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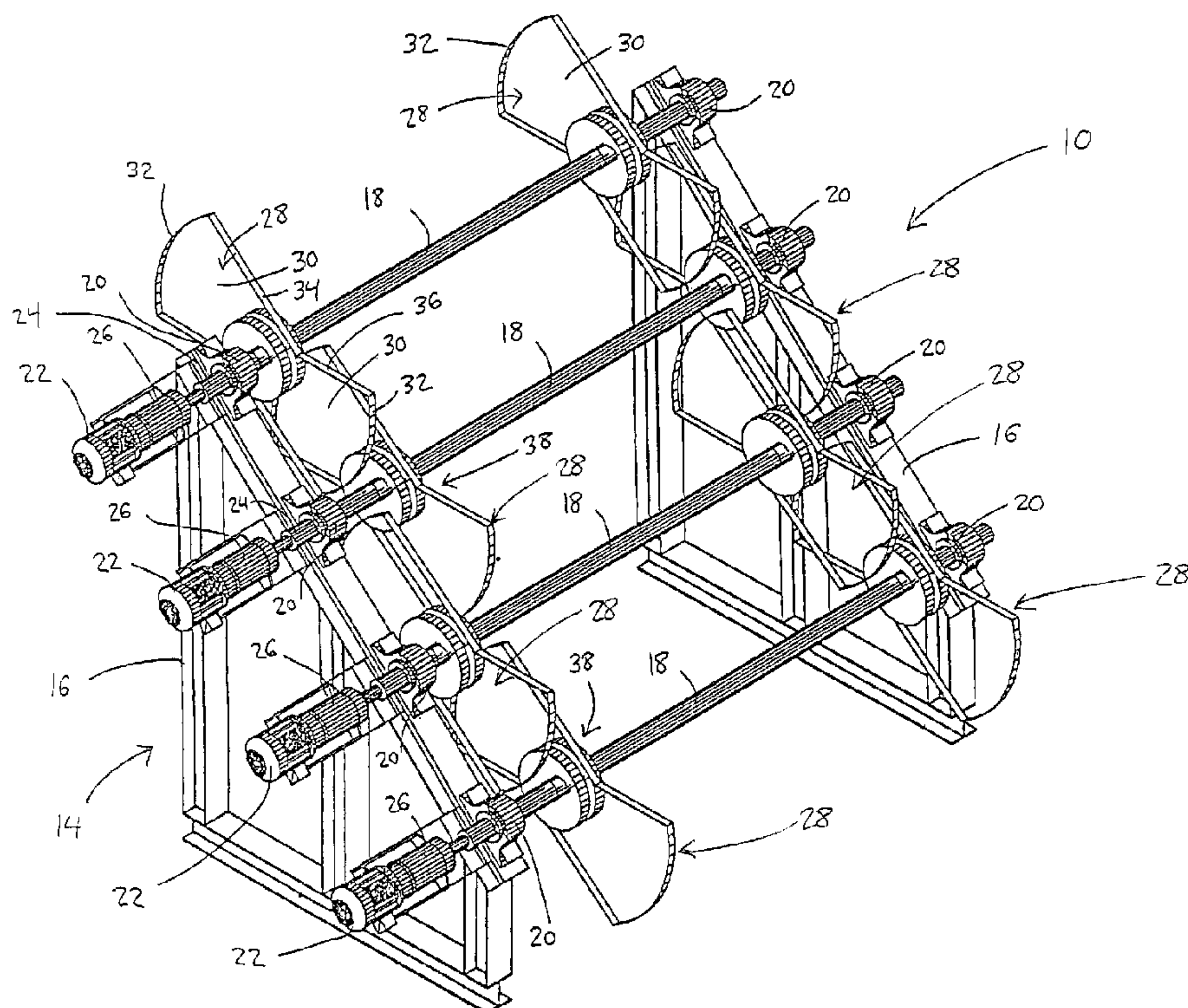
(72) Inventeur/Inventor:
KYRSTEIN, JOHN, CA

(73) Propriétaire/Owner:
KYRSTEIN INVESTMENTS LTD., CA

(74) Agent: OYEN WIGGS GREEN & MUTALA

(54) Titre : CONVOYEUR INCLINE

(54) Title: INCLINE CONVEYOR



(57) Abrégé/Abstract:

An incline conveyor for use in transporting logs from a first elevation to a second elevation in a sawmill. The conveyor includes a support frame and a plurality of rotatable shafts mounted on the support frame at spaced-apart positions between the first and second elevations. Log lifters having at least one log receiving portion are mounted on the rotatable shafts. Each of the shafts is driven by a separate motor mounted on the support frame. The lifters mounted on the shafts may thus be rotated at variable speeds to ensure that logs are discharged from the conveyor at a constant rate (thereby avoiding gaps between successive logs on the discharge conveyor belt). The motors are actuated and controlled by position sensors which detect the position of the logs between the first and second elevations.

INCLINE CONVEYOR

Abstract of the Disclosure

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15 logs on the discharge conveyor belt). The motors are actuated and controlled by position sensors which detect the position of the logs between the first and second elevations.

INCLINE CONVEYOR

Field of the Invention

5 This application relates to an improved conveyor for conveying logs up an incline in a sawmill production line. The conveyor minimizes the gaps between successive logs to enhance sawmill efficiency.

Background of the Invention

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 In sawmill production lines it is often necessary to move logs from one elevation to a higher elevation. For example, debarked logs may be conveyed from a storage bin up an incline to a discharge conveyor belt which delivers the logs one at a time to the cutting saws. Various devices
15 are known in the prior art for transporting logs up inclines of this sort in a controlled manner.

 For example, some incline conveyors employ chains driven by a head shaft, each of the chains having carriers welded thereon for
20 preventing logs from rolling down the incline. However, quite often the logs will not line up properly on the carriers and the misaligned logs will slide back into the storage bin. This results in a gap between logs on the discharge conveyor, resulting in less efficient log processing.

25 Other more sophisticated step feeders are also in common use. United States Patent No. 5,257,688, Fridlund, dated 2 November, 1993 discloses a step feeder for feeding logs up a rising support path. The logs are moved one step at a time up the incline at a constant rate. It is therefore not possible to selectively vary the transfer speed of one log

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relative to the other logs on the conveyor. Some step feeders include photocell sensors to measure the leading and trailing edges of successive logs. This log position information is used to control the timing of discharge of the logs from the step feeder onto the saw conveyor belt,
5 thereby reducing gaps between logs on the conveyor.

Quadrant feeders are also installed in many sawmills. Quadrant feeders comprise a large rotating frame having a log receiving portion which picks up a single log with each rotation and delivers it to
10 the discharge conveyor. Quadrant feeders suffer from the limitation that, if a log is missed on any cycle of the frame, a gap between successive logs will result on the discharge conveyor.

Another limitation common to conventional prior art incline
15 conveyors is that they are bulky in size and therefore difficult to install in existing sawmills without dismantling walls or buildings.

The need has therefore arisen for an incline conveyor which is modular in construction and is adapted for transferring logs at variable
20 speeds to achieve optimum production line performance.

Summary of the Invention

In accordance with the invention, the applicant's incline conveyor is adapted for moving an elongated workpiece, such as a log, between a first elevation and a second elevation. The conveyor comprises a frame; a plurality of shafts rotatably coupled to the frame at spaced-apart locations between the first elevation and the second elevation; and a plurality of lifters coupled to the shafts and rotatable therewith, each of the lifters having at least one workpiece receiving portion. The speed of rotation of each of the shafts is preferably independently controllable. In particular, the conveyor may include a plurality of motors mounted on the frame, each of the motors driving one of the shafts and being controlled by one or more position sensors identifying the position of the workpiece between the first and second elevations.

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The application also describes a method for conveying an elongated workpiece, such as a log, between a first elevation and a second elevation. The method includes the steps of (a) providing a frame for supporting a plurality of rotatable shafts extending at spaced-apart locations between the first and second elevations, each of the shafts having log lifters mounted thereon; (b) delivering the log to the log lifters mounted on one of the shafts; (c) actuating rotation of said one of the shafts to move the log to approximately the elevation of a next-in-sequence one of the shafts; (d) sensing the position of the log at the elevation of step (c); (e) actuating rotation of the next-in-sequence shaft to cause the transfer of the log from the log lifters mounted on said one of the shafts to the log lifters mounted on the next-in-sequence one of the shafts; and (f)

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repeating steps (c) - (e) until the log has been transferred between the first elevation and the second elevation.

Brief Description of the Drawings

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In drawings which illustrate a preferred embodiment of the invention, but which should not be construed as restricting the spirit or scope of the invention in any way,

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Figure 1 is an isometric view of the applicant's incline conveyor;

Figure 2 is a side elevational view of the incline conveyor of Figure 1;

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Figure 3 is an end elevational view of the incline conveyor of Figure 1; and

Figure 4 is a side elevational view of a rotary log lifter component of the incline conveyor of Figure 1.

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Detailed Description of the Preferred Embodiment

This application relates to an incline conveyor 10 for conveying elongated workpieces, such as logs, from one elevation to a higher elevation. Conveyor 10 is particularly adapted for the efficient transport of logs in a sawmill.

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As shown in Figure 1, conveyor 10 includes a support frame 14 consisting of spaced-apart support members 16 preferably constructed from metal tubing. A plurality of rotatable connector shafts 18 are mounted on frame 14 at different elevations. The ends of each shaft 18 are supported in bearings 20 mounted on a respective support member 16. Rotation of each shaft 18 is driven by a corresponding variable speed drive motor 22 mounted on a support member 16. Each motor 22 is coupled to one end of a corresponding shaft 18 by means of a bearing 20, a coupling 24 and a gearbox 26 preferably having a 60:1 gear ratio.

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A pair of rotary lifters 28 are coupled to end portions of each connector shaft 18. Lifters 28 are keyed and timed to rotate at the same speed as the respective shaft 18. As shown best in Figure 2, the longitudinal positions of lifters 28 are staggered so that all of the lifters 28 may rotate simultaneously at variable speeds without obstruction. Each lifter 28 has first and second blades 30 having curved end edges 32 (Figure 4). The side edges 34, 36 of blades 30 taper inwardly to form a pair of opposed log receiving portions 38. Lifters 28 are preferably fabricated by machining a circular metal wheel having the desired diameter and cutting first and second wedge-shaped segments from the wheel to define the log receiving portions 38.

As should be apparent to someone skilled in the art, the spacing between each pair of lifters 28 may be adjusted to suit the length of the logs 12 to be transported. For example, for 8 foot logs, lifters 28 are preferably spaced about 6 feet apart.

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Conveyor 10 is modular in nature. Thus, two or more conveyors may be aligned side-by-side to accommodate logs 12 of any desired length. The modular nature of conveyor 10 also allows for easy installation into existing sawmills without dismantling any walls or
5 buildings.

In use, conveyor 10 is adapted for transporting logs 12 up an incline in stages from an input elevation 40 to an outlet elevation 42 (Figure 3). For example, in many sawmill operations logs are transferred
10 to a storage pit after debarking. The logs must then be conveyed one at a time from the storage pit to a discharge conveyor belt which delivers the logs to the saws. In this example, the log storage pit is the input elevation 40 and the discharge conveyor belt 42 is the output elevation 42. For optimum sawmill performance, logs 12 must be delivered to the discharge
15 conveyor belt in a controlled manner with no gaps between successive logs.

As shown in Figure 3, logs 12 are delivered to the first stage of conveyor 10 at an elevation approximating that of the lowermost
20 connector shaft 18. Logs 12 are oriented so that their longitudinal axis is parallel to the longitudinal axis of shafts 18. As the first log 12 approaches the lowermost connector shaft 18, a first photo cell or cam switch control (not shown) triggers a motor 22 to drive rotation of the lowermost shaft 18. The spaced-apart lifters 28 mounted on the lowermost shaft 18 rotate with
25 the shaft to receive the first log 12 in one of the log-receiving portions 38. The remaining shafts and lifters 28 comprising conveyor 10 remain parked in a stationary position. As the lowermost shaft 18 rotates, the first log 12

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is moved upwardly to the second stage of conveyor 10 where it is deposited into the lifters mounted on the next highest or second stage shaft 18 (Figure 3). The second stage shaft 18 and the lifters 28 mounted thereon are triggered to rotate when a second photo cell sensor or cam switch control signals to the corresponding drive motor 22 that the first log 12 has reached a height sufficient to be received by the second stage lifters 28. The first log 12 is then conveyed upwardly to the third stage of the conveyor 10 in a similar manner, and so on, until the log 12 is ultimately discharged on to the saw conveyor at outlet elevation 42.

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The next-in-sequence logs 12 are transported upwardly by conveyor 10 from input elevation 40 to output elevation 42 in a similar manner (Figure 3). Each lifter arm 28 is configured so that as one log is deposited from one of the log-receiving portions 38 to the next stage in the conveyor, the next-in-sequence log is received by the opposite log-receiving portion 38. Accordingly, each full rotation of the uppermost shaft 18 deposits two successive logs onto the discharge conveyor at output elevation 42.

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The speed of rotation of shafts 18 may be selectively varied to ensure that gaps between logs 12 on the discharge conveyor are minimized. For example, if the conveyor 10 fails to pick up a log 12 from the storage bin due to production line malfunctions or the like, this is detected by the conveyor's log position sensors which are interfaced with a microprocessor. The microprocessor in turn sends a "catch-up" signal to the motors 22 driving the lower shafts 18 to cause such shafts 18 to rotate at an increased rate in comparison to the upper shafts 18. This ensures

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that the gap between successive logs on the conveyor 10 (caused by the production line malfunction) will be reduced or eliminated as the logs 12 move toward the upper stages of conveyor 10. Thus the time lost by the missing log(s) 12 will effectively be recovered, thereby avoiding a degradation in sawmill performance. It is anticipated that the top speed of conveyor shafts 18 will be on the order of 20 revolutions per minute.

Another advantage of selectively controllable drive motors 22 is that shafts 18 and attached lifters 28 may be "parked" in a stationary position when not required. This results in enhanced energy efficiency. For example, immediately following start-up only the lowermost shaft 18 will be triggered to rotate; the upper shafts 18 will remain stationary until log(s) 12 have been moved to the corresponding upper stages of the conveyor 10. Conversely, if the delivery of logs 12 to conveyor 10 stops, this will be sensed by log position sensors and the lowermost lifters 28 will be parked in a stationary position.

As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

WHAT IS CLAIMED IS:

1. An incline conveyor for moving an elongated workpiece from a first elevation to a second elevation, comprising:

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(a) a frame;

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(b) a plurality of shafts rotatably coupled to said frame at spaced-apart locations between said first elevation and said second elevation; and

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(c) a plurality of lifters coupled to said shafts and rotatable therewith, each of said lifters having at least one workpiece receiving portion.

2. The conveyor of claim 1, wherein the speed of rotation of each of said shafts is independently controllable.

3. The conveyor of claim 2, further comprising a plurality of motors mounted on said frame, wherein each of said motors drives one of said shafts.

4. The conveyor of claim 3, wherein each of said motors is controlled by a position sensing means identifying the position of said workpiece between said first and second elevations.

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5. The conveyor of claim 1, wherein said frame comprises first and second sections spaced apart a distance greater than the length of said workpiece and wherein said connector shafts extend between said first and second sections.

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6. The conveyor of claim 5, wherein first and second lifters are mounted on each of said connector shafts proximate end portions thereof, wherein said lifters are adapted to support said workpiece such that a longitudinal axis thereof extends parallel to longitudinal axes of said connector shafts.

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7. The conveyor of claim 6, wherein each of said lifters comprise opposed first and second workpiece receiving portions.

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8. The conveyor of claim 5, wherein said connector shafts are spaced between a front end and a rear end of said frame such that a plane intersecting said connector shafts is non-vertical.

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9. The conveyor of claim 5, wherein said lifters are mounted on said connector shafts at staggered longitudinal positions, whereby the rotation of one of said lifters will not obstruct the rotation of another one of said lifters mounted on an adjacent one of said shafts.

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25 A modular incline conveyor for moving logs one at a time from a first elevation to a second elevation, comprising:

(a) a frame;

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(b) a plurality of shafts coupled to said frame at spaced-apart locations between said first elevation and said second elevation; and

(c) a plurality of rotatable lifters coupled to said shafts, each of
5 said lifters having at least one log receiving portion,

wherein each of said logs is moved in stages between said lifters mounted on a lowermost one of said shafts extending at said first elevation and said lifters mounted on each of shafts extending above said lowermost shaft.

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11. A method of moving a log between a first elevation and a second elevation comprising the steps of:

(a) providing a frame for supporting a plurality of rotatable shafts
15 extending at spaced-apart locations between said first and second elevations, each of said shafts having log lifters mounted thereon;

(b) delivering said log to said log lifters mounted on one of said shafts;

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(c) actuating rotation of said one of said shafts to move said log to approximately the elevation of a next-in-sequence one of said shafts;

(d) sensing the position of said log at the elevation of step (c);

25

(e) actuating rotation of said next-in-sequence shaft to cause the transfer of said log from said log lifters mounted on said one of said

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shafts to said log lifters mounted on said next-in-sequence one of
said shafts; and

(f) repeating steps (c) - (e) until said log has been transferred
5 between said first elevation and said second elevation.

Oyler & Wight
Greene & Wight
PATENT AGENTS

Oscar Williams
Queen & Maitland
 PATENT AGENTS

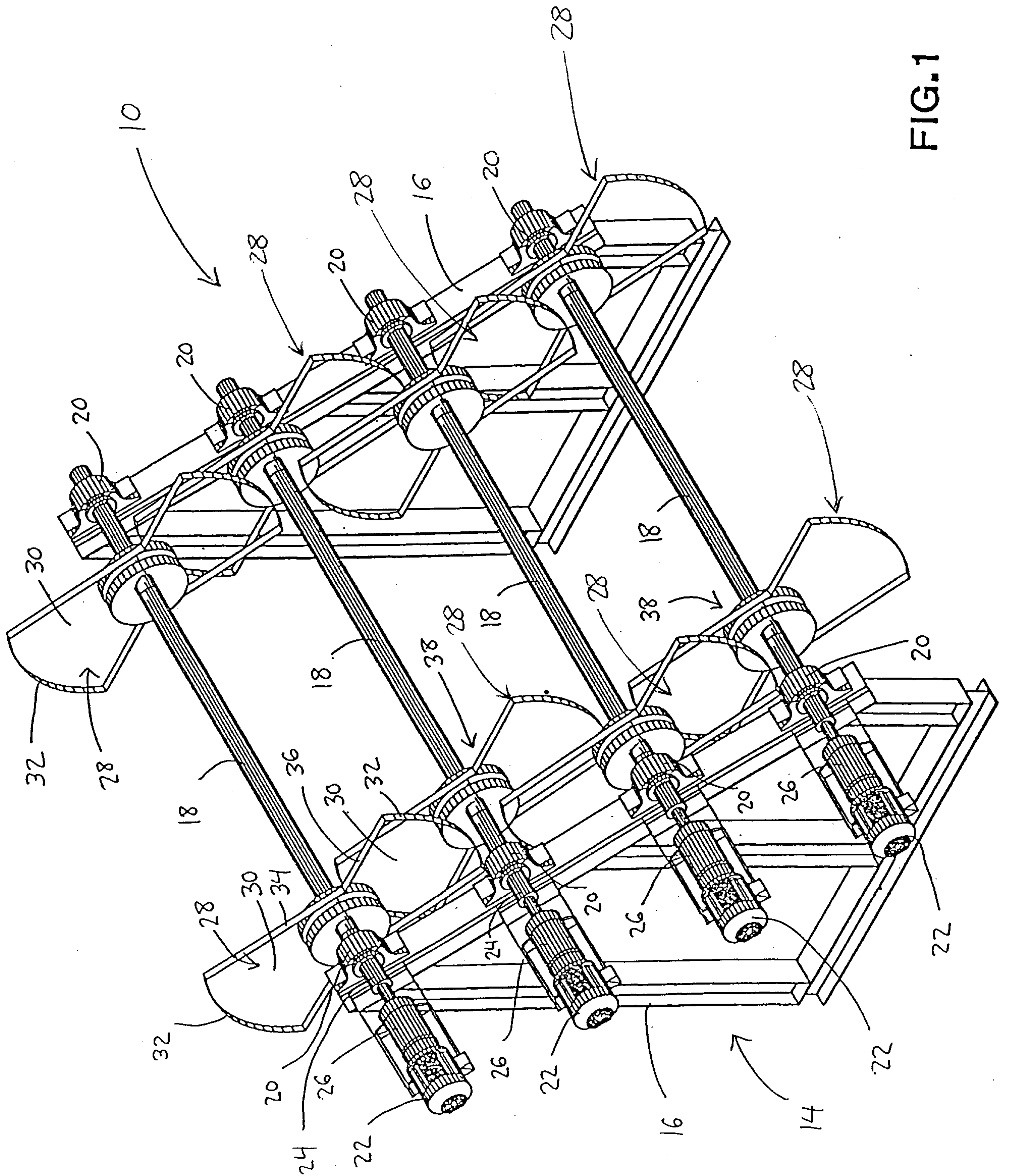


FIG. 1

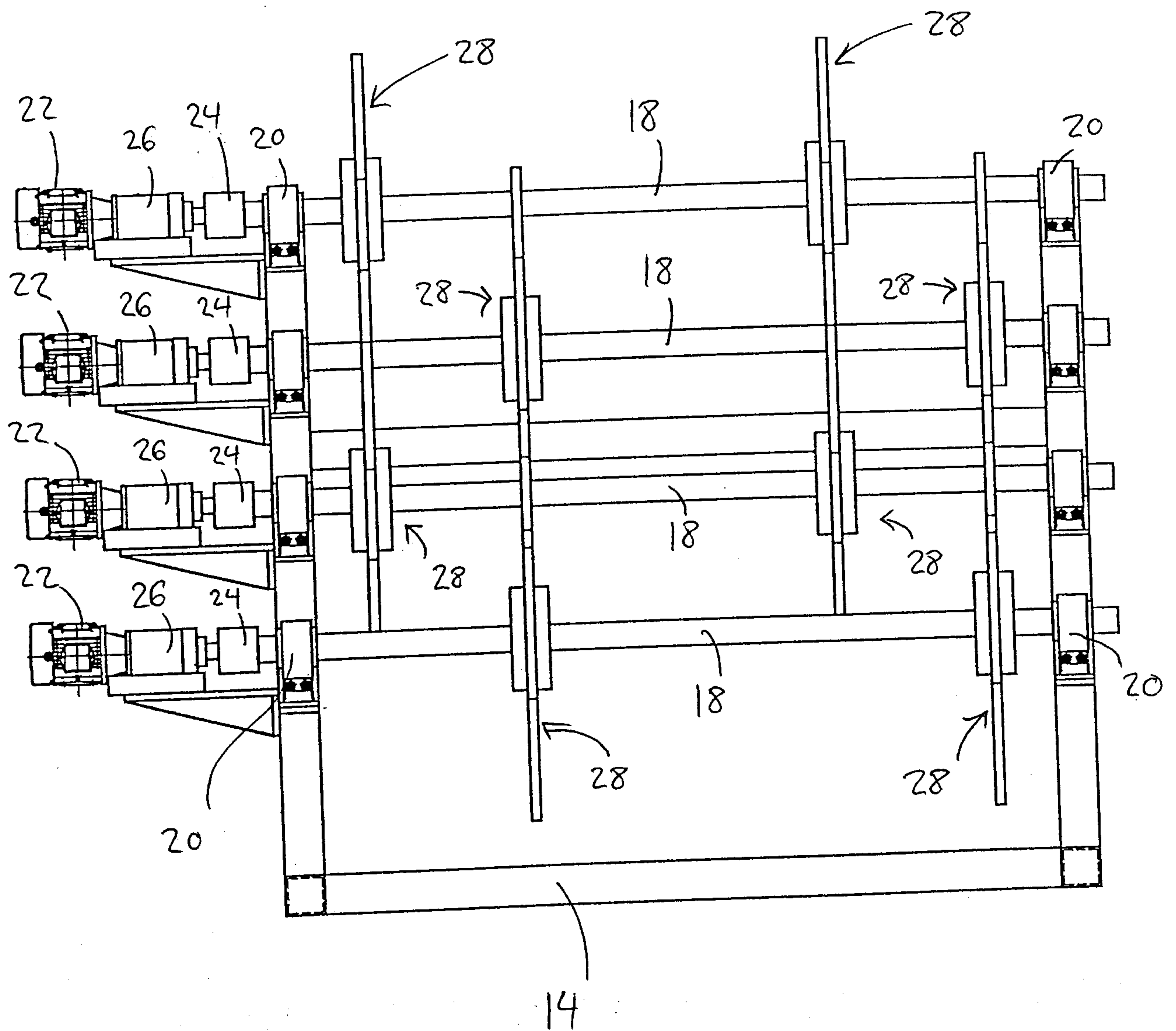


FIG.2

Oyen Wiggs
Green & Mutala
 PATENT AGENTS

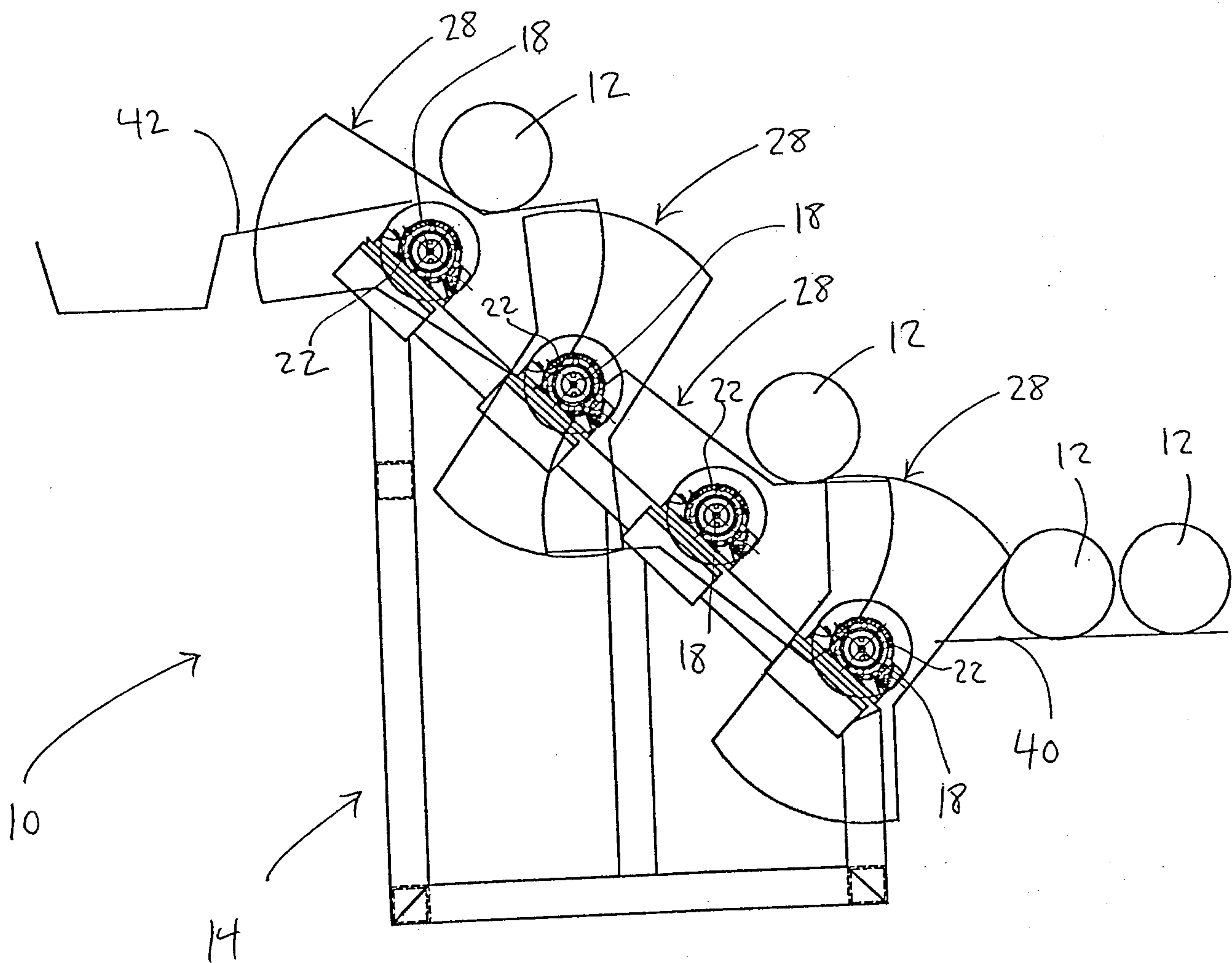


FIG.3

Owen Wiggs
Green & Mitala
 PATENT AGENTS

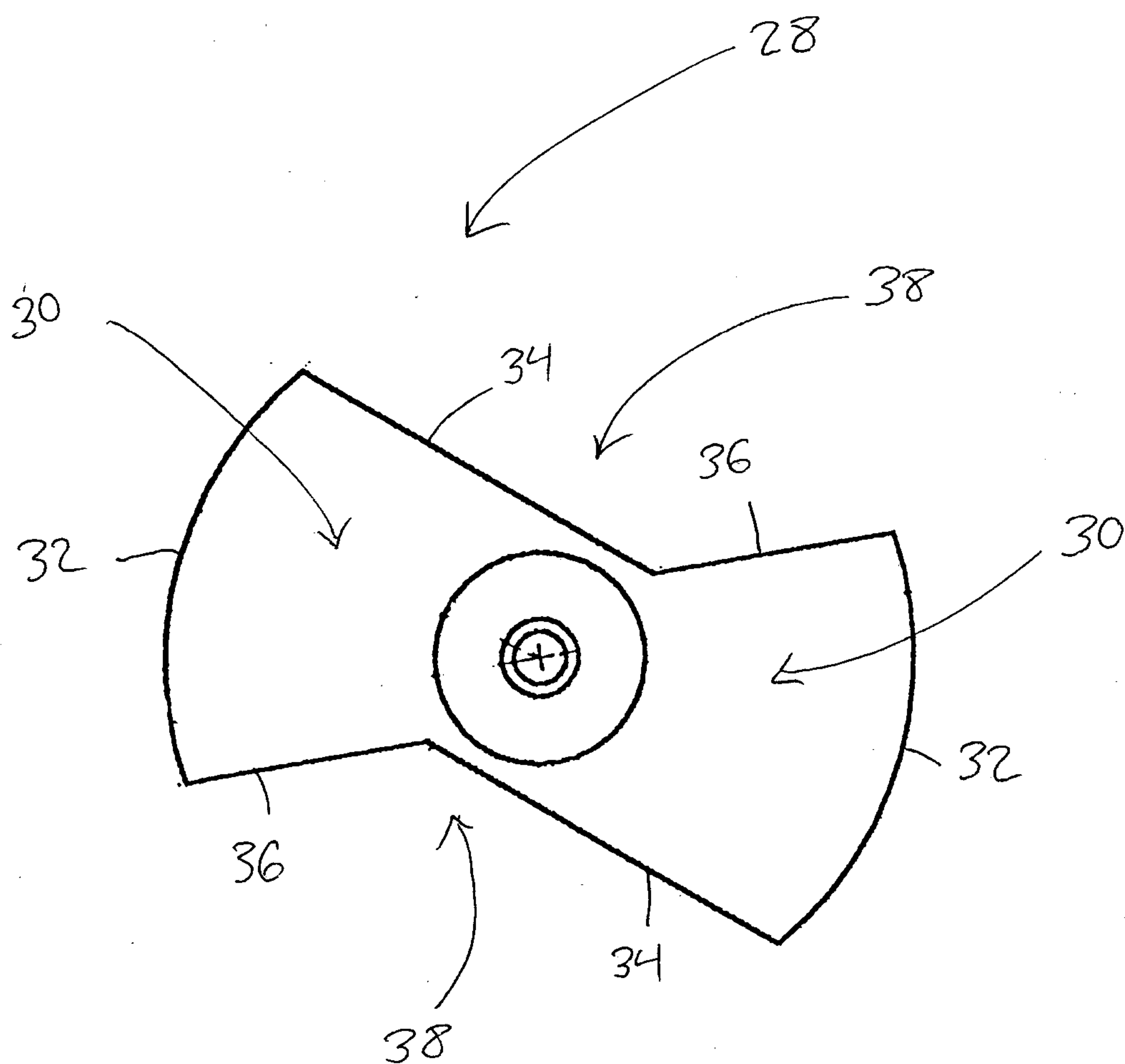


FIG. 4

Owen Wiggs
Green & Mutala
PATENT AGENTS

