

Nov. 27, 1928.

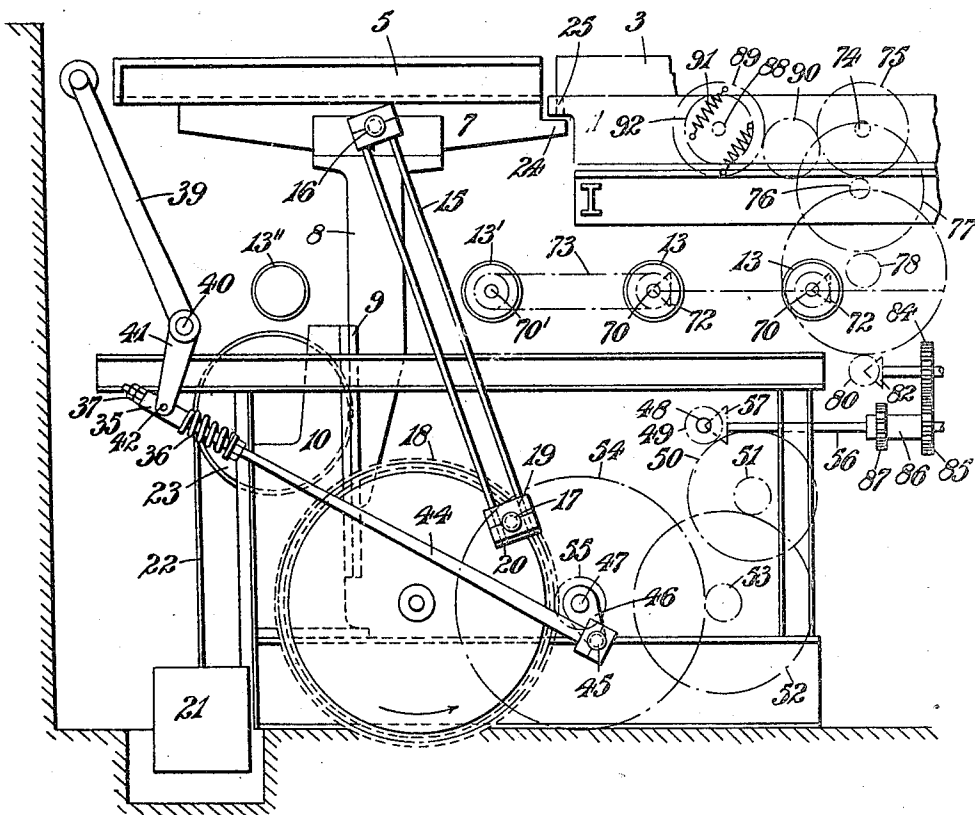
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F. B. WALDRON
APPARATUS FOR CONVEYING THE WORKHOLDING TABLES
OF A CONTINUOUSLY MOVING SERIES OF TABLES

Filed Aug. 11, 1924

3 Sheets-Sheet 1

Fig. 1.



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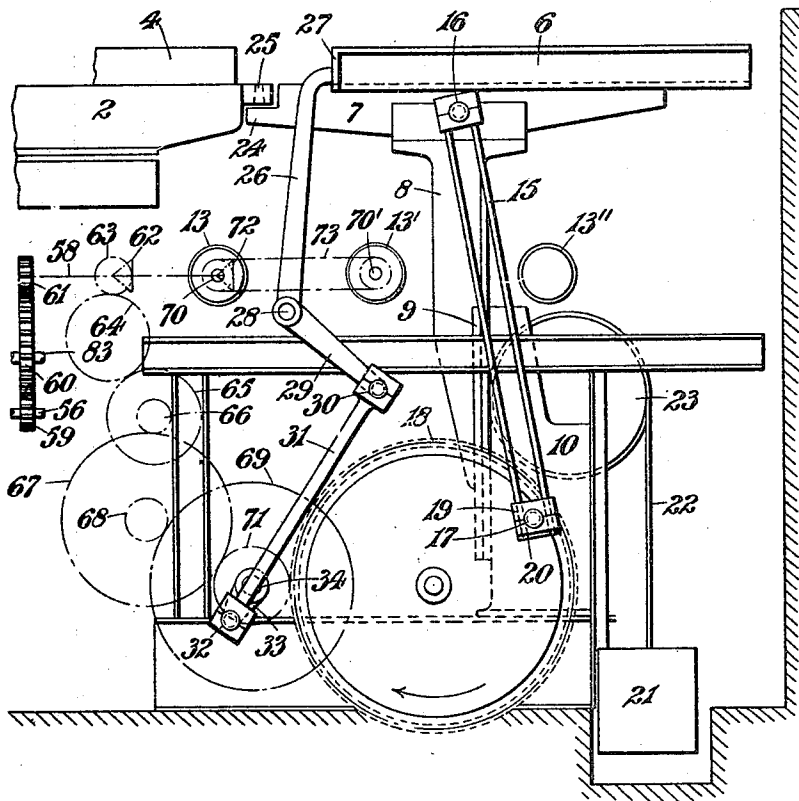
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Fig. 1^a



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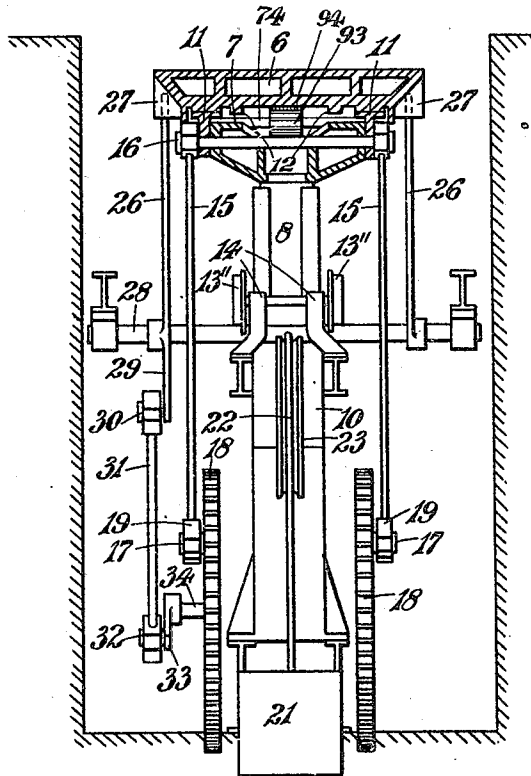
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3 Sheets-Sheet 3

Fig. 2.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR CONVEYING THE WORKHOLDING TABLES OF A CONTINUOUSLY-MOVING SERIES OF TABLES.

Application filed August 11, 1924, Serial No. 731,385, and in Great Britain August 23, 1923.

This invention relates to apparatus for conveying the work-holding tables of a continuously moving series of tables of the type in which a series of tables pass from one end to the other of the apparatus, and has for its object improved apparatus whereby the tables are transported from the finishing to the starting end of the apparatus.

According to this invention, a table, on reaching the finishing end of the apparatus, is pushed on to an elevator so as to be free of the following tables and the elevator is then lowered so as to bring the table on to a runway situated below the level of the continuously moving series of tables. The table is transported on this runway to the starting end of the apparatus and it is there lifted by an elevator to the level at which the work is executed and then pushed so as to come into contact with the next preceding table and engage with the driving gear of the apparatus.

In the accompanying drawings, Figures 1 and 1^a together form a side view of the apparatus, with the central portion and the runway omitted, and

Figure 2 is an end elevation of the finishing end of the apparatus with the table in section.

Referring to the drawings, the starting and finishing ends of the framework which supports the tables of the grinding apparatus, are shown at 1 and 2 respectively, and 3 and 4 respectively are portions of the first and last tables on the said framework, while 5 is a table about to be added at the start of the series of tables and 6 is a table being removed from the end of the series.

The mechanism at the two ends of the apparatus is to a great extent similar, and similar parts at the two ends are designated by the same reference number.

The tables 5 and 6 are supported on platforms 7 provided with guiding surfaces 11 similar to those on the fixed framework 1, 2, so that when the platforms 7 are in the positions shown, they form extensions of the framework 1, 2.

The platforms 7 are attached to vertical supports 8 adapted to slide vertically in guides 9 on fixed supports 10. By means of the said guides 9, the platforms 7 can be

guided when lowered and raised, so that, at the finishing end, the table 6 is lowered until guiding surfaces 12 on it, rest on a series of wheels 13, 13' and 13'', of which the shafts 70, 70' are supported in journals 14 and turned by means to be hereinafter described, said series of wheels constituting a runway, stretching below and from one end to the other of the apparatus. At the starting end, the table which has been transferred by means of the said runway to this end, is raised by means of the platform 7 into the position shown at 5.

The platforms 7 are raised and lowered by means of connecting rods 15, pivoted at their upper ends to the platforms at 16 and at their lower ends to crank pins 17 on wheels 18, the pins 17 being journaled in blocks 19 adapted to slide on the connecting rods 15, but limited in their downward motion by stops 20.

Each platform 7 when loaded with a table, is overcounterbalanced by a weight 21 attached to the support 8 of said platform, by a chain 22 passing over a pulley 23, so that the platform tends to rise until arrested by the block 19 coming against the stop 20.

The wheels 18 are turned in the directions shown by the arrows, by means to be hereinafter described and, considering the mechanism at the finishing end of the apparatus, the wheel 18, in turning from the position shown in the drawings, draws down the platform 7 carrying the table 6 until the latter rests on the runway wheels 13' and 13'' by which the table is caused to travel towards the starting end of the apparatus. The table is brought to rest on the runway wheels 13' and 13'' before the crank pin 17 has reached its lower dead centre so that there is time for the table to be carried away by the runway from above the platform 7, while the wheel 18 turns further, carrying the pin 17, through the dead centre and first further lowering the platform 7 and then raising it again before the platform is raised above the level of the table. Continued rotation of the wheel 18 raises the platform until the registering stop 24 thereon engages with the stop 25 on the end of the framework 1, 2. The stops 24 and 25 engage when the crank pin 17 is approximately one-sixth of a revo-

lution of the wheel 18, from its upper dead centre, and any further rotation of the wheel causes the block 19 to slide up the connecting rod 15, while the platform 7 remains stationary and in position to receive another table.

The operation of the mechanism at the starting end is similar to that at the finishing end, except that the platform 7 rises with a table 5 and descends without a table.

The table 6 is pushed partially on to the platform 7 by the pressure on its end surface of the table 4, which is moved by the means employed for traversing the series of tables along the framework 1, 2. As soon as the table 6 has been pushed nearly to the desired extent on to the platform 7, it is pushed further on to it and clear of the table 4 by means of the pushers 26 acting on lugs 27 on the table 6. The pushers 26 are fast to a rock shaft 28 turning about a fixed axis and one of them forms one arm of a lever, of which the other arm 29 is pivoted at 30 to the upper end of the pusher connecting rod 31. The lower end of the pusher connecting rod 31 is pivoted to a crank pin 32 on a crank 33 on a shaft 34.

By rotation of the crank shaft 34 anti-clockwise from the upper dead centre (with reference to the pin 30) through half a turn, the pusher 26 is moved from left to right, first moving into engagement with the lug 27 and then pushing the table 6 along the platform 7 until it is clear of the table 4.

At the starting end, the table 5, after being raised into position by the platform 7, has to be pushed forwards into contact with the table 3 until it is engaged with the means employed for traversing the series of tables.

This pushing is effected by a pair of pushers 39 fast to a rock shaft 40 turning about a fixed axis and one of them forms one arm of a lever of which the other arm 41 is pivoted at 42 to a block 35 adapted to slide on a connecting rod 44, but pressed upwards by the spring 36, its upward motion being limited by the stop 37. The lower end of the connecting rod 44 is pivoted on a crank pin 45 on a crank 46 on a shaft 47.

Rotation of the crank-shaft 47 clockwise causes the pushers 39 to move to the right from the position shown in Figure 1 and to push the table 5 against the first table 3 of the series of tables. The extent of the pushing motion is such that the table 5 is pushed against the table 3 a little before the crank-pin 45 is at its dead centre with reference to the pivot 42. The continued rotation of the crank-shaft 47 over the dead centre moves the connecting rod 44 to compress the spring 36 and thereby to keep the table 5 pressed against the table 3 for a certain interval of time before the pushers 39 are moved to the left away from the table

5 by continued rotation of the crank-shaft 47.

The wheels 18, the crank-shafts 34 and 47 and the wheels 13 and 13' of the runway are all geared together and to the driving means of the tables, in such ratios that, in the time required for the traverse of one table a distance equal to its length, there correspond, one revolution of the wheels 18, six revolutions of the crank shafts 34 and 47 and the travel of a table from the finishing end of the grinding apparatus to the starting end, such travel comprising the pushing of the table by pushers 26 and 39, the lowering and raising of the table on the platforms 7 and the travel of the table on the runway wheels 13.

The several parts are so timed that, at the finishing end, the table 6 overhangs the framework 2 before the platform 7 rises to support it, to an extent sufficient to enable the pushers 26 to engage the lugs 27 and push the table on to the platform before the latter descends. At the starting end, after the table 5 has been pushed by the pushers 39, the platform 7 descends while nearly half the length of the table 5 overhangs the framework 1.

The several parts may be geared together and driven by any convenient mechanism such as that shown diagrammatically in Figures 1 and 1^a but omitted from Figure 2.

The shaft 48 is the main driving shaft and drives the wheel 18 at the starting end by pinion 49, wheel 50, pinion 51, wheel 52, pinion 53, wheel 54 which is on the crank shaft 47, and pinion 55.

The shaft 48 also drives the longitudinal shaft 56 by bevel gear 57 and the said shaft 56 drives the longitudinal shaft 58 which extends to the finishing end of the grinding apparatus and is shown only by a broken line, by wheels 59, 60 and 61. The shaft 58 drives the crank-shaft 34 by bevel gear 62, wheels 63, 64 and 65, pinion 66, wheel 67, pinion 68 and wheel 69 and the crank-shaft 34 drives the wheel 18 at the finishing end by pinion 71.

The shaft 58 also drives each of the shafts 70 of the runway wheels 13 by bevel gears 72. The shafts 70' of the runway wheels 13' are driven by chains 73 from the adjacent shafts 70, and the wheels 13'' are idle. The shaft 56 also drives the shaft 74 which drives the tables by a pinion 93 and rack 94 (Figure 2) through wheel 75, pinion 76, wheel 77, pinion 78, wheel 79, pinion 80, bevel gear 82, countershaft 83, wheels 84 and 85, countershaft 86, wheel 87 and a wheel on shaft 56 behind wheel 87.

The shaft 88 carries a pinion adapted to drive the tables similar to that carried by shaft 74, and is connected to shaft 74 by wheels 89, 90 and 75. The wheel 89 is however not fast to the shaft 88 but is connected

with it by a spring driving device of any known type, indicated diagrammatically by springs 91 attached between the wheel 89 which is loose on the shaft 88 and the wheel 92 which is fast on the shaft 88. By means of this spring driving device, the table 5 can be engaged with its driving means carried by shaft 88 at whatever moment it is pushed against table 3 by the pushers 39, and the table is then driven by the shaft 88 until it comes into engagement with the main driving means carried by shaft 74.

The invention is not limited to the form of apparatus shown and described and this may be varied widely in mechanical construction; thus, for example, the runway shown could be replaced by several known types of runway, and any type of platform raising and lowering gear which admits of the introduction of a lost motion device could be employed in place of that shown. Further a hydraulic or pneumatic raising and lowering gear may be employed and, instead of a mechanical lost motion device, stops capable of withstanding the hydraulic or pneumatic pressure may be provided to limit the rise of the platform.

Further, it is not essential that the lowering, transporting and raising devices should be geared so as to operate continuously, and they may be operated intermittently so as to deal with each table as it reaches a position adapted for engagement by the pushing and lowering devices. Such intermittent operation may be controlled by switches or valves operated by the travel of the last table or by a cam gear operated by the driving mechanism of the series of tables.

Having described my invention, I declare that what I claim and desire to secure by Letters Patent is:—

1. Apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, comprising in combination with said continuously moving series of tables, means adapted to lower the table to be conveyed, to a level below that of the continuously moving series of tables, means operative to convey said table at this lower level to the starting end, means operative to raise this table at the starting end to the level of the continuously moving series of tables, means adapted to push the table to be conveyed, on to the lowering means, and means adapted elastically to push said table against the first table of the series.

2. In apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, the combination with said continuously moving series of tables, and a stationary frame having guiding surfaces for the tables, of fall-

ing and rising platforms adapted respectively to lower and raise the table to be conveyed, to and from a level below that of the continuously moving series of tables, a continuously rotating crank-shaft operative to lower and raise each of the platforms, a connecting rod operatively connecting together the platform and the crank-pin, a journal slidable on the connecting rod, a stop on the rod limiting this movement of the journal on the connecting rod and a weight tending to lift the platform.

3. In apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, the combination with said continuously moving series of tables of a pivoted lever of which one arm is adapted to engage the table to be conveyed and to push it, a continuously rotating shaft, a crank-pair motion operatively connecting the said shaft with the other arm of the lever, means adapted to lower the table to be conveyed, to a level below that of the continuously moving series of tables, means operative to convey said table at this lower level to the starting end, and means adapted to raise this table to the level of the series of tables.

4. In apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, the combination with said continuously moving series of tables, of a pivoted lever of which one arm is adapted to engage the table foremost of the series to push it away from the next following table, a continuously rotating shaft, a crank-pair motion operatively connecting the said shaft with the other arm of the lever, means adapted to lower the table to be conveyed, to a level below that of the continuously moving series of tables, means operative to convey said table at this lower level to the starting end, means adapted to raise this table to the level of the series of tables, a second pivoted lever of which one arm is adapted to engage this raised table to push it against the rear of the next preceding table, a second continuously rotating shaft, and a second crank-pair motion operatively connecting this shaft with the other arm of the second pivoted lever.

5. In apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, the combination with said continuously moving series of tables, of a pivoted lever of which one arm is adapted to engage the table foremost of the series to push it away from the next following table, a continuously rotating shaft, a crank-pair motion operatively connecting the said shaft with the other arm of

the lever, means adapted to lower the table to be conveyed, to a level below that of the continuously moving series of tables, means operative to convey said table at this lower level to the starting end, means adapted to raise this table to the level of the series of tables, a second pivoted lever of which one arm is adapted to engage this raised table to push it against the rear of the next preceding table, a second continuously rotating shaft, a second crank-pair motion operatively connecting this shaft with the other arm of the second pivoted lever, and a spring-pressed lost motion device whereby the table is pressed resiliently against the first table of the series during a portion of a revolution of the second continuously rotating shaft.

6. In apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, the combination with said continuously moving series of tables, of means operative to propel the tables, means operative to automatically advance the leading table away from the next following one at the finishing end of the series, means adapted to automatically lower the said leading table, means adapted to automatically convey the said lowered table beneath the succeeding tables of the series, means adapted to automatically raise the

same table to the level of the travelling series of tables, and means adapted to automatically push this same table against the rear of the next preceding table, all operating continuously and in timed relationship whereby tables are automatically removed from the finishing end and added to the starting end of their operative course.

7. In apparatus for conveying the work-holding tables of a continuously moving series of tables from the finishing end to the starting end of their operative course, the combination with said continuously moving series of tables and main driving means operative to propel said series, of auxiliary driving means adapted to push forward the table last added to the series the auxiliary and main driving means being in operative connection with each other, and a spring driving device in the auxiliary driving means adapted to push the said added table resiliently against the next preceding table of the series, whereby the table so added may be pushed at any moment, into engagement with the said auxiliary driving means and driven thereby into operative engagement with the main driving means.

In testimony whereof I have affixed my signature hereto.

FREDERIC BARNES WALDRON.