United States Patent [19]

Heiland

[11] **3,848,734**

[45] **Nov. 19, 1974**

[54] **DOCTORING APPARATUS**

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[73] Assignee: **The United States of America as represented by the Secretary of Agriculture,** Washington, D.C.

[22] Filed: **June 14, 1973**

[21] Appl. No.: **370,094**

[52] **U.S. Cl.** **198/230,** 198/188

[51] **Int. Cl.** **B65g 45/00**

[58] **Field of Search** 198/230, 188; 74/230

[56] **References Cited**

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[57] **ABSTRACT**

An apparatus for continuous, uninterrupted doctoring of material from a moving belt combines a stand-by blade and a multiple-bladed assembly, each of which is supported on the lower ends of a pair of pivotally mounted lever arms. The multiple-bladed assembly is rotatable and is provided with ratchet and pawls for indexing when a new blade is needed for doctoring. Actuating and sequence timing means engage the upper ends of the two pairs of lever arms and provide the energy needed for doctoring and for indexing the multiple-bladed assembly. When it is time to provide a new blade for doctoring, the stand-by blade is moved into doctoring position, the multiple-bladed assembly is then retracted, automatically indexed to the next blade in sequence, and returned to the doctoring position after which the stand-by blade is retracted.

2 Claims, 6 Drawing Figures

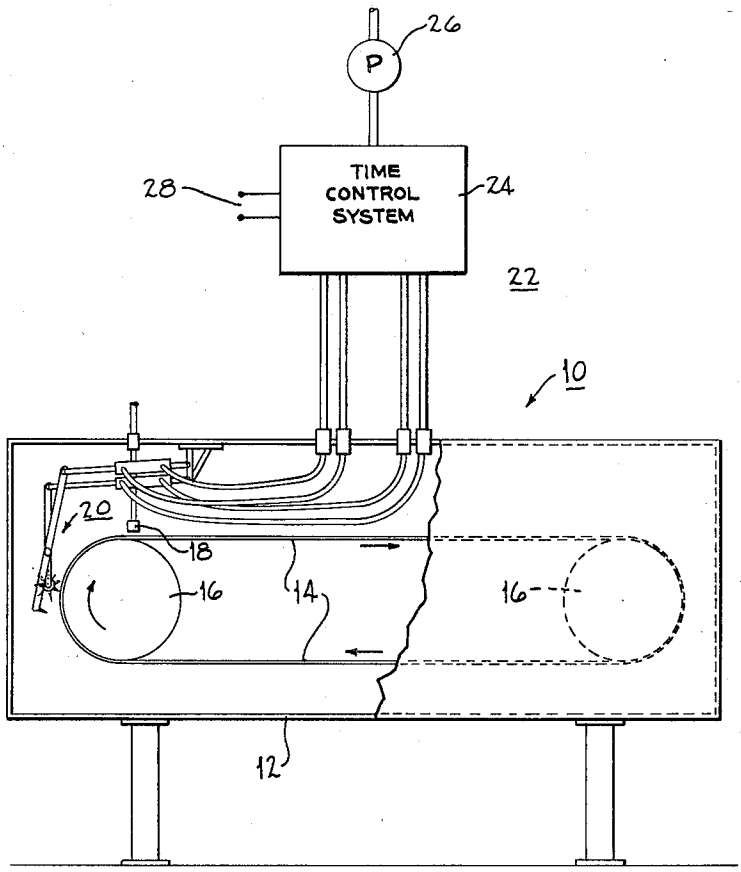


Fig. 1

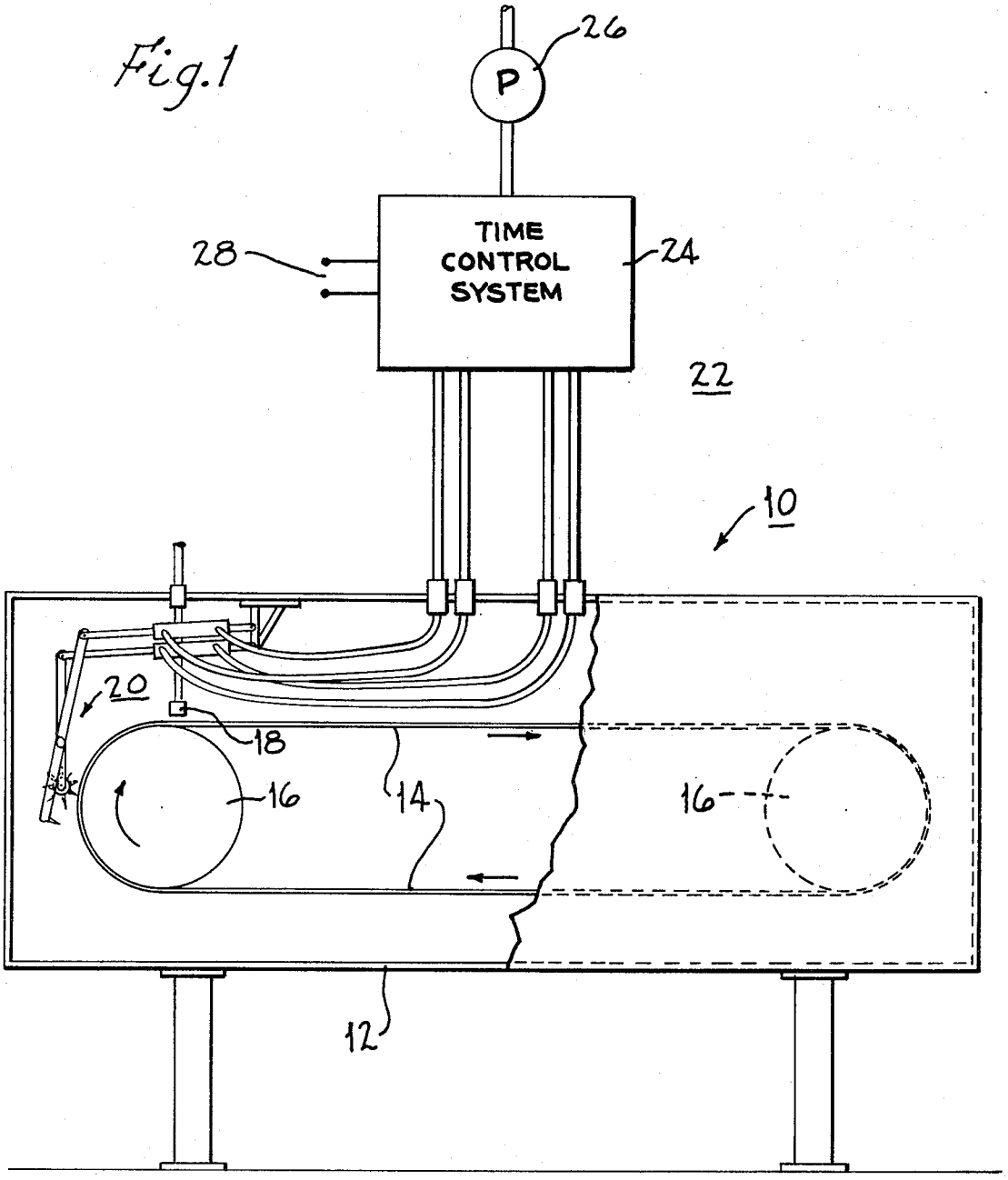


Fig.2

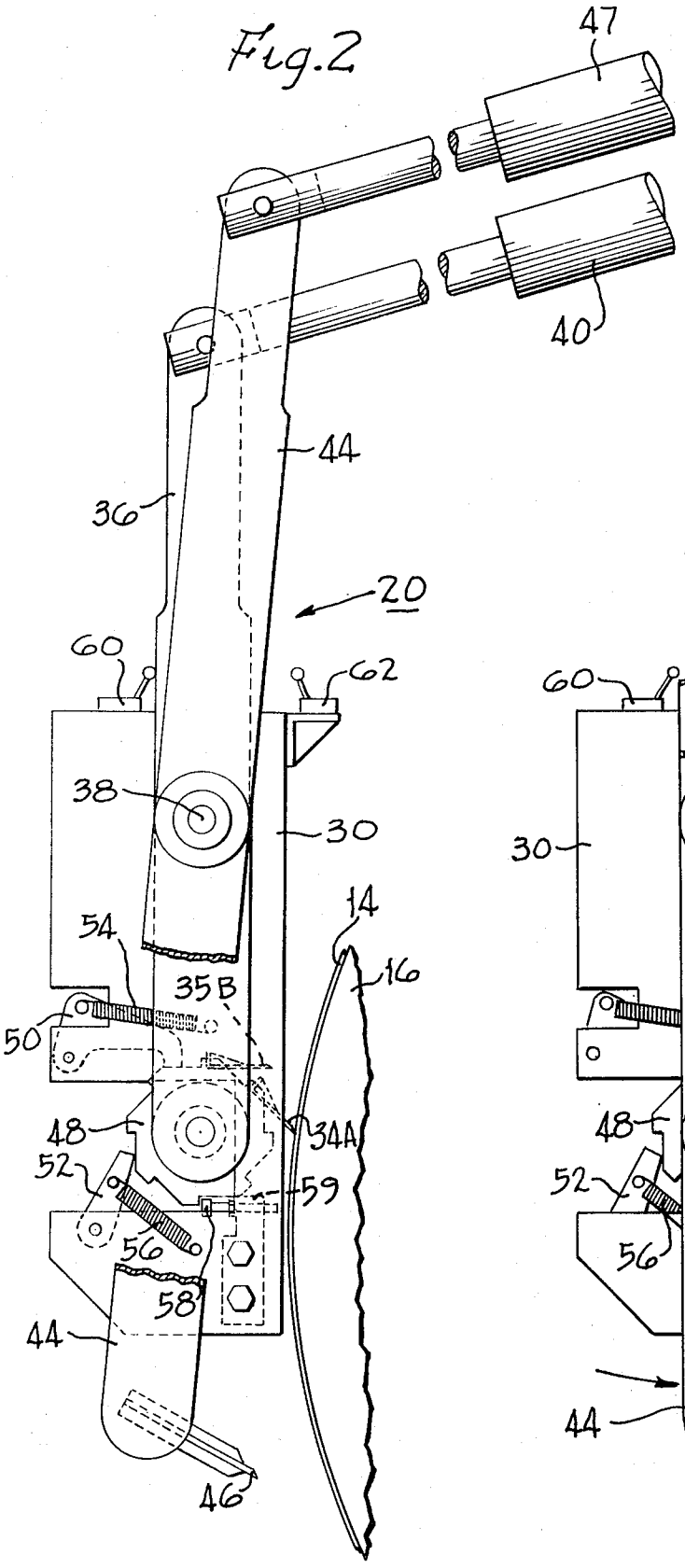

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35B
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34A
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Fig.4

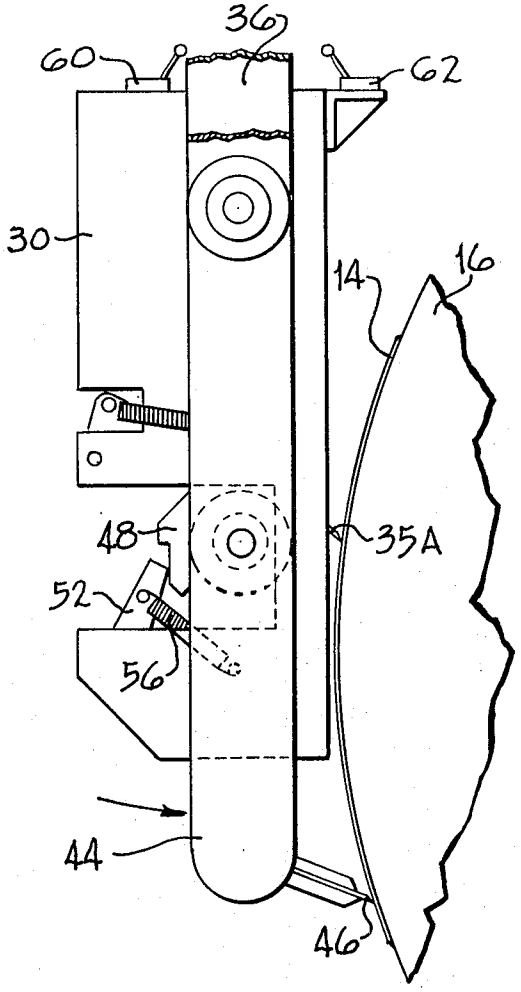
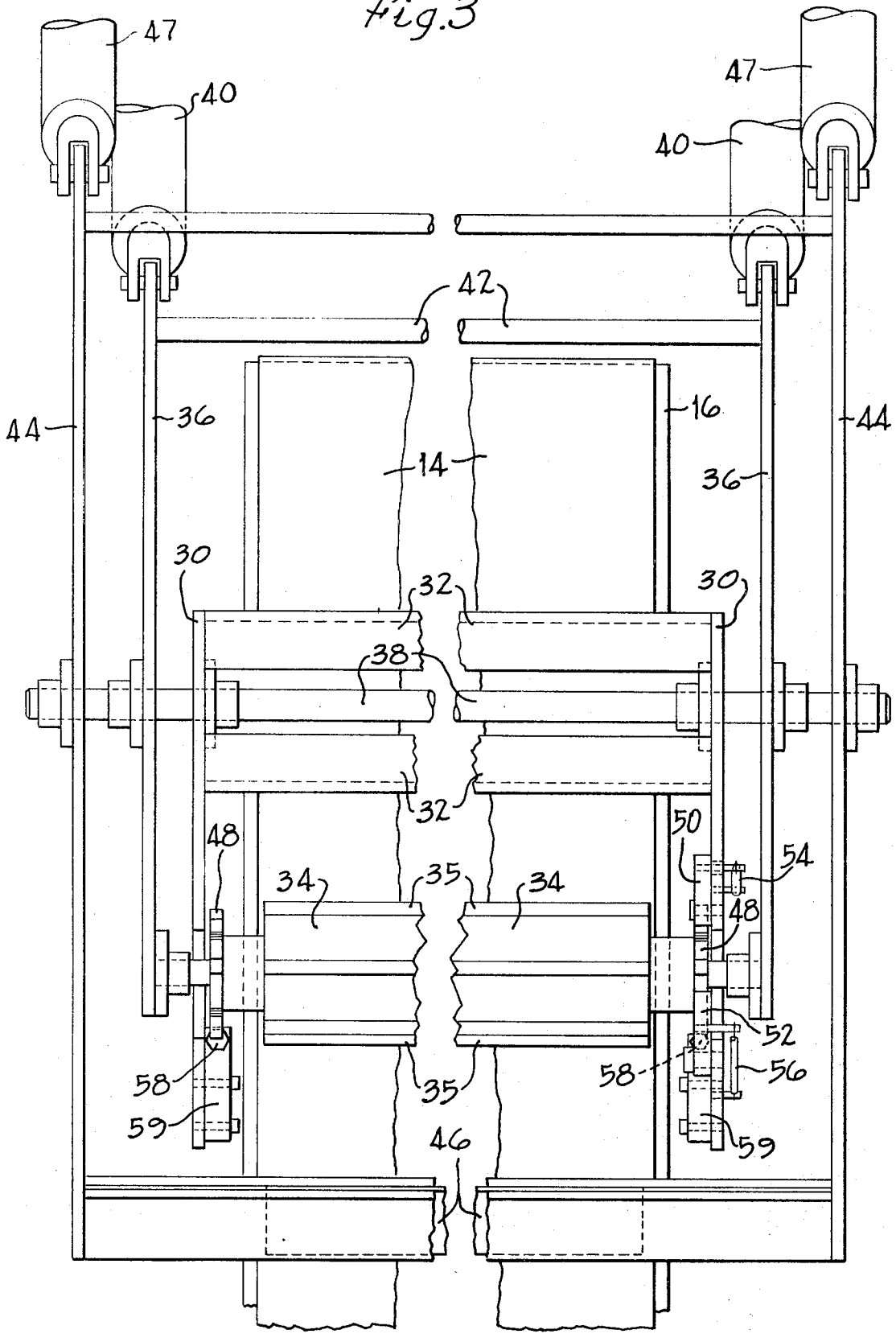

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35A
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Fig.3


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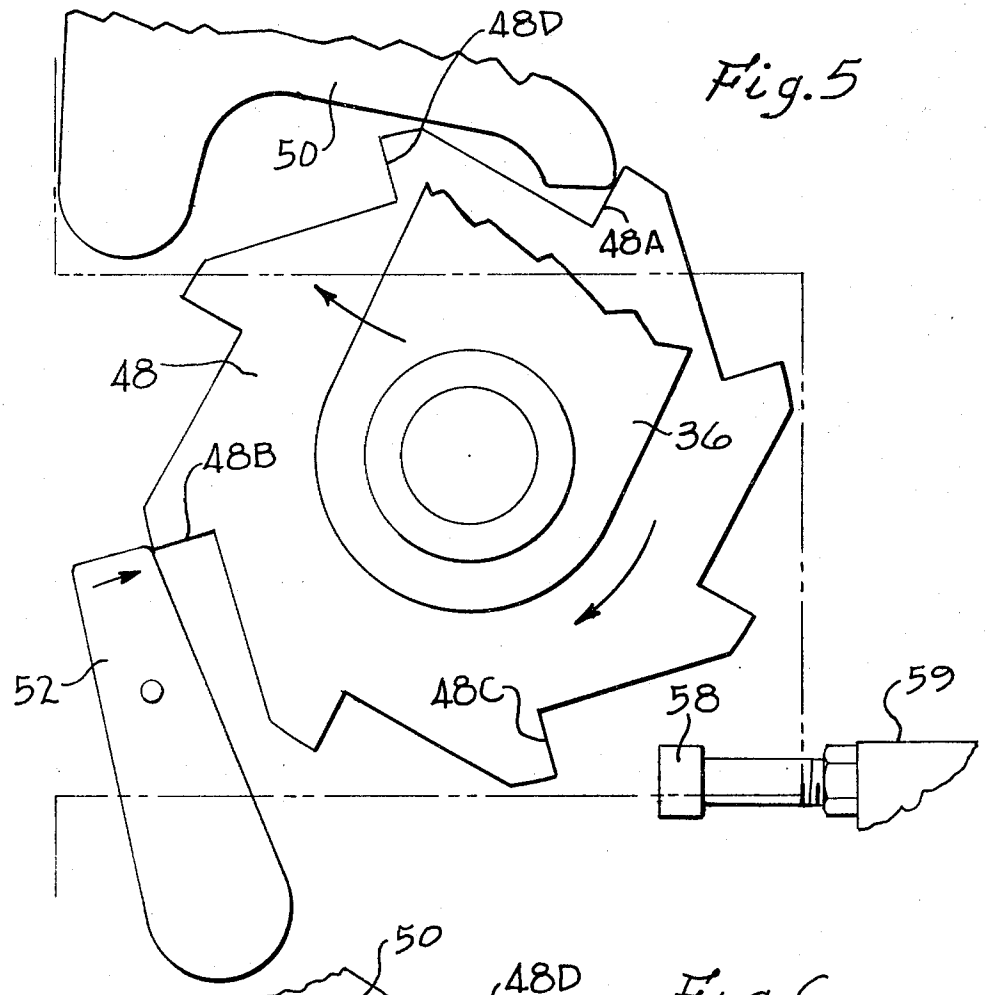

48D
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48A
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48B
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48C
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Fig. 5

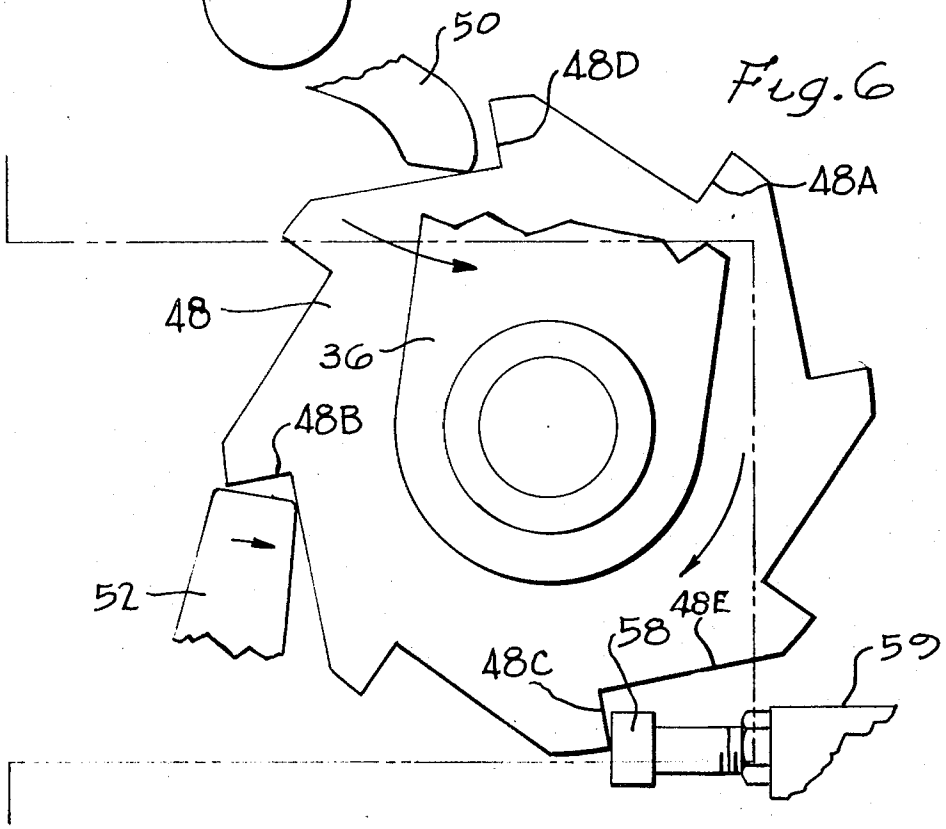

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48D
48A
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48B
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48E
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48C
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Fig. 6

DOCTORING APPARATUS

A non-exclusive, irrevocable, royalty-free license in the invention herein described, throughout the world for all purposes of the United States Government, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

This invention is related to a multiple-bladed doctor apparatus for doctoring a product from a rotating drum or a moving belt. More specifically, it relates to a combination of a single and multiple-bladed doctoring apparatus for providing uninterrupted doctoring of material from a rotating drum or a moving belt.

Doctoring by means of a stationary blade in contact with a moving belt or drum is well known and has been applied successfully in many instances in various configurations and under various conditions. However, there are doctoring problems that cannot be satisfactorily resolved by the use of available doctoring devices. One of these problems is the removal of milk powder which has been vacuum dried on a moving stainless steel belt to a moisture content of about 2 to 3 percent.

In order to be economically feasible, a vacuum belt drying process for producing milk powder must be operated continuously for many days. Furthermore, to make a quality product, efficient doctoring is essential because any product that remains on the belt past the doctoring point will contribute to an unacceptable cooked or scorched flavor. In addition, the materials and design of any new doctoring apparatus must conform with the sanitation standards of the diary industry.

An object of this invention is to provide an efficient and continuous means of doctoring material from a moving belt or drum.

Another object of this invention is to provide a means for replacing a doctor blade without interrupting the doctoring of material from a moving belt.

Still another object is to provide an apparatus by which the above means can be accomplished.

A further object is to provide an apparatus having a multiple-bladed assembly in which the same source of power operates indexing of the multiple-bladed assembly and provides the force needed for the doctoring operation.

According to this invention the above objects are accomplished by an apparatus that combines a stand-by blade and a multiple-bladed doctor assembly with a conventional actuating and sequence-timing means so that when a blade change is needed the stand-by blade is brought into doctoring position and after a short time delay the multiple-bladed assembly is withdrawn and automatically indexed to bring the next blade in sequence into position. The multiple-bladed assembly is returned to the doctoring position after which the stand-by blade is withdrawn until another blade change is needed.

The apparatus will be described with reference to the drawings wherein:

FIG. 1 illustrates schematically the apparatus assembled with a typical application.

FIG. 2 is a side view of the apparatus in detail in operating position.

FIG. 3 is a front view with center portion broken away.

FIG. 4 shows the stand-by doctor blade in operating position to maintain production during the indexing cycle.

FIG. 5 shows the first stage of the indexing cycle.

FIG. 6 shows the final stage of the indexing cycle.

In FIG. 1 a dryer 10 is schematically shown having an enclosure 12, a continuous stainless steel conveyor belt 14 driven over rolls 16 in the direction indicated by the arrows, a spray head or applicator 18, and a combination single blade and multiple-bladed doctor assembly 20.

A hydraulic actuating means 22 for operating the doctor blade assembly at predetermined periods is also shown in FIG. 1. Since this can be accomplished manually or by various electrical, hydraulic and/or pneumatic systems, a simple time control system 24 is indicated for actuating the necessary valves periodically in a time sequence to effect the desired motions. A source of pressurized fluid is indicated at 26 and an electrical source at 28.

FIGS. 2 and 3 show the combination single and multiple-bladed assembly 20 in detail. The assembly is supported by a pair of plates 30 held together rigidly by cross members 32. A doctor roll 34 supporting eight doctor blades, of which only 35A and 35B are indicated in the drawing, is suspended rotatably on the lower ends of lever arms 36 which are pivotally mounted on shaft 38 journaled on side plates 30. The upper ends of lever arms 36 are connected to the actuating and sequence time means through hydraulic cylinders 40. Tie rod 42 is provided to improve rigidity.

Also pivotally mounted on shaft 38 are another pair of lever arms 44 which support a stand-by doctor blade 46 on their lower ends and are connected at their upper ends to the actuating and sequence timing means through hydraulic cylinders 47.

Secured to multiple-bladed doctor roll 34 are a pair of ratchet wheels 48 which function to index doctor roll 34 when a blade change is needed and to position the doctoring blade against the moving belt. Since indexing requires only a small amount of energy relative to that needed for doctoring, pawls 50 and 52 are provided only on the right side of the apparatus as seen in FIG. 3. The pawls are pivotally mounted on right plate 30 and are biased against the surfaces of ratchet wheel 48 by springs 54 and 56, respectively. Adjustable stops 58 and 59, which are displayed most prominently in FIGS. 5 and 6, are provided on both sides of the apparatus. Adjustable stop 58 prevents counter-clockwise rotation of multiple-bladed doctor roll 34 during the indexing cycle thus allowing pawl 50 to engage ratchet wheel 48 at the next succeeding tooth face. Adjustable stop 59 prevents clockwise rotation of doctor roll 34 after a new doctor blade has contacted belt 14 and thus bears the full force of the doctoring operation. Limit switches 60 and 62 control the extremes of hydraulic system 22 for the indexing cycle.

DESCRIPTION OF OPERATING CYCLE

Indexing of the blades on doctor roll 34 is initiated by time control system 24. The time sequence is predetermined by experience. When it is time for a blade to be changed, cylinders 47 are actuated, thus pivotally rotating lever arms 44 and moving blade 46 into doctoring position as shown in FIG. 4. After a short time delay, cylinders 40 are actuated and cause lever arms 36 to rotate pivotally in a clockwise, i.e., in the same direc-

tion of rotation as the belt 14, direction thus withdrawing doctor roll 34 and associated blades 35 away from belt 14. As lever arms 36 continue their clockwise movement, doctor roll 34 and accompanying ratchet wheels 48 move away from belt 14, tooth face 48A of ratchet 48 contacts pawl 50 (FIG. 5) and remains in contact causing roll 34 to rotate clockwise until pawl 52 falls into contact with tooth face 48B. Shortly thereafter, lever arm 36 contacts limit switch 62 causing actuating cylinders 40 to reverse the rotation of lever arms 36. The counter-clockwise movement of lever arms 36 in conjunction with the contact of pawl 52 and tooth face 48B causes further clockwise rotation of doctor roll 34. Near the end of the counter-clockwise movement of lever arms 36, tooth face 48C contacts indexing stop 58 causing further clockwise rotation of doctor roll 34 until pawl 50 drops down behind tooth face 48D (FIG. 6). In the final phase of the indexing cycle, the new doctor blade 35B contacts belt 14 and, because of the reactive doctoring force, causes still further clockwise rotation of doctor roll 34 until pawls 50 and 52 and indexing stops 58 clear their respective ratchet tooth faces and surface 48E of ratchet wheel 48 contacts doctoring stop 59 and stops the rotation to complete the indexing cycle. Lever arm 36 then contacts limit switch 60 initiating retraction of stand-by doctor blade 46 and resetting of sequence timer.

I claim:

1. A doctoring apparatus for uninterrupted doctoring of material from a moving belt comprising a multiple-bladed doctor assembly rotatably mounted and provided with means for indexing said assembly by rotating said assembly in the same direction of rotation as the moving belt to provide a new blade in doctoring position, a single blade for doctoring during the indexing operation of the multiple-bladed assembly, a first pivotal means engaging said multiple-bladed doctor assembly for moving said assembly in and out of doctoring position, a second pivotal means engaging said single blade for moving said blade in and out of doctoring position during the indexing operation of the multiple-bladed assembly and actuating and sequence timing means engaging said first and second pivotal means for controlling the sequence and timing of the operations and providing the energy for indexing and for doctoring.

2. An apparatus for uninterrupted doctoring of material from a moving belt, comprising:

a. a supporting means for the apparatus;

b. a multiple-bladed doctor assembly mounted on said supporting means and provided with ratchet and pawls for indexing said assembly by allowing said assembly to rotate in the same direction of rotation on the moving belt, thereby placing the next blade in sequence in doctoring position;

c. a single blade mounted on the supporting means for doctoring during the indexing operation of the multiple-bladed assembly;

d. a first pair of lever arms rotatably suspending at their lower ends the multiple-bladed doctor assembly, said lever arms being pivotally mounted on the supporting means for moving the multiple-bladed assembly in and out of doctoring position;

e. a second pair of lever arms fixedly suspending at their lower ends the single doctor blade, said lever arms being pivotally mounted on the supporting means for moving the single blade in and out of doctoring position;

f. an actuating and sequence timing means engaging said first and second pairs of lever arms, said means controlling the sequence and timing of the operations and providing the force needed for indexing and for doctoring.

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