United States Patent

Reist

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[54] CONVEYOR APPARATUS

[72] Inventor: **Walter Reist,** Hinwil, Zurich, Switzerland

[73] Assignee: **Ferag AG,** Zurich, Switzerland

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Related U.S. Application Data

[63] Continuation of Ser. No. 745,596, July 17, 1968, abandoned.

[30] **Foreign Application Priority Data**

July 21, 1967 Switzerland 10389/67

[52] **U.S. Cl.** **271/76,** 271/79

[51] **Int. Cl.** **B65h 29/12,** B65h 29/28

[58] **Field of Search** 271/45, 63, 75–76, 271/79

[56] **References Cited**

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Primary Examiner—Edward A. Sroka

Attorney—Waters, Roditi, Schwartz & Nissen

[57] **ABSTRACT**

Conveyor apparatus for transporting an imbricated formation of objects, such as a succession of folded newspapers, comprises a conveyor track adjoining the trailing edges of the newspapers, and pairs of grippers moving along the conveyor track and gripping the trailing edges of the newspapers. A distribution or device is disposed ahead of the conveyor track to provide the intervals between successive newspapers of the imbricated formation so that the distance between successive trailing edges of the newspapers corresponds to a predetermined value.

12 Claims, 10 Drawing Figures

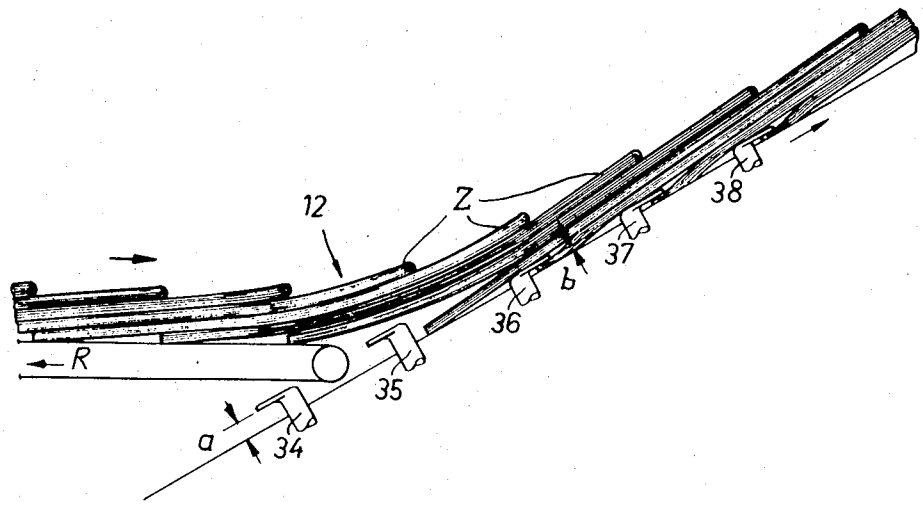
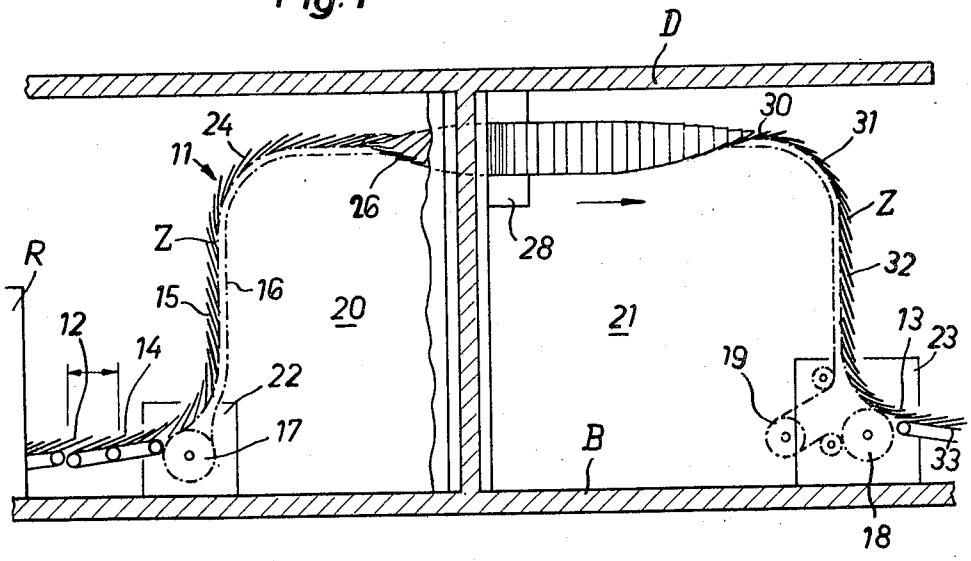


Fig. 1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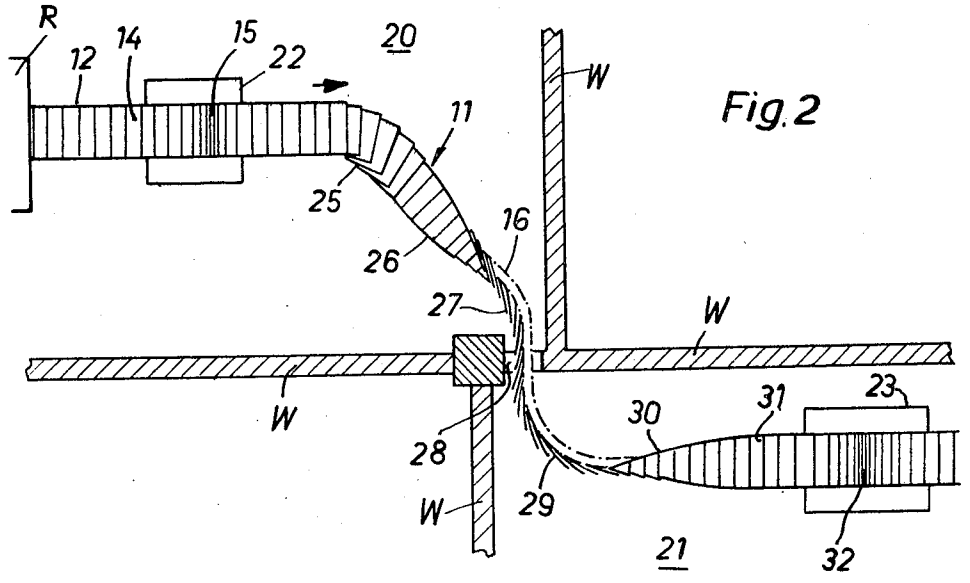
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Fig. 2

Fig.3

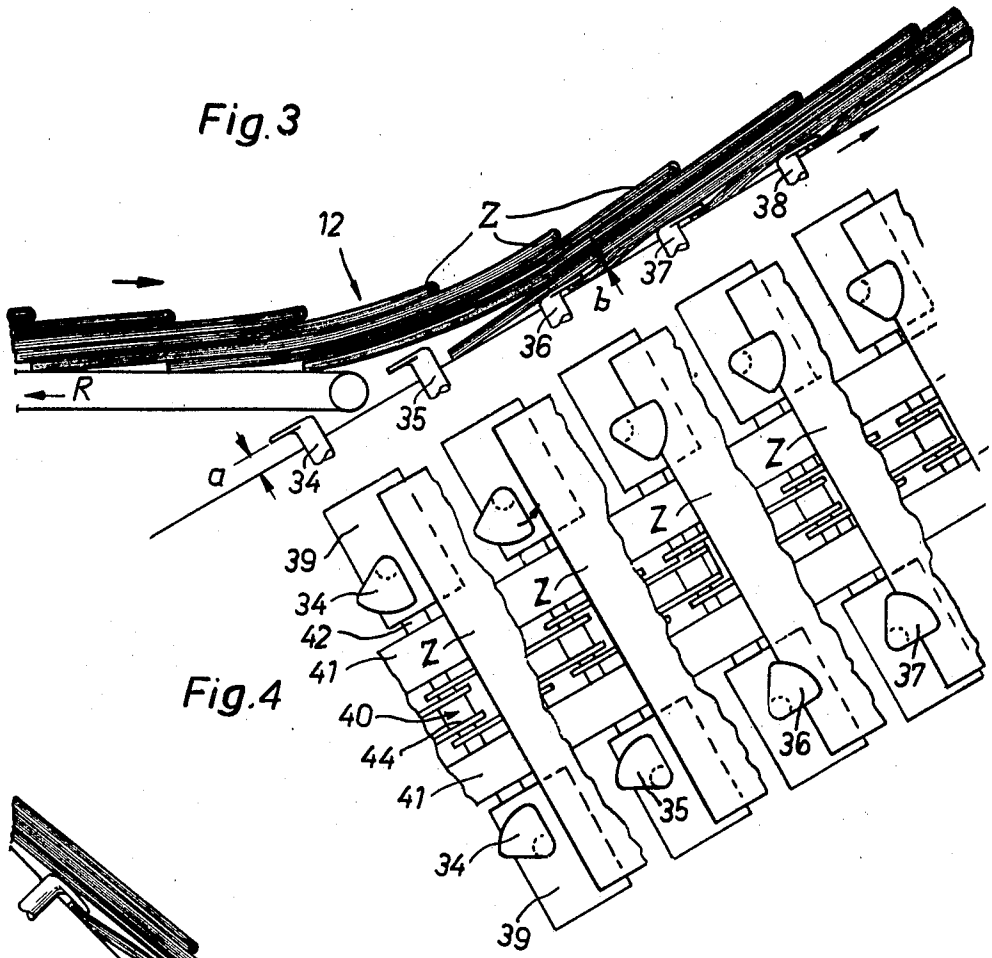


Fig.4

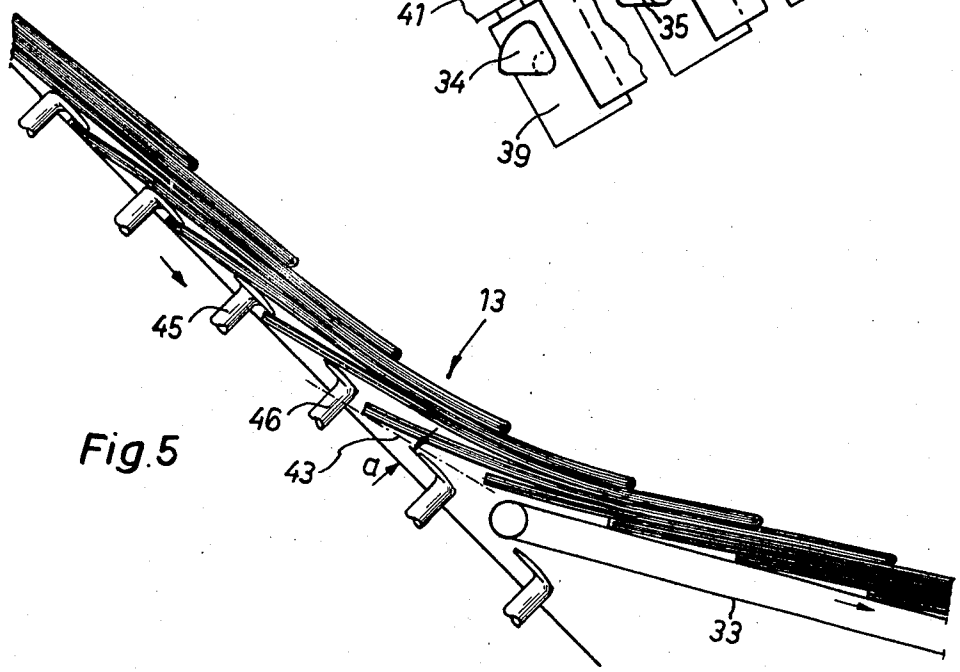


Fig.5

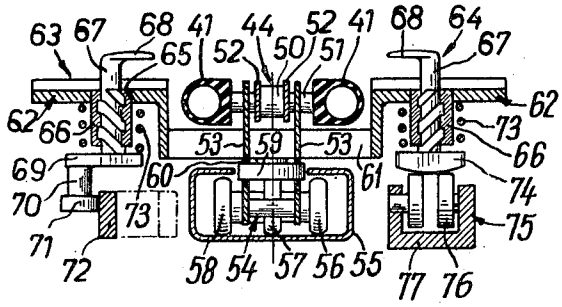


Fig. 7

Fig. 6

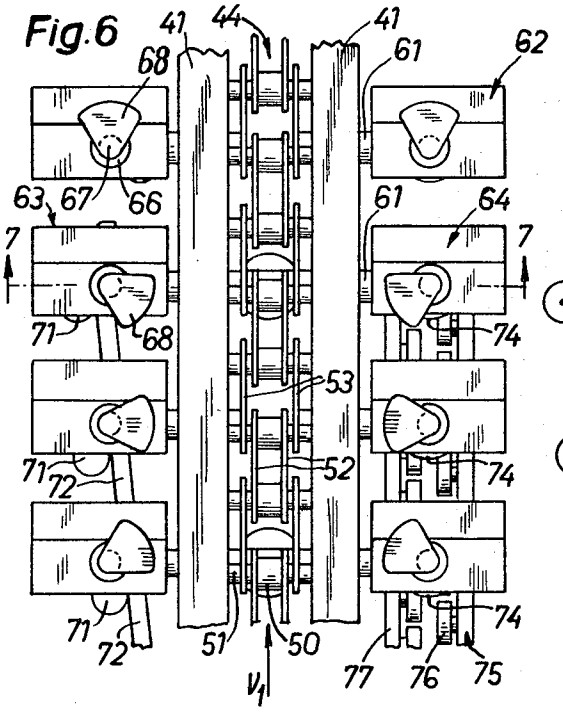


Fig. 8

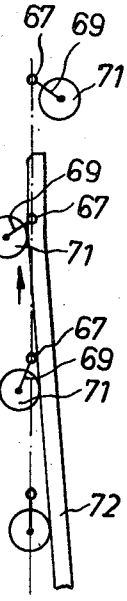


Fig. 9

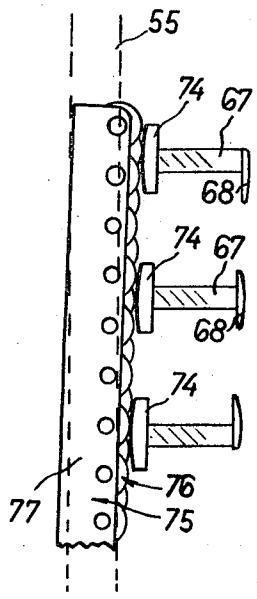
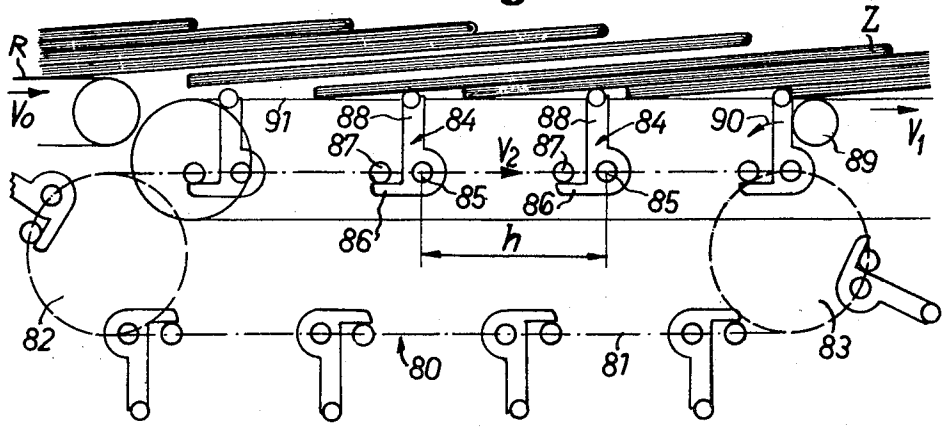


Fig. 10



CONVEYOR APPARATUS

This application is a continuation of Ser. No. 745,596, filed July 17, 1968, now abandoned.

The present invention relates to conveyer apparatus for transporting laminar or flat objects arriving in imbricated formation, particularly for folded printing shop products, and having a conveyer track adjoining the succession of trailing edges of the laminar objects, and a number of endless travelling grippers.

In known conveyer apparatus of the mentioned kind, the grippers are associated with the conveyer track in such manner that they engage the two side edges of the objects, i.e., the two sides of the imbricated formation to clamp the latter for transportation to a kind of continuous ribbon which travels together with the conveyer track. This known conveyer apparatus, however, is dependent on the size of the conveyed objects, i.e., the distance between the grippers engaging both sides must be closely adapted to the width of the objects.

For avoiding this drawback, a further conveyer apparatus has become known, the grippers of which only engage one lateral edge of the objects of the imbricated formation. This further conveyer apparatus is no longer dependent on size, but is suitable only for transporting relatively stiff objects. It has been proposed in this connection, to modify this further known conveyer apparatus in such manner that the grippers not only seize one side edge of the objects or the side edge of the imbricated formation, but at the same time produce a buckling of the objects at the gripping points extending transversely to the conveying direction, i.e., a crease-shaped fold and thereby impart to the objects the stiffness required for transportation. This means, however, is only applicable there where the objects to be conveyed may support a buckling or fold, or where the traces of the action of force required for buckling of the objects left on the surface of the goods to be conveyed, can be tolerated.

Moreover, both of the mentioned known conveyer apparatus do not admit complete freedom in the path of the conveyer track. In other words, it is not possible, without else, to build-in any curvatures into the path described by the known conveying apparatus, without relative movements resulting between the grippers on the one hand and the conveying goods on the other hand, which again may lead to damaging the conveying goods, e.g., to smearing the print in the case of printed products.

In addition, at the discharge end of the two known conveyer apparatus, problems result upon the transfer of the goods to be conveyed, inasmuch as the imbricated formation practically can be transferred only in a substantially horizontal plane to a treating station following the conveyer apparatus. A further difficulty with the mentioned known conveyer apparatus is that the grippers may have to grip varying thicknesses, i.e., according to the compactness of the imbricated formation and according to the place of gripping at the side edge of the imbricated formation.

It is an object of the invention to provide a conveyer apparatus which substantially avoids or obviates the mentioned drawbacks and difficulties.

In the conveyer apparatus according to the invention, at least a portion of the travelling path of the grippers directly adjoins the conveyer track and means are provided for moving the grippers, in a region of said travelling path thereof, in the conveying direction relative to the conveyer track to cause the grippers to grip the trailing edges of the laminar objects.

In the conveyer apparatus according to the invention, the grippers accordingly are associated with the trailing edges of the objects and "push" so to speak the latter ahead in conveying direction, the side edges and the leading edge of the products remaining free.

Conveniently, the grippers are arranged symmetrically, e.g., in pairs at both sides of an endless travelling conveyer member which coincides with the conveyer track by one of its lengths. Further, the grippers advantageously are arranged at regular spaces longitudinally of the conveyer member, which conveyer member can be a chain guided within a tubular rail.

The grippers can comprise a jaw which is fixed relatively to the conveyer member, as well as a jaw which is movable relatively to the conveyer member and cooperating with the fixed jaw, the movement of the movable jaw conveniently being helical, in such manner that when the gripper is open the fixed jaw is completely and freely accessible and the movable jaw is turned away from the fixed one, while the closing of the gripper is effected by a simultaneous inward pivoting movement and displacement of the movable jaw towards the fixed jaw. At the entrance of the conveyer apparatus a distribution member can be provided, so that upon arrival of an imbricated succession with an irregular compactness, this imbricated succession can be arranged such that the intervals between successive objects of the imbricated formation correspond to a predetermined value or a whole multiple of this value.

An example of execution of conveyer apparatus according to the invention is illustrated in the accompanying drawings, in which:

FIGS. **1** and **2** show in elevation and in section, respectively, the course of a conveyer track of the apparatus according to the invention in a building,

FIGS. **3** and **4** represent in diagrammatic side view and in diagrammatic plan view, respectively, a portion of the entrance section of the conveyer apparatus,

FIG. **5** is a diagrammatic side view of the discharge section of the conveyer apparatus,

FIG. **6** shows in diagrammatic plan view a portion of the non loaded conveyer apparatus, two different gripper actuating means being represented on the left hand and the right hand side, respectively, of the figure,

FIG. **7** is a section along the line **7—7** of FIG. **6**,

FIG. **8** represents diagrammatically in plan view the operation of the actuating means of the grippers shown in FIG. **6** at the left hand side,

FIG. **9** represents diagrammatically in side view the operation of the actuating means of the grippers shown in FIG. **6** at the right hand side,

FIG. **10** is a diagrammatic side view of a distribution or cadence member at the entrance section of the conveyer apparatus.

The conveyer apparatus **11** in FIGS. **1** and **2** has an inlet section **12** with a distribution member **14** which will be described later, and the conveyer apparatus **11** terminates at a discharge section **13**.

The conveyed material in imbricated formation, in the present case newspapers Z, arriving from a rotary printing press R into a room **20**, is supplied to a feeding device **33** of a further treating station of the production line in another room **21** along a path providing as much free space as possible on the floor B.

This path is described by the portion of the conveyer apparatus following the distribution member **14** and first is directed vertically upwards in a section **15**, then continues horizontally via a section **24** bent about a horizontal axis. Afterwards the conveyer path describes a right turn **25** about a vertical axis. After the turn **25**, the imbricated formation is twisted in a section **26** about an axis situated in the conveying direction and then travels in a horizontal section **27**, with the imbricated formation vertically situated imbricated formation, through an opening **28** in a wall W between the rooms **20** and **21**, whereafter the imbricated formation in a further section **30** is twisted back and then, after a curved section **31**, it travels vertically downwards in a section **32** prior to reaching the discharge section **13**.

This total path also is described by an endless travelling conveyer member **16** only indicated diagrammatically, at least by one of its strands, preferably, however, by both strands. In the region of the inlet section **12** and in the region of the discharge section **13**, deflection members for the conveyer member **16**, e.g., rolls **17** and **18** are provided which are rotatably mounted in corresponding frames or casings **22** and **23**, respectively. The drive of the conveyer member **16** is effected in conventional manner and is indicated herein diagrammatically only by a motor driven pulley **19** near the casing **23**.

It results from this arrangement, that the conveyer path of the represented conveyer apparatus can be designed with practically any desired curves, twists and bends, the relative movements between the objects, in the present case newspapers, and the grippers, as well as the relative movements between successive objects remain limited to a minimum rate and accordingly also the risk of damaging the objects during transport.

Referring to FIGS. 3 to 5 the receiving and the delivery of the imbricated succession at the inlet section 12, and at the discharge section 13, respectively, of the conveyer apparatus shall now be described.

FIG. 4 represents a portion of an endless conveyer member 40, consisting of a link chain 44, a flexible follower member 41 being attached to both sides thereof to hold the newspapers Z in spaced relation on the link chain 44. The construction of the conveyer member 40 is described in detail with reference to FIGS. 6 and 7.

It is seen in FIG. 4 that pairs of grippers are provided on both sides of the conveyer member 40, for movement with the conveyer member. The movable jaws of each of the pairs of grippers are designated by numerals 34, 35, 36, 37 and 38, and numeral 39 designates the jaws which are fixed with respect to the conveyer member 40 and are associated with the movable jaws 34.

In the construction shown in FIGS. 3 and 4, when the grippers are open, the movable jaws 34 and 35 are raised above the fixed jaws by a distance *a* and face rearwardly with respect the conveying direction. When the grippers are closed, the movable jaws 36, 37, 38 are closer to the fixed jaw and are spaced there from FIG. *b* which corresponds to the thickness of the gripped newspaper and are forwardly turned with respect in the conveying direction, whereby the newspaper is clamped at its trailing edge.

It is further seen in FIGS. 3 and 4 that the movable jaws 33 to 38 essentially consist of a circular sector-shaped flap which is fixed to a cylindrical shank at the center of the circular sector, extending at right angles to the flap.

As long as the gripper is open, the shank of the movable jaw first can act as a driver which moves upon the trailing edge of an adjacent newspaper situated in front of it as seen in the conveying direction, whereafter the flap turns forwardly and is urged towards the fixed jaw to clamp this edge.

This operation is effected in reverse order upon delivery at the discharge section 13 represented in FIG. 5. In FIG. 5, as seen from the left to the right, there are visible two not identified grippers in closed position, a gripper 45 ready to open, and three grippers (the first one being designated by 46) in open position, i.e., raised by the distance *a* and having the jaws turned rearwardly.

The transfer to the following conveyer belt 33, see also FIG. 1, is assisted by a stationary guide member 43, e.g., a guide rail or a guide plate (indicated diagrammatically in FIG. 5). The transfer, however, can also be effected without the help of a guiding member. It suffices to direct the path of the conveyer member, at the place where the grippers have returned to open position, i.e., in FIG. 5 at the raised position of the gripper 46 from the imbricated formation. The result thereof is that the objects reaching the discharge end of the conveyer apparatus, project freely beyond this discharge end and can be picked up from underneath by the beginning of the following conveyer device 33.

In FIGS. 6 and 7 the construction of the conveyer apparatus is illustrated in more detail.

In these figures, the links of the link chain 44 carry rolls 50, which are mounted on roll pins 51 projecting from the rolls 50 on both sides therefore. The roll pins 51 are uniformly spaced and hingedly connected to each other in conventional manner, alternately by means of inner link pairs 52 and outer link pairs 53. The roll pins 51 extend through the links, and both of their ends engage an endless flexible member 41, formed, for example, as a profiled tube of rubber moving with the chain, the purpose of which consists in not letting the conveyed material make contact with the link chain 44, in order to avoid possible interference therewith. As shown in FIG. 7, the links 53 of the outer link pairs are disposed in a plane at right angles to the roll pins 51 on the lower side of the chain and form carrier flanges for the guide members of the chain and the components of the grippers.

The guide members of the chain 44 consist of a carriage 54 travelling in a stationary tubular rail of substantially C-shaped cross section.

This carriage is attached to the lower end of the outer links 53 and comprises three rolls 56, 57 and 58 which are rotatably mounted on the carrier flanges about axes extending parallel to the roll pins 51, and the rolls 56, 57, and 58 travel inside the tubular rail 55. In order to laterally guide this carriage a fourth roll 59 is provided, extending through slits 60 in the links and adapted to travel with clearance along the terminal edges of the bent-over wings of the C-shaped tubular rail 55. The three-point contact of the carriage 54 within the rail 55 is to be noted, which allows travel of the conveyer member without vibration and accordingly without noise even then when its rail and accordingly its path describes a twist as in the sections 26 and 30 of the conveyer track.

In the middle region of the outer links 53 and extending through these latter are supporting arms 61 which are secured to the links 53 and carry L-shaped brackets 62. One of the wings of the bracket 62 is fixed to the link 53 and the other wing forms the table-like fixed jaw of the gripper.

As seen in FIG. 7, one gripper is provided at each side of the chain 44. For simplifying the drawing, however, one kind of gripper 63 is illustrated in FIG. 7 on the left hand side, and another kind of gripper 64 on the right hand side. It will be understood that in the practical embodiment of the conveyer apparatus, similar grippers will be provided on both sides of the chains, e.g., such as indicated at 63 or such as indicated at 64.

Referring to FIGS. 6,7 and 8, the gripper 63, as already mentioned, is carried on the laterally projecting wing of the bracket 62. This wing is formed with a bore 65 in which a threaded sleeve 66 is secured in suitable manner. The threaded sleeve is provided with a female screw thread of coarse pitch, in the present example, a double square thread. The shank 67 of the movable jaw of the gripper 63 is screwed into this thread. The circular segment-shaped flap 68 is secured to the upper end of the shank 67, while an arm 69 is fixed to the lower end of the shank 67, a follower roll 71 being rotatably mounted about an axis extending parallel to the shank 67 at the free end of the arm by means of a connecting pin 70. This follower roll is adopted to cooperate with a stationary guide 72 disposed at the level of the rail (see also FIGS. 6 and 8). A compression spring 73 acts between the bottom side of the laterally projecting wing of the bracket 62 and the arm 69, in order to urge the shank normally into its lowermost position. In this position also the angular position of the arm 69 is defined owing to the action of the thread.

Now, when the follower roll 71, upon movement of the conveyer member in the direction of the arrow in FIG. 8, arrives against the stationary guide 72, the arm 69 together with the shank 67 and the flap 68 are pivoted in opposition to the spring 73, i.e., the flap 68 arrives into its lifted and turned-back open position. Inversely, when the follower roll 71 does not engage the guide 72, the spring 73 urges the shank into its lowermost position, the flap at the same time being turned forwardly into closing position.

Thus, in case of the gripper 63, the guide 72 directly causes a rotation of the shank 67, and the square thread, due to this rotation produces a lifting of the shank 67, whereas the element corresponding to the guide 72, in the case of the gripper 64, directly causes the raising of the shank and accordingly the thread causes its rotation.

As shown in FIG. 7 the gripper 64 is constructed similar to the gripper 63. This gripper again comprises the flap 68, the shank 67 with the double square thread, the threaded sleeve 66 and the spring 73. Instead of the arm 69, the shank 67 is provided with a sliding pad 74 having the shape of a planoconvex lens (FIGS. 7, 9) and being fixed by its plane side to the

lower end face of the shank **67**. This sliding pad **74** is adopted to cooperate with a roll track **75**, the path of which is inclined relative to the path of the rail **69**, as seen in FIG. **9**. It is to be noted, when comparing FIGS. **8** and **9**, that FIG. **8** is a plan view, whereas FIG. **9** is a side elevation. While the guide **72** (when the rail **55** is horizontal) is situated in a horizontal plane parallel to the path of the rail, the roll path **75** is situated in a plane parallel and at right angles to the path of the rail (see also FIG. **6**).

The rolls **76** of the roll track **75** are staggered in longitudinal direction within a U-shaped support **77**, in order to afford a travel of the sliding pads **74** as much as possible without vibrations and shocks.

In FIG. **10** the already mentioned distribution and member is illustrated. The conveyer belt arriving from the printing press R is driven in the direction of the arrow at the speed v_o, the imbricated formation being transported thereby. Following this conveyer belt a further belt conveyer driven with a speed v_1 comprising a plurality of individual, parallel conveyer belts **91**. This belt conveyer is associated with a driver device **80**. The driver device **80** comprises an endless chain **81** driven by two chain wheels **62** and **83** at a speed v_2. Drivers **84** in the form of bell crank levers are fixed to the chain **81** at uniform longitudinal intervals and each is hingedly mounted at its angle vertex for rotation about a pin **85** against the action of a spring (not shown), the pin being fixed to and travelling with the chain. One of the legs **86** of the bell crank levers **84** is trailing with respect to the travelling direction of the chain **81** and normally abuts against a stop **87** also travelling with the chain, while the other leg **88** extends at right angles to the direction of movement of the chain **81** and the end of outwardly of this latter, and one strand of the chain **81** penetrates between the individual conveyer belts of the belt conveyer driven with the speed v_1.

A stationary stop member **89** is provided in proximity of the chain wheel **83**, and is adapted to rearwardly collapse the driver members **84** abutting against it, in the direction of the arrow **90** and thereby to swing the ends of the legs **88** downwardly to face in a direction opposite the conveying direction v_1 and opposite the direction of travel of the chain **81** and out of reach of the conveyer belts **91**. In operation, v_2 is greater than v_1, while v_1 is at least equal to v_o.

This means that the travelling speed of the chain **81** and accordingly of the driver members **84** in any case is greater than the conveying speed of the imbricated formation formed by the newspapers Z. It results therefrom, that the ends of the legs **88** penetrating between the conveyer belts **91** as a rule catch up with a trailing edge of a respective one of the newspapers, abut against this latter and push the corresponding newspapers forwardly through a certain amount until the distance from the preceding newspaper is exactly the same as the distance h between two successive driver members **84**, which is greater than the distance between two successive gripper pairs of the following portion of he conveyer apparatus **11** (FIG. **1**).

Since now v_2 is greater than v_o and v_1 and the uniformity of the imbricated formation arriving at the speed v_o is not established with certainty, it may happen from time to time, that one or the other of the driver members **84**, when travelling along its engaging path, will remain "empty," i.e., will not run up against a trailing edge. In such cases the distance between two successive newspapers on the conveyer belt **91** driven at the speed v_1 will be double than normal. This, however, is without importance, since, as already mentioned, the distance h is as uniform as is the distance between the following grippers of the conveyer apparatus. In this manner, even when in the imbricated succession to be conveyed, a "gap" has been formed by the distribution and device **14**, which gap has a distance twice the normal distance between successive newspapers, it is assured that the imbricated succession arrives in correct "frequency" and "phase" on the section of the conveyer apparatus provided with grippers. This means that owing to the action of the distribution member **14**, a pair of grippers of the conveyer apparatus will be available for each single object of the imbricated formation at the right moment and at the right place, while, inversely, one of the gripper pairs from time to time will be "empty."

It will be understood that the speed v_1 of the conveyer belts **91** and accordingly of the conveyer chain **44** with the grippers must be so chosen that the number of grippers becoming available per unit of time corresponds at least to the peak value of the "compactness" of the imbricated formation arriving at the speed v_o.

The represented conveyer apparatus, besides the advantages of a simple construction and of the greatest possible liberty in the design of the conveyer path, offers the possibility that the conveyed imbricated succession is regular in the sense that the distance between successive objects always corresponds to a constant value or to a whole multiple of this value. Further, the illustrated conveyer apparatus, besides the general advantage of the particular absence of any problems at the end of the conveyer path, offers the possibility, owing to the regularity of the conveyed imbricated formation, to serve directly as a supply device for a successive treating station.

Moreover, the use of the illustrated distribution and member is not absolutely limited to the represented conveyer apparatus.

It can rather be used in all those cases, where it is required to arrange a travelling imbricated formation of articles arriving without a regular frequency of the articles, in such a manner that the spacing of the individual articles always corresponds to a fixed value or to a whole multiple of this value. This can also be the case for an imbricated formation freely transported on a conveyer belt and directly supplied to a treating station which depends on receiving an imbricated formation of regularly spaced individual objects.

I claim:

1. Conveyer apparatus for flat objects supplied in an imbricated formation, said apparatus comprising a conveyer track on which the objects are transported with successive trailing edges of the objects resting on the track, a plurality of grippers travelling along an endless path, at least a portion of which directly adjoins the conveyer track, and means for moving the grippers, in a region of said portion of the endless path thereof, in the conveying direction of the conveyer track, to cause said grippers to grip said trailing edges of the objects.

2. Conveyer apparatus according to claim **1** comprising an endless travelling conveyer member, said grippers being secured to said conveyer member at regularly spaced intervals.

3. Conveyer apparatus according to claim **1** comprising a distribution means arranged ahead of said conveyer track and comprising a plurality of driving members each cooperating with a respective one of said objects in said imbricated formation, said driving members being successively arranged at uniformly spaced intervals and being moved in a direction parallel to said conveyer track at a travelling speed greater than the conveying speed of the supplied imbricated formation.

4. Conveyer apparatus according to claim **3**, in which said distribution means comprises an endless travelling member having one length running parallel to said conveyer track, said driving members being secured to the latter said travelling member.

5. Conveyer apparatus according to claim **4**, in which said driving members each comprises a two-armed lever pivotally connected to said endless travelling member, said lever having one free end urged to protrude into the path of conveyance of the imbricated formation and a stop member positioned to pivot the levers out of the conveying path.

6. Conveyer apparatus according to claim **2**, in which said grippers are arranged in pairs, the two grippers of a pair being disposed symmetrically at both sides of said endless travelling conveyer member.

7. Conveyer apparatus according to claim **1**, comprising an endless travelling chain guided at least over a portion of its

length along said conveyer track, said grippers being secured to said chain.

8. Conveyer apparatus according to claim 1, in which said grippers each comprises a movable jaw adapted to travel at a greater speed than the conveying speed of said track upon gripping said objects.

9. Conveyer apparatus according to claim 8, in which said grippers each comprises a fixed jaw, said means causing each movable jaw to effect a pivoting movement towards a respective fixed jaw for exerting clamping action on the trailing edges of said objects.

10. Conveyer apparatus according to claim 9, in which said movable jaw is supported for undergoing a helical motion, said means comprising a spring operated retracting mechanism having a relieved position in which it holds the grippers in clamping position.

11. Conveyer apparatus according to claim 10, in which said means comprises a link motion mechanism to pivotally move the movable jaws of the grippers into open position against the action of the retracting mechanism.

12. A method for conveying flat objects supplied in an imbricated formation onto a conveyer track with successive trailing edges of the objects resting on the track, a number of grippers travelling along an endless path being adapted to grip said trailing edges during a portion of their travelling path, said method comprising arranging said imbricated formation, prior to transfer thereof to the conveyer track and the grippers, so that the interval between successive objects of the formation corresponds to a predetermined value or to a whole multiple of this value.

* * * * *