

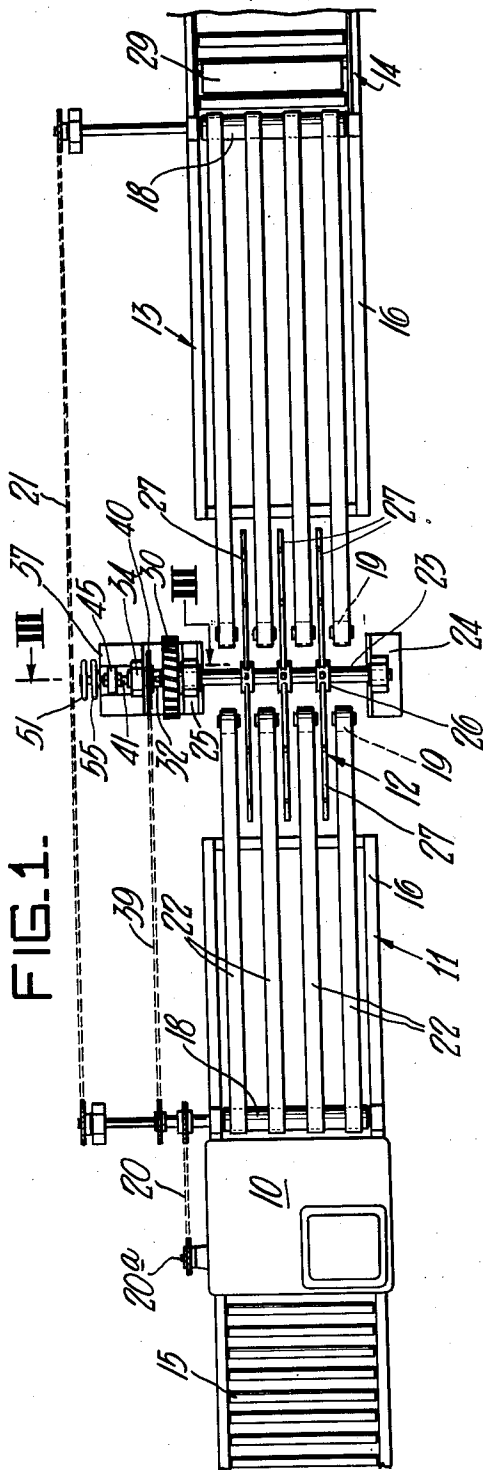
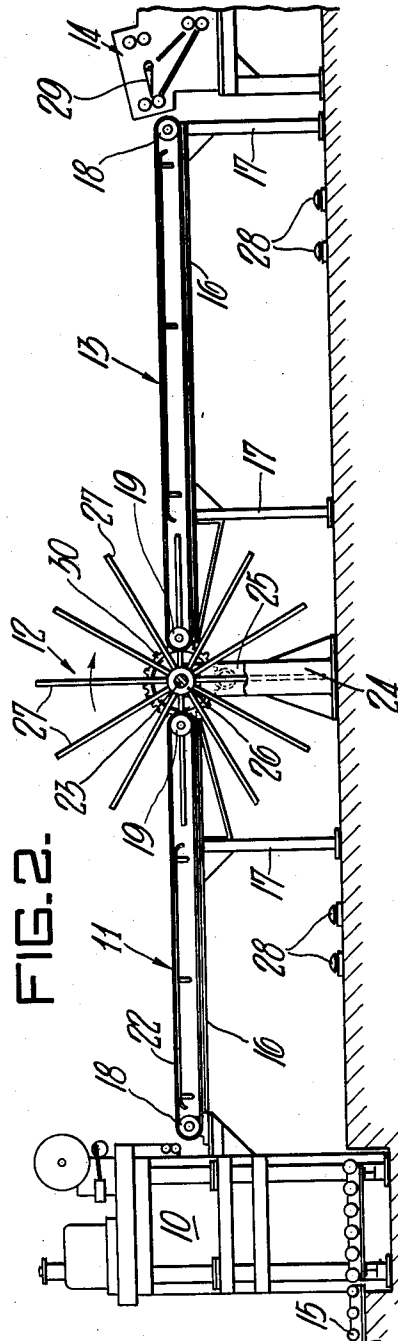
Aug. 28, 1951

E. R. MUDDIMAN
DRIVE FOR PORCUPINE SHEET-TURNOVER
RACK WITH TIMING-ADJUSTING MEANS

2,565,779

Filed March 26, 1948

2 Sheets-Sheet 1



Inventor:
EARLL R. MUDDIMAN,
by: *Donald G. Dalton*
his Attorney.

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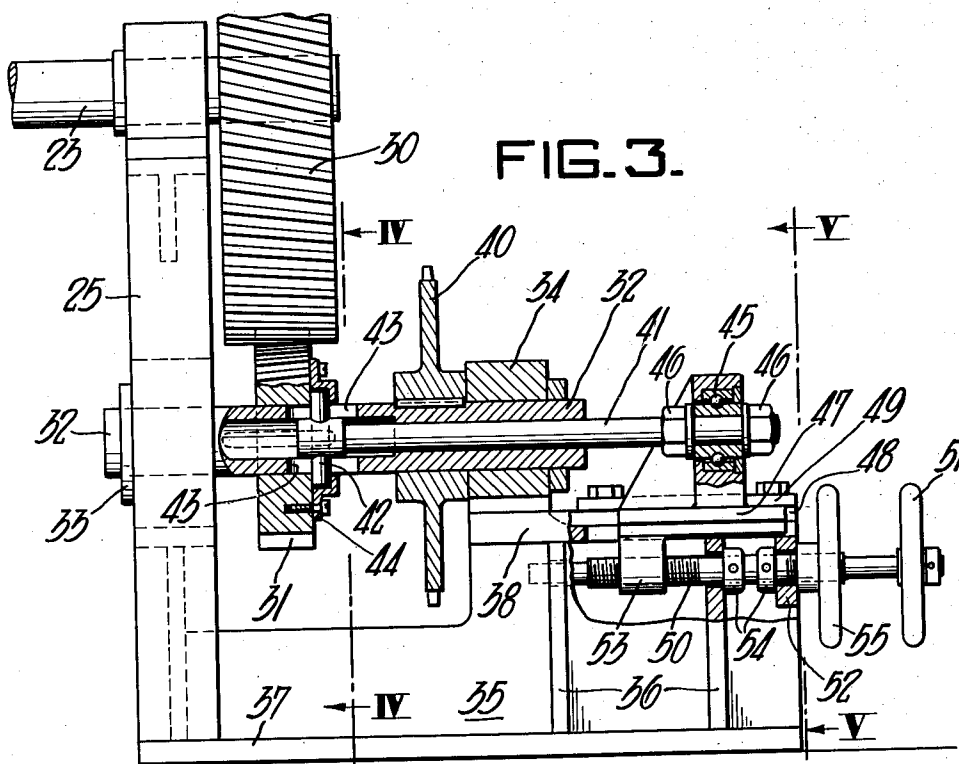


FIG. 3.

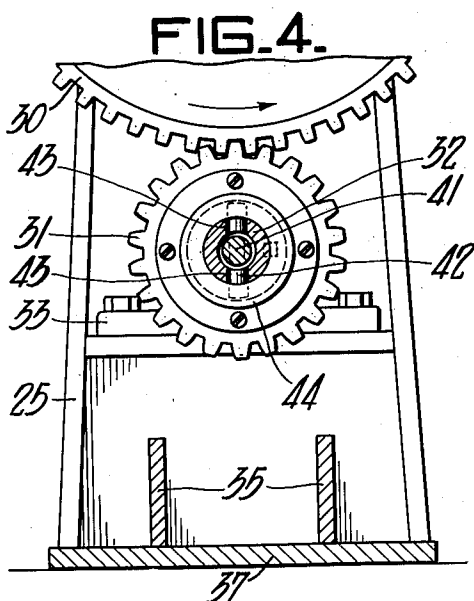


FIG. 4.

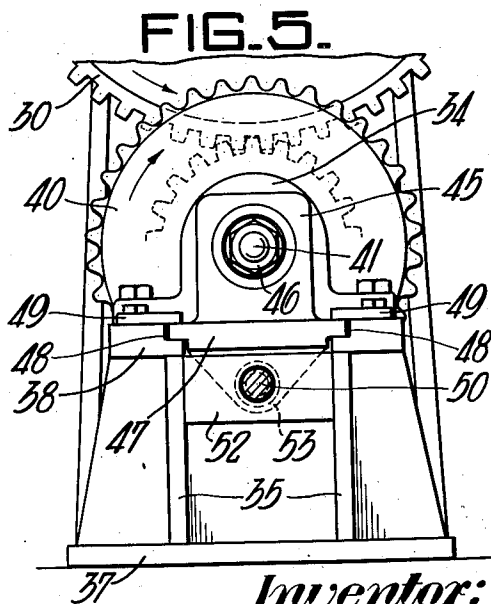


FIG. 5.

Inventor:
EARL R. MUDDIMAN,
by: *Donald L. Dalton*
his Attorney.

UNITED STATES PATENT OFFICE

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DRIVE FOR PORCUPINE SHEET-TURNOVER
RACK WITH TIMING-ADJUSTING MEANSEarll R. Muddiman, Wilkensburg, Pa., assignor
to United States Steel Company, a corporation
of New Jersey

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4 Claims. (Cl. 198—103)

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This invention relates to a turnover rack for handling sheets during inspection and, in particular, to an improved drive therefor incorporating means for varying the timing relative to the arrival of successive sheets so that each will be picked up promptly to clear the way for the next one.

The manual turning of sheets, such as tinplate, during inspection, has persisted despite the fact that it is time-consuming and laborious, because no mechanical sheet-turning means has been found satisfactory. One such means, the so-called "porcupine" type turnover rack, consisting of a shaft mounted for rotation, with a plurality of sets of radial arms, has been used but with only limited success because of the difficulty in timing the passage of the several sets of arms through the pick-up position in synchronism with the arrival of successive sheets, traveling on a belt conveyor, at that position.

I have invented a novel drive particularly suited for "porcupine" type turnover racks which overcomes this difficulty. According to the invention, I provide means for adjusting the timing or instantaneous angular position of the shaft while the device is operating, in order to synchronize the passage of the arms through lifting position with the arrival of successive sheets on the belt conveyor at the proper position for engagement by the arms. In a preferred embodiment, I mount a driving gear on the shaft of the turnover rack and provide a pinion slidable on an intermediate shaft, meshing therewith. The gear and pinion have helical teeth. The intermediate shaft is driven at a speed proportional to that of the belt conveyor which delivers sheets to the turnover rack from a sheet feeder, for example. I employ manually operable means for shifting the pinion axially of the gear, thereby changing the angular relation between the gear and pinion by reason of the helical cut of their teeth. Preferably the intermediate shaft is hollow and the adjusting means is a rod slidable therethrough so that the adjustment may be made while the turnover rack is operating.

A complete understanding of the invention may be gained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred embodiment. In the drawings,

Figure 1 is a partial plan view, largely diagrammatic, showing a turnover rack having the invention incorporated therein, associated with a sheet feeder, a delivery conveyor and a carry-away conveyor;

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Figure 2 is a side elevation thereof;

Figure 3 is a partial vertical section through the drive for the turnover rack, to enlarged scale, taken along the plane of line III—III of Figure 1; and

Figures 4 and 5 are transverse vertical sections with parts in elevation, taken along the planes of lines IV—IV and V—V, respectively, of Figure 3.

Referring in detail to the drawings, and particularly to Figures 1 and 2 for the moment, the invention is illustrated therein as applied to apparatus for inspecting sheets comprising generally a sheet feeder 10, a belt delivery conveyor 11 for the inspection of one side of sheets fed successively thereto by the feeder, a turnover rack 12 having my improved drive incorporated therein, a belt carry-away conveyor 13 for the inspection of the other side of the sheets, and a classifier line, the entrance end only of which is shown at 14. The feeder 10 is of the known vacuum type and operates to feed sheets singly from a pile therein to conveyor 11. Piles of sheets on pallets are moved into the feeder on a roller conveyor 15, as needed.

The conveyors 11 and 13 are similar in construction. Each comprises a frame 16 supported on legs 17 or other suitable means with a driving pulley 18 journaled at one end and spaced idler pulleys 19 at the other. The idler pulleys of both conveyors are located adjacent the rack 12. Conveyor 11 is driven by the sheet feeder through a chain-and-sprocket drive 20 and conveyor 13 is driven by conveyor 11 through a similar drive 21. It will be understood that the feeder has a built-in motor for driving it. It is provided with an output shaft 20^a for driving the conveyors. Spaced belts 22 travel around pulleys 18 and 19.

The rack 12 comprises a shaft 23 journaled in bearing posts 24 and 25 with hubs 26 spaced therealong. The hubs are located intermediate the belts 22 and have radial arms 27 spaced circumferentially thereof. The arms of the several hubs lie in common radial planes and thus serve to lift successive sheets from the conveyor 11 and deposit them progressively in turned-over position on conveyor 13 as the shaft 23 is driven clockwise, as viewed in Figure 2. One side of the sheets is examined by an inspector standing adjacent conveyor 11 as they pass therealong. The other side of the sheets is examined by an inspector standing adjacent conveyor 13. The inspectors operate pedal switches 28 in accordance with the condition of the two surfaces of successive sheets. The switches control deflector gates 29 of the classifier line 14 in the known manner

to cause different classes of sheets, i. e., primes, menders and wasters to be piled separately.

My invention relates particularly to the drive for the rack 12 and specifically to means for indexing or timing the arrival of the several sets of the arms 27 at the pick-up position, i. e., the level of the upper run of the belts of conveyor 11, in synchronism with the arrival of successive sheets traveling on said conveyor at a position thereon in which they are ready to be lifted by said arms. The mechanism involved is shown in detail in Figures 3 through 5. Referring to Figure 3, the shaft 23 has a helical gear 30 at one end. A helical pinion 31 splined on a hollow intermediate shaft 32 meshes with the gear. The gear has an extra wide face whereby the pinion may be adjusted axially a substantial distance in either direction from a central position and still remain in mesh with the gear. Such adjustment will effect a slight change in the relative angular positions of the gear and pinion because of the pitch of their helical teeth. The width of the gear face and the pitch of the teeth are so chosen that this change will suffice to turn the shaft 23 through at least one-half the angle between adjacent sets of arms 27 if the pinion be held against rotation during axial movement.

The intermediate shaft 32 has its inner end journaled in a bearing 33 mounted in bearing post 25. The outer end of the shaft is journaled in a bearing 34. This bearing is mounted on a support composed of spaced parallel longitudinal plates 35 and spaced parallel transverse plates 36 standing on a base 37 and provided with a top plate 38. The shaft 32 is driven through a chain-and-sprocket drive 39 from the pulley 18 of the conveyor 11, the sprocket on the shaft 32 being designated 40.

A rod 41 is slidable in the bore of shaft 32 for shifting the pinion 31 therealong. A pin 42 extends transversely of the inner end of the rod and the ends of the pin project through slots 43 in the shaft 32. A flanged collar 44 secured to the pinion 31 by screws fits over the ends of the pin 42, whereby the pinion may be pulled outwardly as well as pushed inwardly. The outer end of rod 41 is journaled in a combined radial and thrust bearing 45 being secured thereto by nuts 46 threaded on the rod which permit it to be initially adjusted axially to the proper position. The bearing 45 is carried on a slide 47 adapted to travel along ways 48 formed on opposite sides of a slot in the top plate 38 extending inwardly from the outer end thereof. The slide is secured in the ways by gibs 49.

A screw 50 having a handwheel 51 on the outer end thereof is journaled in the transverse plates 36 and a vertical plate 52 extending between the side plates 35 at the outer end thereof. The screw is threaded through a tapped hole in a lug 53 depending from the slide 47. Axial movement of the screw is prevented by thrust collars 54 pinned thereto between end plate 52 and the outer transverse plate 36. By this construction, the slide 47 and bearing 45 mounted thereon may be adjusted axially of shaft 32 by turning handwheel 51. The rod 41, of course, moves with the bearing 45 and effects a corresponding axial adjustment of the pinion 31 on the shaft. A locking handwheel 55 having a threaded bore is turned on the screw 50 and is adapted to clamp the latter in adjusted position when turned down tightly against plate 52.

It will be evident from the foregoing that the apparatus described permits the position of the

pinion 31 relative to the gear 30 to be nicely adjusted with ease. The adjustment may be made, furthermore, while the gear and pinion are turning with their shafts, respectively. This facilitates the desired adjustment precisely to the point where the sets of arms 47 ascending past the discharge end of the conveyor 11 will pick up the sheets delivered thereby exactly at the instant when they arrive at the proper pick-up position. As already stated, sufficient range of adjustment is provided to cover at least the full angle between adjacent sets of arms 27 so that if a given set of arms cannot be advanced far enough, the next set ahead can be set back by the necessary angle. The delivery conveyor 11, the rack 12 and the carry-away conveyor 13, all driven by the same means, may be given the desired speed ratios by properly choosing the sizes of the various driving and driven sprockets. Any variation of the speed of the sheet feeder will be reflected proportionately in the changes of the sheet-handling means mentioned.

These ratios, and corresponding sprocket sizes, are so chosen that for a given number of sheets per minute leaving the feeder (one sheet being delivered for each revolution of the main shaft of the feeder), the rack 12 will rotate at a speed equal to the R. P. M. of the feeder divided by the number of rows of arms on the rack. For example, for an operating rate of 100 sheets per minute, or 100 R. P. M. of the feeder shaft, the rack speed will be 100 divided by 12 (the number of rows of fingers illustrated in Figure 2) or 8.33 R. P. M. The linear speed of the belts of conveyor 11 is then determined by the size of the sheets being inspected. For the maximum size sheets (36" long), the belt speed will be 3' x 100 or 300 feet per minute. At this belt speed, the sheets will move along the table just touching each other, edge to edge. To provide for 2" or .166' spaces between the sheets, the belt speed would be increased by .166' x 100 or 16.6 feet per minute, giving a resultant belt speed of 316.6 feet per minute. Assuming 8" diameter belt pulleys, the speed of the conveyor drive shaft would be 151.4 R. P. M. for 100 sheets per minute to be inspected. The speeds of the feeder, table and rack shafts would then be 100, 151.4 and 8.33 R. P. M., respectively, and would remain fixed in this ratio. The speed of conveyor 13 should be made the same as that of conveyor 11 and, therefore, its drive shaft is connected by a 1:1 chain and sprocket drive to the shaft of conveyor 11.

For operating speeds greater or less than 100 sheets per minute, the speed of the main drive motor is increased or reduced accordingly, no other adjustment being required.

For sheet lengths less than 36", operations would be the same except that spaces between sheets would be greater, the smaller the sheets. For 19½" sheets, the minimum size, the spacing between sheets would be 18½". To eliminate this increased spacing between smaller sheets, the drive shaft of the conveyor 11 could be broken and provided with a mechanical variable-speed device whose input speed would be 151.4 R. P. M. and whose output speed would be 151.4 R. P. M. or less, depending on size of sheets. This provision is not deemed essential to the invention.

In operation of the line, the indexing device is employed to adjust the pick-up aspect of the rows of rack arms with respect to approaching sheets, as described above, when the line is first started. Changes in this adjustment are not required with changes in feeding speed or sheet size unless the position of the pile in the feeder,

slippage of sheets on the belts or some unaccountable factor, such as wear of moving parts, causes a change in the relative position of the leading edges of the sheets with respect to the rack arms as they are presented to the turnover rack. Such adjustments of the indexing device, if needed, can be made without slowing or stopping operation of the line.

The advantages of the invention will be apparent from what has been stated above. It makes possible the use of a turnover rack for handling sheets of tin plate during inspection which has not been possible heretofore because of the difficulty of securing and maintaining the proper adjustment of the passage of the radial arms through pick-up position relative to the arrival of sheets on the conveyor at that position. In addition, the apparatus is simple and relatively inexpensive to manufacture and exceedingly easy to operate. Once the desired synchronism has been obtained, furthermore, readjustment should not be necessary unless sheets of different size are to be inspected, barring such factors as wear or slippage of sheets on the belts, as previously mentioned.

Although I have illustrated and described but a preferred embodiment of the invention, it will be recognized that changes in the details and arrangement of the parts as disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. Apparatus for adjusting the timing of the radial arms of a sheet-turnover rack relative to the arrival of successive sheets traveling along a conveyor at a position to be picked up by the rack comprising a helical drive gear on said rack, an intermediate shaft, means driving said shaft at a speed proportional to that of the conveyor, a helical pinion slidable on said intermediate shaft meshing with said gear and means for manually adjusting said pinion along said intermediate shaft, said intermediate shaft being hollow and said last-named means including a shifter rod extending therethrough and connected to said pinion.

2. Sheet-handling apparatus comprising a sheet-turnover rack including a shaft having a plurality of sets of radial arms extending therefrom, a conveyor delivering sheets to said rack, a

helical gear on said shaft, an intermediate shaft driven from said conveyor, a helical pinion slidable on said intermediate shaft meshing with said gear, and manually operable means for moving said pinion along said intermediate shaft, said intermediate shaft being hollow and said last-named means including a shifter rod extending therethrough and engaging said pinion.

3. Apparatus for adjusting the instantaneous angular position of a continuously driven rotating member comprising a helical gear driving said member, a hollow shaft having a helical pinion slidable but non-rotatable thereon, meshing with said gear, a combined thrust and radial bearing mounted adjacent the end of the shaft for movement along the axis thereof, a shifter rod slidable in said shaft having its outer end journaled in said bearing, means causing said pinion to move axially with said rod and means for adjusting said bearing along said axis, thereby effecting axial movement of said rod and pinion relative to said gear.

4. In a sheet-handling apparatus, the combination with a sheet-turnover rack including a shaft having a plurality of sets of radial arms extending therefrom and a conveyor delivering sheets to said rack, of a helical gear on said shaft, an intermediate shaft driven from said conveyor, a helical pinion slidable on said intermediate shaft meshing with said gear, manually operable means for moving said pinion along said intermediate shaft, a base adjacent said intermediate shaft, a combined radial and thrust bearing movable on said base parallel to said intermediate shaft, and a shifter rod journaled in said bearing, extending through said intermediate shaft and engaging said pinion.

EARLL R. MUDDIMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,039,202	Smead	Sept. 24, 1912
1,298,828	Todhunter	Apr. 1, 1919
1,517,285	Fischedick et al.	Dec. 2, 1924
2,163,035	Grupe	June 20, 1939