United States Patent

Mueller

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[54] TRANSFER APPARATUS

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[52] **U.S. Cl.** ..... **214/6 BA,** 198/24, 198/218, 271/86, 93/93 DP

[51] **Int. Cl.** **B65g 25/04,** B65g 57/30, B65h 33/00

[58] **Field of Search** ..... 198/24, 35, 218; 93/93 DP; 214/6 BA; 271/86

[56] **References Cited**

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[57] **ABSTRACT**

A pair of rakes, each provided with a plurality of tines projecting in a substantially horizontal direction. The rakes are mounted for movement in a substantially triangular path between an advanced position and a retracted position spaced from one another in the direction of elongation of the tines, and also between an upper and a lower level while they are in the advanced position. Movement of the rakes is controlled so as to assure that whenever one of the rakes is in the advanced position and at the upper level another rake will move to the advanced position and to the lower level before the first-mentioned rake moves away towards the retracted position.

13 Claims, 4 Drawing Figures

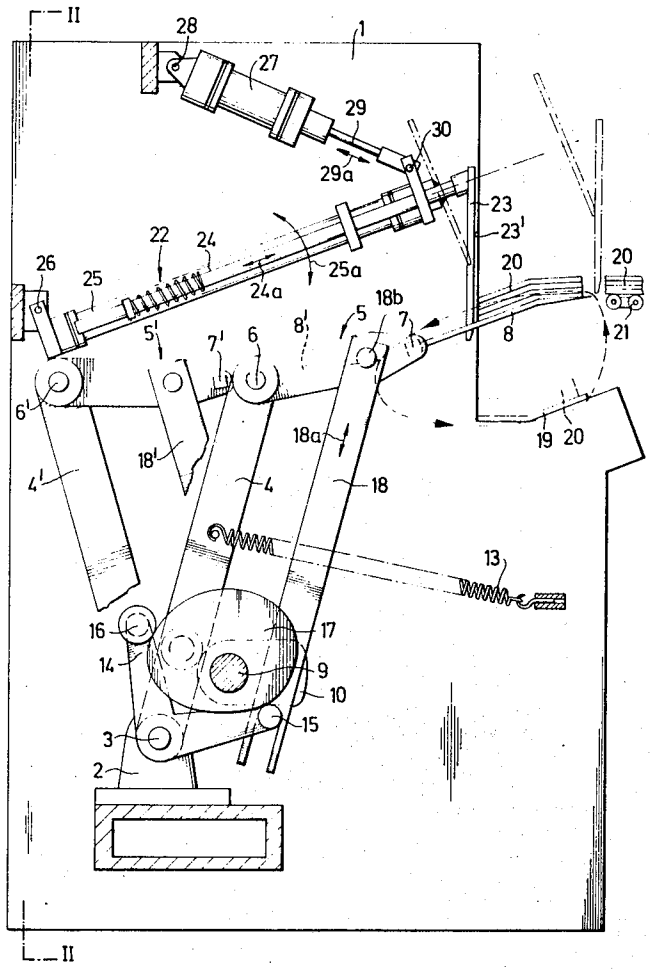
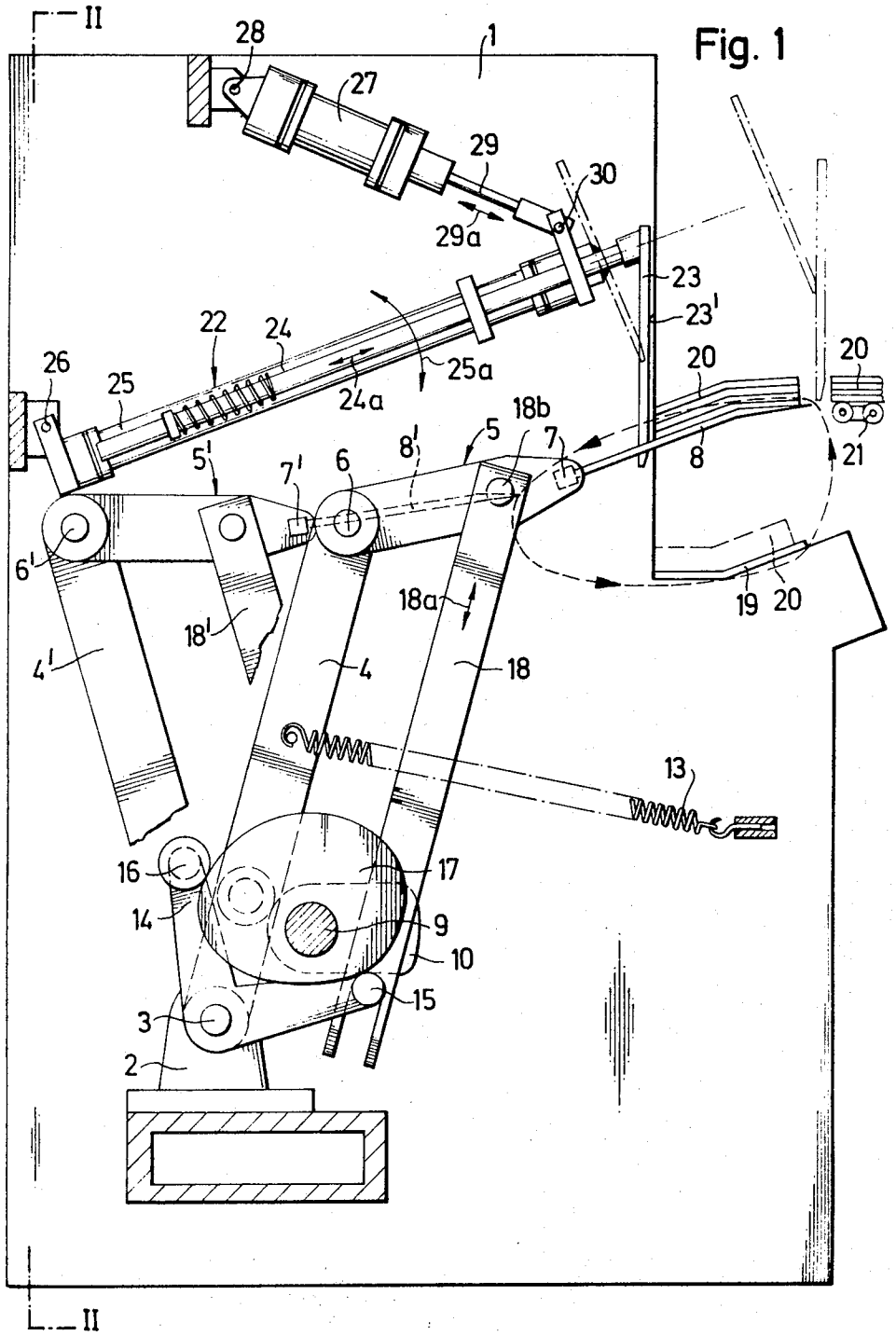


Fig. 1



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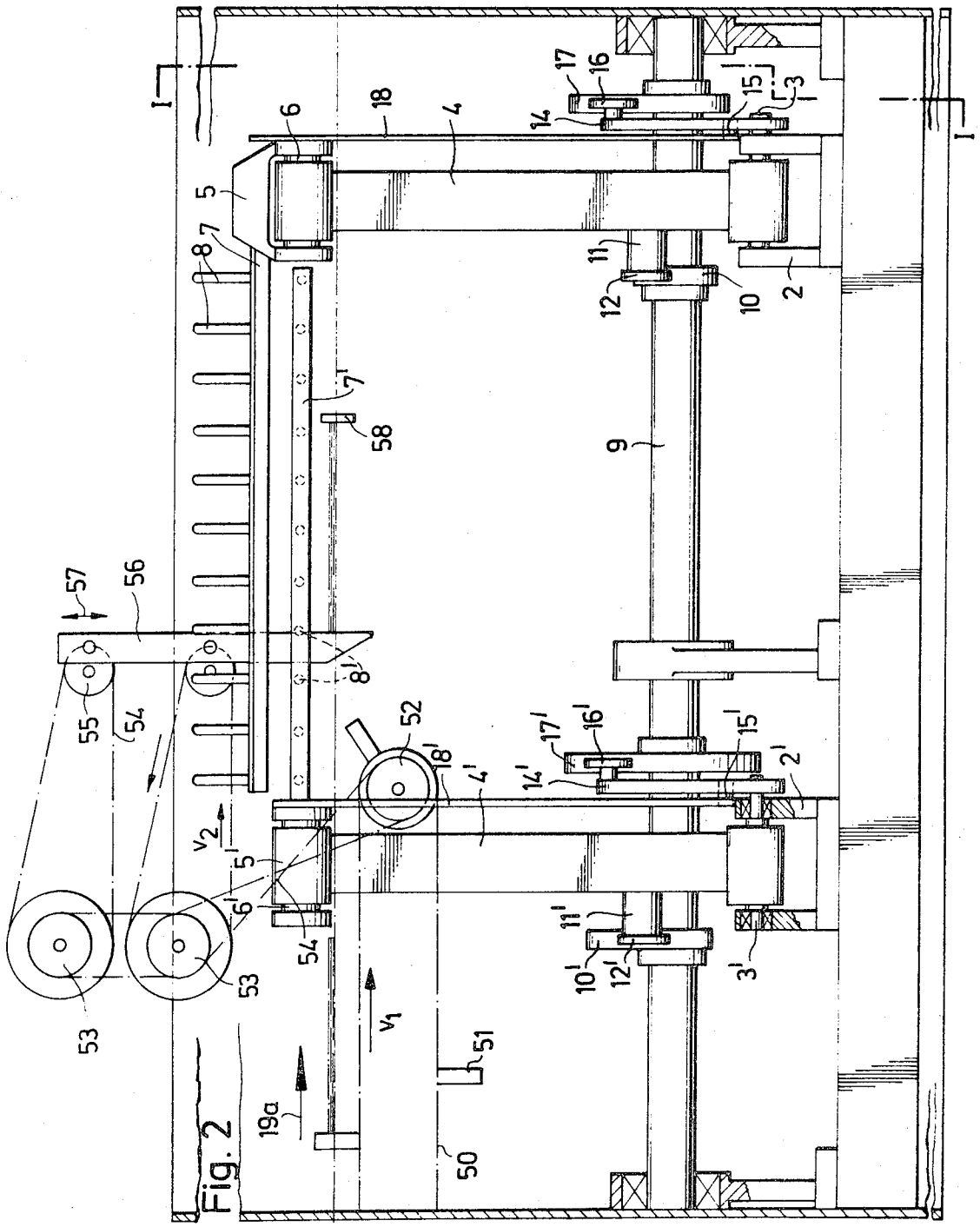

Fig. 2

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Fig. 4

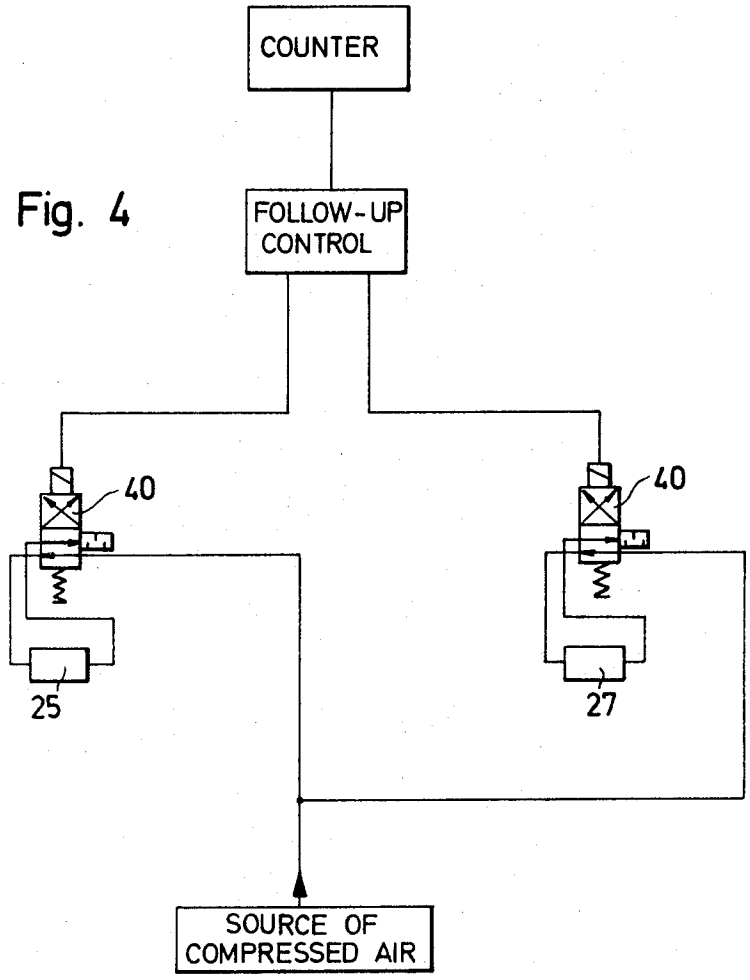
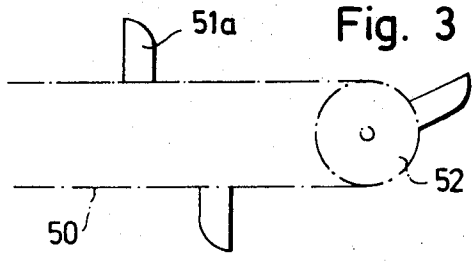


Fig. 3



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TRANSFER APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates generally to a transfer apparatus, and more particularly to a transfer apparatus for use, for instance, for transferring vertical stacks of objects, such as in the assembly of book blocks for book binding machines.

While machines of this general type are already known it is desirable to further improve them in terms of performance, simplicity and reliability.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to afford the aforementioned improvements.

More particularly it is an object of the present invention to provide an improved apparatus of the type under discussion.

In pursuance of the above objects, and of others which will become apparent hereafter, one feature of the invention resides in an apparatus of the type under discussion which comprises, briefly stated, a pair of rakes each of which is elongated in one direction and each of which have a plurality of tines projecting in a substantially horizontal other direction. First means mounts the rakes for movement in a substantially triangular path between an advanced position and a retracted position spaced from one another in the aforementioned other direction, and also between an upper and a lower level while the respective rake is in the advanced position. Second means is provided and operative for controlling the movements of the rakes in a sense effecting movement of one of the rakes to the advanced position and the lower level while the other of the rakes is in the advanced position and at the upper level, and for thereupon effecting movement of the other rake from the advanced position and upper level to the retracted position.

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 drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a somewhat diagrammatic section taken on line I—I of FIG. 2;

FIG. 2 is a similar section taken on line II—II of FIG. 1, with certain portions omitted for clarity;

FIG. 3 is a diagrammatic fragmentary detail view illustrating a detail of a modified embodiment; and

FIG. 4 is a simplified diagram illustrating a control arrangement for use in the preceding embodiments.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, and firstly FIGS. 1 and 2, it will be seen that reference numeral 1 identifies a support in which there are mounted two journals 2 and 2'. A pair of shafts are provided, identified with reference numerals 3 and 3' and each turnably mounted in one of the journals 2 and 2', respectively. Each of the shafts 3 and 3' has connected thereto an arm 4 or 4', respectively. At the upper end of the arms 4 and 4' there is mounted respectively a rake 5 and 5', pivotable about shafts 6 and 6' which respectively parallel the shafts 3 and 3'.

As the Figures show, each of the rakes 5 and 5' is provided with a yoke 7 and 7', respectively. The yoke 7 is provided with tines 8 and the yoke 7' with tines 8'.

A motor driven shaft 9 is turnably mounted in the support 1 and carries a pair of cams 10 and 10' fast with the shaft and each associated with one of the arms 4 and 4'. From the arm 4 there extends laterally a stub shaft 11 and from the other arm 4' a similar stub shaft 11'. On these shafts 11 and 11' are mounted cam follower rollers 12 and 12' respectively.

A pair of springs 13 (only that of the arm 4 visible in FIG. 1) urge the arms 4 and 4' in a sense effecting abutment of the respective follower rollers 12 and 12' against the cam tracks of the cams 10 and 10'. The drawing shows that the cams 10 and 10' are configurated so as to have substantial eccentricity and that they are provided with respective cam tracks which over a portion of arc of 180° are concentric and circular with reference to the shaft 9. It follows that the arms will remain in their advanced end position through a rotation of the shaft 9 by 180°; subsequently they will be briefly retracted to their retracted position and then be advanced again. The cam tracks 10 and 10' are also mounted on the shaft 9 with a 90° displacement relative to one another, so that during a rotation of the shaft 9 through 90° both arms 4 and 4' will simultaneously be in the advanced end position.

Mounted on the shafts 3 and 3' and associated with the respective arms 4 and 4', are angled arms or levers 14 and 14' which are pivotably arranged. One free end of one arm of the respective levers 14 and 14' is provided with a pin 15 or 15', whereas the other end of the other arm is provided with a roller 16 or 16' each of which engages a cam track on a cam 17 and 17' which are stationarily mounted on the shaft 9.

A pair of push rods 18 and 18' are provided whose upper ends are articulated at 18*b* to the rakes 5 and 5' respectively. The other ends of the push rods 18 and 18' are respectively articulated to the pins 15 and 15' and when the cam tracks 17 and 17' turn, the push rods 18 and 18' are displaced in direction of their elongations, that is axially, and in so doing they displace the rakes 5 and 5' between an upper and a lower level while the rakes are in their advanced position. It will be seen that the cam tracks 10 and 17 (and similarly the cam tracks 10' and 17') impart to the rakes 5 (and 5') a closed path of movement of substantially triangular configuration, with the movement for both rakes being the same, that is the path being the same. The arrangement of the cam tracks 10 and 17 as well as 10' and 17' on the shaft 9 is such, as can be seen from the drawing, that the rakes 5 and 5' will always remain in their advanced end position and upper level until such time until the respectively other rake has reached the advanced end position at the lower level.

The tines 8 and 8' of the rakes 5 and 5' extend through corresponding cutouts of a transport support 19 when they move from their advanced lower-level position to their advanced upper-level position. As FIG. 2 shows, the supply of objects onto the transport element 19 (such as book blocks 20 from a non-illustrated book block assembling device) may be effected by means of a conveyor using a chain 50 trained about sprocket wheels 52 (only one shown) and having engaging member 51 which project through suitable openings in the member 19 and advance the book blocks in the direction of the arrow 19*a*. There may then be provided an accelerator device which receives the articles or objects and pushes them against an abutment 58. This device may comprise a member 56 which is mounted on two chains which advance in one and the same direction and are identified with reference numeral 54, being trained about sprockets 53 and 55 and being driven from the sprocket 52 so as to advance at a speed V_2 which is greater than the speed of advancement V_1 of the chain 50. The member 56 is displaceable in the sense indicated by the double-headed arrow 57 between a rear position in which it is lowered until it engages behind the incoming object whereupon it is horizontally displaced forwardly at the speed V_2. It thus receives the object from the chain 50 and pushes it against the abutment 58 whereupon the member 56 is then again moved upwardly and rearwardly. However, this device is discussed and illustrated only for purposes of completeness of disclosure, because such a device in itself is not novel and does not form a part of the present invention. As shown in FIG. 3, the members 51 may also be replaced with members 51*a* the flank of which faces in the direction of movement is rounded to avoid damage to the engage objects and to release them readily when the respective members 51' move about the sprocket 52.

When, as shown in FIG. 1, one of the rakes 5 or 5' with an object (such as a book block 20) moves to the upper-level advanced position, then on the member 19 a following object 20 can be advanced into the path of movement of the other rake. That rake which is in the advanced upper-level position remains therein until the other rake has moved to the advanced lower-level position and advances the second book block 20 or object 20 against the first objects 20 on the rake which is in the advanced upper-level position. Thereupon the latter is retracted to the retracted position so that the object which it carries is now deposited on the rake which is in the advanced lower-level position. In this manner book blocks or objects 20 which are supplied can be stacked vertically to any desired extent. The rakes 5 and 5' provide — when they are in their advanced position — an at least substantially horizontal supporting surface on which the objects 20 are located. Coplanar with this supporting surface there is provided a transport belt or similar device 21 at the upper-level advanced position of the rakes, onto which belt 21 the stacked objects 20 can be pushed off the tines of the rakes.

There is provided for this purpose an ejecting device 22 which is arranged at least substantially parallel to the tines 8 and 8' of the rakes 5 and 5'. The device 22 is provided with a bifurcated member 23 having an at least substantially vertical contact face 23'. In the upper-level advanced position of the rakes 5 and 5' the member 23 engages between tines thereof. It is mounted on a piston rod 24 of a pneumatic cylinder and piston unit 25 and can be displaced between a retracted (full-line) position and an advanced (broken-line) position. The rear end of the cylinder and piston until 25 is secured to the support 1 pivotable about a horizontal axis 26. A second pneumatic cylinder and piston unit 27 constituting drive means is provided, located at an angle of approximately 45° with reference to the pneumatic cylinder and piston unit 25 and being secured to the support 1 at its rear end pivotable about a horizontal axis 28. The free end of the piston rod 29 of the unit 27 is articulately connected at 30 to the front end of the cylinder 25. It will be clear that when the piston of the unit 27 is actuated, the unit 25 is tilted between an upper and a lower end position. A follow up control unit controls the cylinders and piston units 25 and 27 in such a manner that the device 22 will be in its lower end position and perform a movement forwardly, thereby ejecting any object 20 on the rakes 5 or 5' onto the belt 21. Thereupon the cylinder unit 27 is retracted, causing the unit 25 to move to its other end position whereupon the bifurcated member 23 is retracted towards the rear position and whereupon finally it is pivoted to its lower end position. The displacement of the unit 25 is indicated by the double-headed arrow 25*a*, the displacement of the rods 18 by the arrow 18*a*, and the displacement of the piston rod 24 by the arrow 24*a* and of the piston rod 29 by the arrow 29*a*. All of these arrows are double-headed arrows in view of the respectively oppositely directed movements involved.

The follow-up control device and its connections via electromagnetic two-way valves with the units 25 and 27 is illustrated by way of example in FIG. 4. The illustration in FIG. 4 is very diagrammatic and it will be seen that a source of compressed air is provided which can be connected with the units 25 and 27 in dependence upon the operation of the valve 40 which are controlled by the diagrammatically illustrated follow-up control unit. Such units, are available from Grapha Electronic AG, Zofingen, Switzerland, and may be in form of a simple binary counter or a relay control unit and the follow-up control unit in turn may be controlled as shown in FIG. 4 by a counter, for instance of the type available under the name "Graphag Vorwahlzaehler" from the Graphag Maschinenfabrik, 4,800 Zofingen, Faerbestrasse 556, Switzerland. An impulse or impulses originating in the counter alternately initiates at the outputs of the follow-up control unit a complementary impulse which operates the respective valves 40. The counter may utilize a photoelectric cell or the like to determine the objects 20 which arrive on the member 19 and can be set for any desired number of such objects. For instance if five objects 20 are to be stacked atop one another in the illustrated device and to be supplied to the belt 21, then the counter is set accordingly so that after it has counted five of the objects 20 it will supply an impulse to the follow-up control unit which then actuates the device 22 to perform the movements discussed above and to eject the five superimposed stacked objects onto the belt 21.

By resorting to the present invention articles 20 such as book blocks compiled by the non-illustrated selecting or compiling apparatus, can be vertically stacked and then supplied to the transport belt 21 which is located at right angles to the member 19 which receives the blocks 20 from the compiling apparatus.

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 constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a transfer apparatus, 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 be 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 protected by Letters Patent is set forth in the appended

I claim:

1. In an apparatus of the character described, in combination, a pair of rakes each elongated in one direction and having a plurality of tines projecting in a substantially horizontal other direction; first means mounting said rakes for movement in a substantially triangular path between an advanced position and a retracted position spaced from one another in said other direction, and between an upper and a lower level while in said advanced position; and second means operative for controlling the movements of said rakes in a sense effecting movement of one of said rakes to said advanced position and lower level while the other of said rakes is in said advanced position and upper level, and for thereupon effecting movement of said other rake from said advanced position and upper level to said retracted position.

2. In an apparatus as defined in claim 1, said first means comprising a pair of shafts, a pair of arms mounted on said shafts and connected with the respective rakes for movement about said shafts in a sense effecting displacement of said rakes between said advanced and retracted position, and cam means acting upon said arms for effecting movement of the same about the respective shafts.

3. In an apparatus as defined in claim 2, said first means further comprising displacing means for displacing said rakes between said upper and lower levels while said rakes are in said advanced position.

4. In an apparatus as defined in claim 3, said displacing means comprising additional cam means each having a cam track, rods extending in at least substantial parallelism with the respective arms and articulately connected with the respective rakes, and a cam follower on each rod and engaging one of said cam tracks.

5. In an apparatus as defined in claim 4, wherein each cam follower is a cam follower roller.

6. In an apparatus as defined in claim 4, further comprising a pair of double-armed levers pivotably mounted on the respective shafts and each having two arms, one of said arms being articulated to one of said rods and the other of said arms conveying said cam follower.

7. In an apparatus as defined in claim 6, said one arm comprising a projecting pin, and said rods each having a longitu-

dinal slot in which the respective pin is turnably and slidably engaged.

8. In an apparatus as defined in claim 1, said rakes being adapted to support objects thereon; and further comprising ejecting means for ejecting such objects from the respective rakes when the same are in said advanced position and at said upper level.

9. In an apparatus as defined in claim 8, said ejecting means comprising an ejecting member mounted above said rakes and having a substantially vertical contact face, said ejecting member extending downwardly between respective tines of the rake respectively located in said advanced position and at said upper level, and a cylinder and piston unit acting upon said ejecting member in a sense displacing the same in said other direction between a first position in which it is located between the respective tines and a second position in which it pushes objects resting on said tines off the same.

10. In an apparatus as defined in claim 9, wherein said cylinder and piston unit is a hydraulic cylinder and piston unit.

11. In an apparatus as defined in claim 9, wherein said ejecting member is of bifurcated configuration.

12. In an apparatus as defined in claim 9, said ejecting means further comprising securing means securing the cylinder of said unit for pivotal displacement in substantially vertical direction between an upper and a lower location, and securing said ejecting member on the piston of said unit, drive means acting upon said cylinder in a sense displacing the same between said location, and a coordinating unit coordinating displacement of said cylinder to said second position with its displacement to said lower location, and displacement of said cylinder to said first position with its displacement to said upper position.

13. In an apparatus as defined in claim 10; and further comprising a counter operatively connected with and controlling operation of said coordinating unit.

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