tenth of the entire length of said plate in the direction of movement of said conveyer means.

17. In a material handling system, in combination, conveyer means movable along a predetermined path for conveying articles along said path, said conveyer means including a sprocket chain which also moves along said path; a sprocket wheel cooperating with said sprocket chain to be turned thereby; means cooperating with said sprocket wheel for moving an article onto said conveyer

means; and means cooperating with said chain for maintaining the latter in engagement with said sprocket wheel.

18. In a material handling system, in combination, conveyer means movable along a predetermined path for conveying articles along said path, said conveyer means including a sprocket chain which also moves along said path; a sprocket wheel cooperating with said sprocket chain to be turned thereby; means cooperating with said sprocket wheel for moving an article onto said conveyer means; means cooperating with said chain for maintaining the latter in engagement with said sprocket wheel, said means which cooperates with said sprocket chain for maintaining the latter in engagement with said sprocket wheel being in the form of an elongated guide along which said sprocket chain moves and which prevents said chain from moving out of engagement with said sprocket wheel; and support means adjustably supporting said guide member so that the position of the latter with respect to said chain may be adjusted.

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