Jan. 28, 1969

J. L. MENNITT

3,424,030

DIFFERENTIAL TIMER

Filed July 6, 1966

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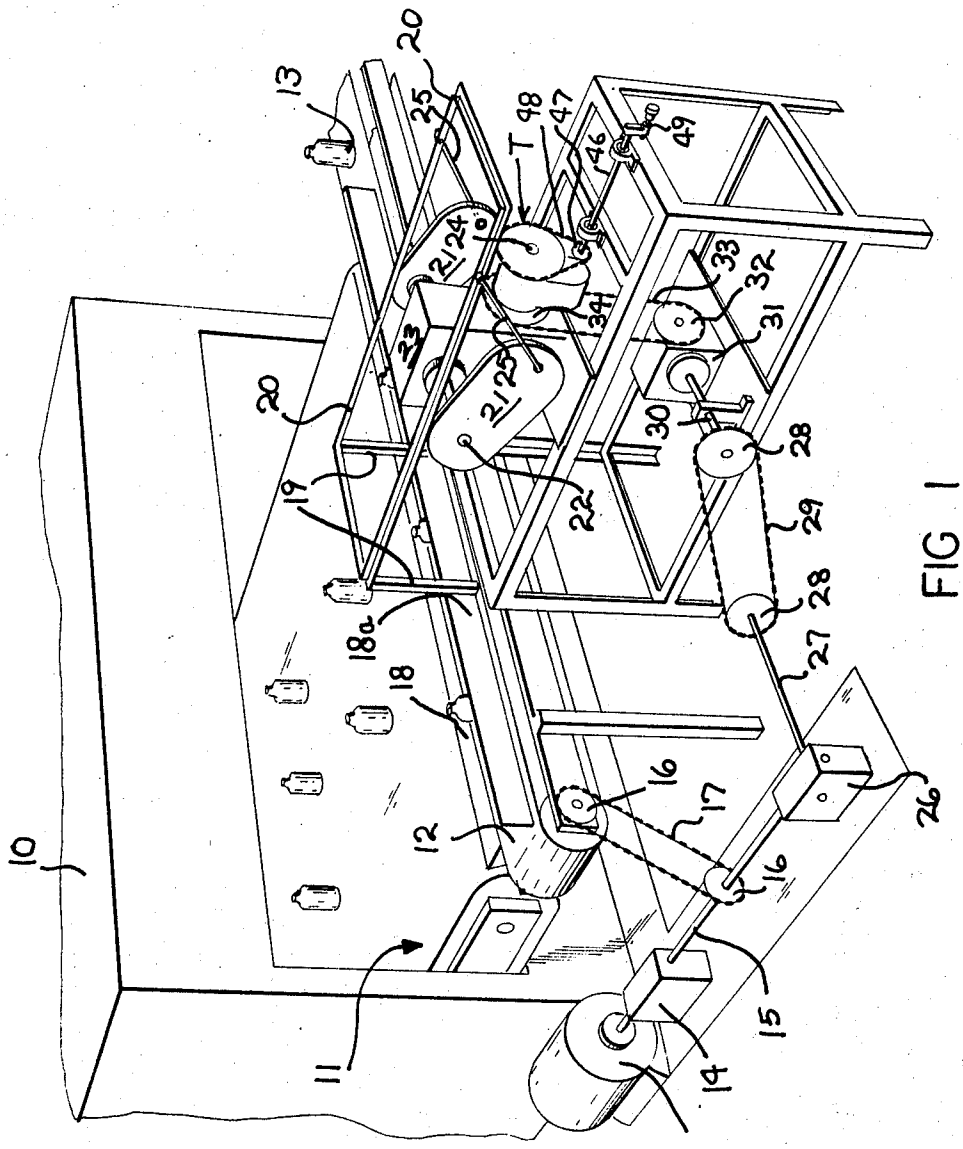


FIG 1

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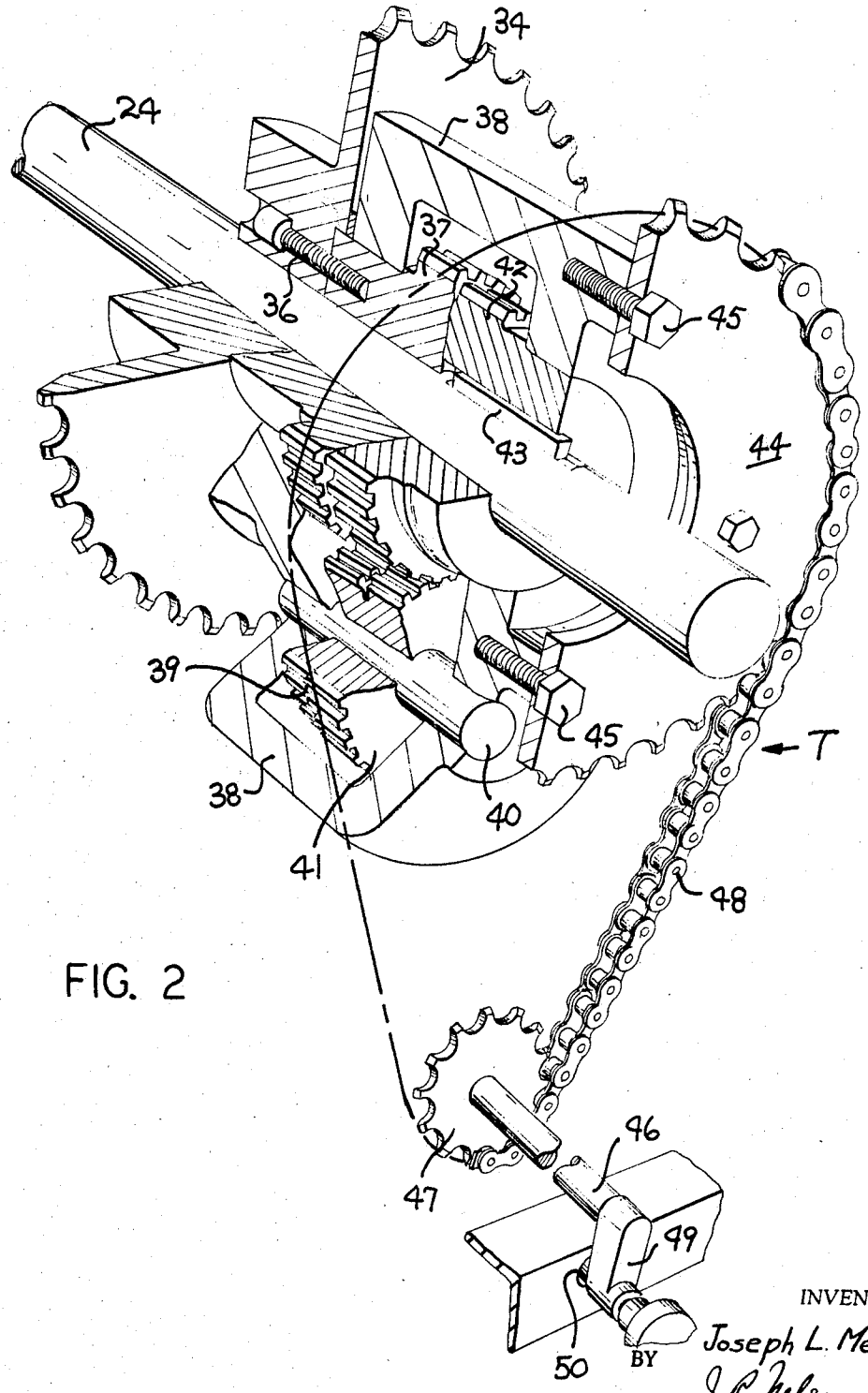


FIG. 2

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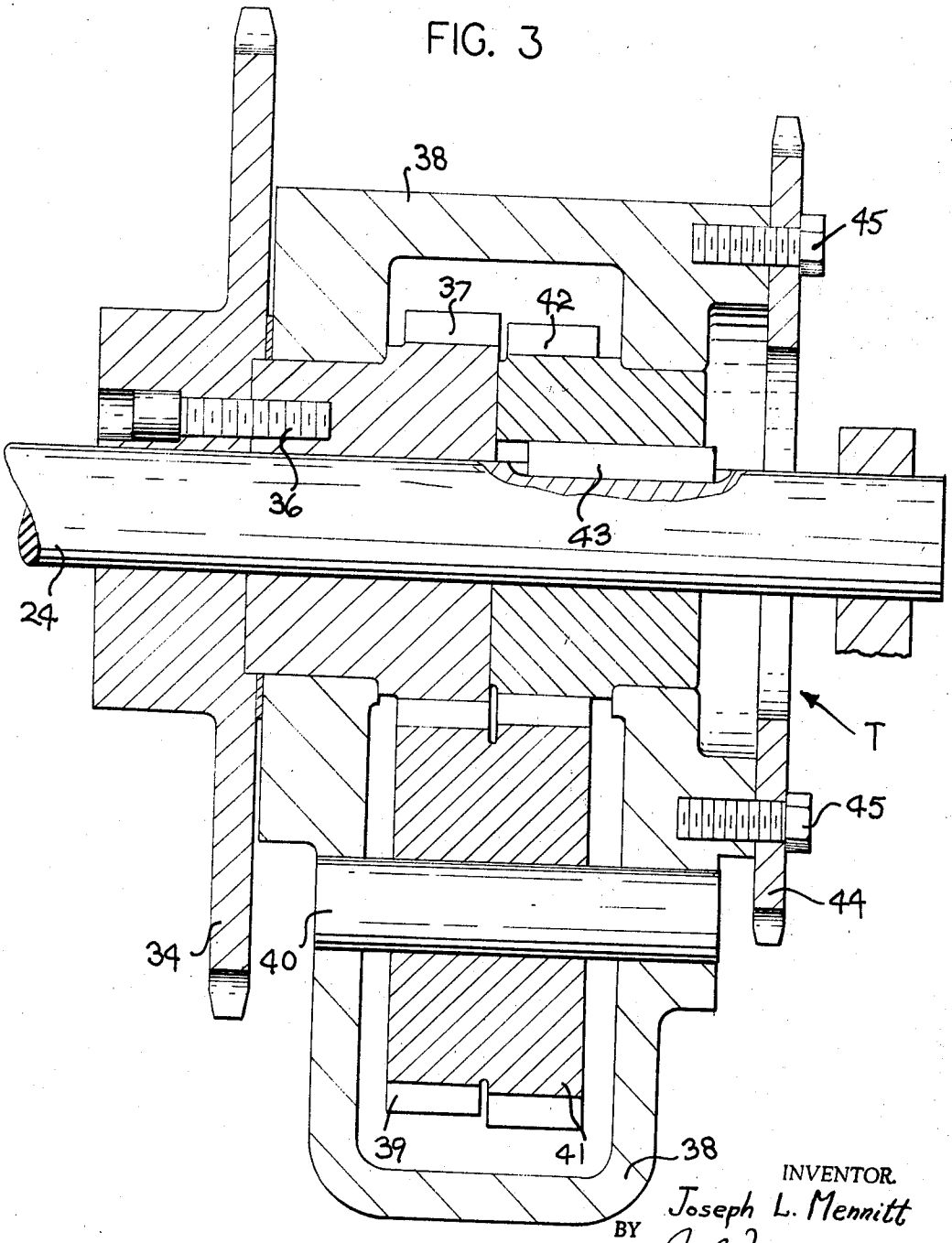
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FIG. 3



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DIFFERENTIAL TIMER

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U.S. Cl. 74—675 5 Claims
Int. Cl. F16h 37/06

ABSTRACT OF THE DISCLOSURE

Apparatus for altering the time relationship of an article-engaging, pusher mechanism with respect to a moving continuous tandem supply of articles in which the apparatus for driving the pusher mechanism includes a shaft, interacting sun gears and planetary gears rotating the shaft, with means for selectively adjusting the angular relationship of the planetary gears with respect to the sun gears such that during the interval of adjustment, the rotational speed of the shaft is altered but subsequent to the adjustment is identical to the antecedent shaft speed.

My invention relates to improvements in differential timers and has for an object the provision of a compact timer, shaft mounted, and capable of manual manipulation from a location remote from such timer and shaft while the mechanism being timed is either at rest or operating.

An important object of my invention is the provision of a differential timer arrangement in which the timer itself is mounted directly upon a high speed, driven, shaft and wherein there is a device for adjusting the timer from a remote point, thereby to vary the timing between the driven shaft and a drive shaft which operates through the timer to rotate the driven shaft. Commercial differential timers presently available are of the bevel gear type and therefore in general are quite bulky and moreover must be mounted on their own individual bases separate from the device being driven. Furthermore, these commercial timers do not permit ready remote control as does my invention.

A further object of my invention is the provision of a differential timer in which spur gears, rather than bevel gears are utilized, thus contributing to compactness of the unit without detracting from its horsepower transmitting ability.

Other objects will be in part apparent and in part pointed out hereinafter.

In the accompanying drawings forming a part of my application:

FIG. 1 is a perspective view showing schematically a conventional lehr loader at the "hot" end of a glassware annealing lehr, with my differential timer supported on a driven shaft which powers the article pusher bar of the loader.

FIG. 2 is a perspective view partially in section showing the timer and adjusting means for same.

FIG. 3 is an enlarged vertical sectional view of the timer.

In the illustrated embodiment of my differential timer it is shown in conjunction with a glassware lehr loader for the purpose of regulably controlling the time of initiation of the working stroke of the ware pusher bar in relation to the movement of bottles or such glassware across the front end of the lehr. Proper timing is, of course, essential to insure against upsetting bottles as would occur incident to improper contact of bottles with the pusher bar. It is understood that this timer may well be utilized in other mechanisms and my showing of a lehr loader is for illustrative purposes only.

In FIG. 1 the mechanism with which my timer is

illustrated comprises a tunnel-like lehr **10** having a continuously moving lehr conveyor belt **11** of conventional form. A horizontal cross-conveyor **12** extends across the front end of the lehr and functions to position bottles **13**, one row at a time for pushing onto the lehr conveyor **11**. This cross-conveyor **12** is driven by a motor M operating through a speed reducer unit **14**, horizontal shaft **15**, sprockets **16** and a sprocket chain **17**. A dead plate **18** supports bottles upright as they are pushed from the cross-conveyor **12** onto the lehr conveyor **11**. One form of lehr loader may well comprise a horizontal pusher bar **18***a* suspended by arms **19** from one end of a vertically swingable, generally horizontally slidable supporting frame **20**. This frame is pivoted so that its bar carrying end and the pusher bar **18***a* may move vertically and clear a row of bottles just transferred to the lehr conveyor, so that it may retract away from the lehr.

Both reciprocation and vertical swinging movement of the pusher bar supporting frame are under the control of a pair of cams **21** which are mounted on a horizontal shaft **22** disposed parallel to the pusher-bar length. This shaft is journaled in a gear unit **23** suitably connected to the driven shaft **24** (FIGS. 2 and 3) of my differential timer T. Links **25** connect the cams **21** to the pusher-bar carrying frame **20**. Power is supplied to the timer from the aforementioned shaft **15**, through a direction change gear unit **26**, shaft **27**, sprockets **28**, sprocket chain **29**, a stub-shaft **30** connecting one of the sprockets **28** and a second direction change gear unit **31**, the latter having a driven sprocket **32** connected by a sprocket chain **33** to a sprocket **34** which constitutes part of my differential timer.

This timer is mounted upon the driven horizontal shaft **24** which is directly connected to the gear unit **23**. The aforementioned drive sprocket **34** is coaxial with and secured by a screw **36** or the like to the hub of a spur gear **37** rotatably mounted upon said shaft **24** within a gear housing **38**. An idler spur gear **39** of the same diameter as the first-named spur gear **37** meshes with the latter and is mounted for free rotation upon a jack-shaft **40** which is disposed parallel to and below the driven shaft **24**. An intermediate spur gear **41** which, in the interest of simplicity, is shown as being integral with the spur gear **39**, is mounted on said jack-shaft **40** for rotation with said gear **39**. This intermediate gear **41** is of slightly greater diameter than both the idler gear **39** and a driven spur gear **42**, the latter mounted upon the driven shaft **24** to which it may be secured by a key **43** or other suitable connecting device. As shown, the intermediate spur gear **41** and driven spur gear **42** run in mesh with each other. In the illustration, the intermediate gear **41** has thirty-two teeth and the driven spur gear **42** has thirty teeth. This may of course vary as conditions require. From the foregoing it is apparent that the motor M operates or drives, the cross-conveyor **18** to bring bottles seriatim in front of the lehr entrance and additionally serves as the drive means which moves the article pusher bar **18***a* through a closed path to thereby push rows of bottles onto the lehr conveyor **11**. Should the time of pusher bar advance be slightly off so that proper contact with the bottles is not being effected, it is necessary to either retard or advance initiation of the working stroke of the bar, such being obtained by manually rotating the driven shaft **24** to either advance or retard the angular position of said driven shaft **24** and correspondingly alter the position of the cams **21**. This is obtained by means comprising a timer sprocket **44** encircling the shaft **24** coaxially and secured by screws **45** to that end of the gear housing **38** remote from the drive sprocket **34**. By rotating this timer sprocket **44** the jack shaft carried spur gears **39** and **41** are moved about the driven shaft **24** and because of the difference in diameter of the intermediate gear **41** and driven gear **42** the latter will be advanced or

retarded angularly and correspondingly change the position of the cams **21** or other mechanism involved. Thus it will be readily apparent that variations in the timing relationship of cross conveyor **12** and pusher-bar **18***a* are exclusively affected when sprocket **44** is angularly displaced. Also, the antecedent speed of the shaft and its speed subsequent to the interval of adjustment are identical, whereas during the adjusting interval, the shaft speed is accelerated or decelerated, with respect to the antecedent speed, depending upon the direction of adjustment.

Because it is distinctly advantageous to be able to move this timer sprocket **44** from a remote point, or location, I utilize means comprising a manually rotatable horizontal timer shaft **46** (FIGS. 1 and 2) having a small sprocket **47** at one end connected by a sprocket chain **48** to the timer sprocket **44**. At its other or outer end, this timer shaft **46** may be provided with a hand crank **49** or handle, embodying a detent device **50** for releasably holding it in one fixed position.

It is believed clear that operation of the hand crank **49** causes movement of the housing **38** and the two spur gears **39** and **41** with the jack-shaft about the axis of the main driven shaft **24** causing either advancing or retarding of the angular position of the latter and consequent change in the time of occurrence of a specified mechanical operation.

Modifications may be resorted to within the spirit and scope and the appended claims.

I claim:

1. Differential timing apparatus comprising a rotatable shaft, a drive spur gear and a driven spur gear coaxially positioned about said shaft, said drive gear being free to rotate about said shaft and said driven gear being secured to said shaft for rotation as a unit, an idler gear and intermediate gear of different diameters rotatable about a common axis disposed proximate and parallel to said shaft, said idler gear meshing with said drive gear and serving to rotate said intermediate gear, said intermediate gear meshing with said driven gear, means supporting said idler gear and said intermediate gear for rotation as a unit, means for rotating said drive gear, means coupled to said idler gear and intermediate gear supporting means for angularly adjusting the common axis of said idler gear and said intermediate gear with respect to said shaft such that when said angular adjustment is affected, the speed of said shaft is altered during the interval of adjustment but subsequent to said adjustment is identical to its antecedent speed, and means coupled to said angular adjusting means for maintaining the latter in selected adjusted positions.

2. The differential timing apparatus of claim **1**, wherein said means for angularly adjusting the common axis of said idler gear and intermediate gear with respect to said shaft includes a rotatable member coaxial with said shaft, means coupling said member to said idler gear and intermediate gear supporting means, and means for rotating said rotatable member.

3. The differential timing apparatus of claim **1**, wherein said means supporting said idler and intermediate gears comprise a jack-shaft and a housing supporting said jack-shaft, said jack-shaft being disposed proximate and parallel to said rotatable shaft and said housing being disposed outwardly of said drive gear and driven gear and having said rotatable shaft extending therethrough.

4. The differential timing apparatus of claim **2**, wherein said rotatable member coaxial with said shaft comprises a sprocket.

5. The differential timing apparatus of claim **2**, wherein said means for rotating said rotatable member comprises a manually operable crank and means connecting said crank to said rotatable member.

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