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Baughman et al.

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[54] **CONTINUOUS CLEANING APPARATUS**

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[52] **U.S. Cl.** **51/15**

[51] **Int. Cl.** **B24c 3/30**; B24c 3/14

[58] **Field of Search** 51/9, 14, 15, 319, 320, 51/321; 198/24, 85; 134/144

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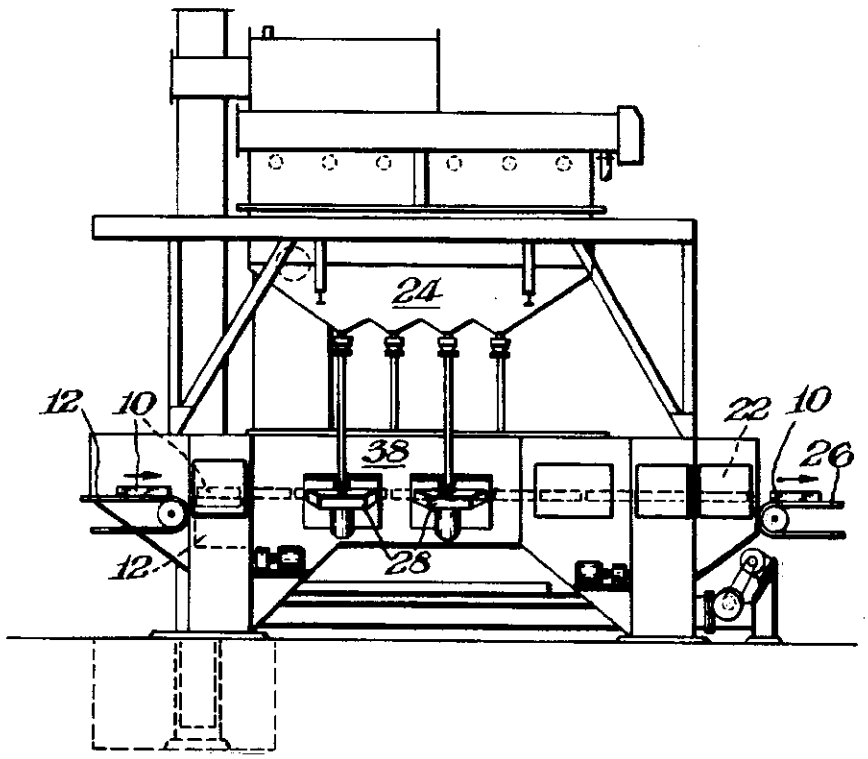
[57] **ABSTRACT**

Automotive heads and manifolds or like molded or cast articles are continuously cleaned by projected streams of impinging particles, by pushing a series of such articles axially into one end of an elongated skeletal barrel that holds these articles in position and rotates them in the path of such impinging streams while they are so held. The successive articles are pushed into one end of the barrel and these push cleaned articles out of the other end of the barrel.

18 Claims, 15 Drawing Figures



CONTINUOUS CLEANING APPARATUS

This invention relates to an apparatus which is particularly suitable for cleaning large batches of parts or continuously fed parts such as automobile heads, manifolds, etc.

Present methods most often used to get high production parts such as automobile heads, manifolds, etc., through a cleaning blast is to hang them on a monorail rotating hook. Another method commonly used involves conveyor fed machines that do not rotate the parts but instead locate the blast wheel streams at various angles around the conveyed parts to get full coverage. Both methods give inefficient blast application. For example with the monorail method, blast time is lost in going from station to station. Additionally only a portion of the total blast hits the part; the head stream and tail stream of necessity miss the part completely. With the second method, locating the wheels around the part in an in-line machine, the head stream and tail stream are used but there is a disadvantage of requiring more wheels to cover the part. Moreover since the part is not rotating, coverage in recesses is not effective.

An ideal method should meet the following conditions:

1. Eliminate the need to travel out of the blast stream in going from one station to another.

2. Present the work piece to the blast stream in such a way that all of the blast including both the head and tail streams is continually hitting the work piece.

3. Rotate the work piece so that maximum surface presentation to the blast stream and dumping of spent abrasive and sand is obtained.

4. Maintain the work pieces as close together as possible to minimize the gaps between the pieces.

5. To control the rate of a single rotation or be able to stop the rotation at any given spot. This would permit the application of a greater amount of blast to hard to clean areas. This in turn would result in an increase in production on parts that have areas requiring spot blast or on parts that have partial areas requiring more blast than other areas. For example automobile intake manifolds and heads require more blast into the ports in order to clean the inside. Additionally sanitary ware requires more blast on the surfaces to be enameled.

An object of this invention is to provide an apparatus capable of fulfilling all of the aforementioned ideal conditions.

A further object is to provide such an apparatus which is more adaptable to automatic loading and unloading than a conventional monorail type machine.

In accordance with this invention the work pieces are fed in a lineal direction along the axis of a barrel which is open at both ends. The barrel is slotted or otherwise incorporates openings to permit blast wheels to project the blast streams against the axially movable work pieces. Additionally the barrel is provided with a positive rotational control whereby the work pieces may be disposed in the most advantageous position to maximize the effectiveness of the blast streams.

Novel features and advantages of the present invention will become more apparent to one skilled in the art by reference to the following description and accompanying drawings wherein similar reference characters refer to similar parts and in which:

FIG. 1 is a side view of one embodiment of this invention;

FIG. 2 is a top view of the embodiment shown in FIG. 1;

FIG. 3 is an end view of the embodiment shown in FIGS. 1 and 2;

FIG. 4 is a view in the direction of lines 4—4 of FIG. 2;

FIGS. 5 and 6 are views in the direction of the lines 5—5 and 6—6 respectively of FIG. 4;

FIG. 7 is a view in the direction of the lines 7—7 of FIG. 5;

FIG. 8 is a view similar to FIG. 6 of a modified form of this invention;

FIG. 9 is a view in the direction of the lines 9—9 of FIG. 4;

FIGS. 10 and 11 are schematic views of alternate hydraulic systems used in this invention; and

FIGS. 12–15 are perspectives of alternate arrangements for the work pieces in accordance with this invention.

As best shown in FIG. 2 the work pieces **10** are fed by automatic feed means such as conveyors **12** to the open feed end of rotatable barrel **14.** The parts are pushed into the end of barrel **14** by for example, an air or hydraulic cylinder **16.** One part pushes against the preceding part. All of the parts **10** in the barrel **14** axially advance one part length each time a new part **10** is inserted. As a new part is inserted and pushed forward, a cleaned part is discharged from the opposite end of barrel **14.** As indicated in FIG. **4,** a positive discharge of the part is attained by kick-out roller **17.** The cleaned parts are then conveyed for example on conveyor **18.** A second piston cylinder assembly **20** moves each part onto oscillator conveyor **22** for facilitating the removal of spent abrasive so that the abrasive can later be reused by being conveyed to storage bin **24** (FIG. **1**). The parts are then removed from the cleaning area by conveyor **26.**

While the parts are being advanced one part length, barrel **14** is not rotating. As soon as the advance is completed the barrel **14** makes one or more revolutions and then stops for the next advance stroke. With parts that are circular or nearly circular in shape, the barrel **14** may continue rotating during the forward advance stroke.

when the parts **10** are advanced with the rotation being stopped, the blast wheels **28** (FIG. **2**) are located in a position to hit the most critical cleaning area. For example with intake manifolds the blast is directed into the ports during this forward advance.

The barrel rotation can be varied to give a different rate of rotation within a revolution. This can be done effectively by using a cam operated control system (FIGS. **4, 10,** and **11**) which utilizes a cam operated valve **30** to control the hydraulic rotating actuator.

Most parts **10** are shaped on their ends in such a way that the ends can be cleaned during the above described treatment. If, however, space is needed between parts for end cleaning, it can be obtained by casting lugs **32** onto casting as shown in FIG. **12.** Alternatively ball spheres **34** may be inserted between parts **10,** 10 as shown in FIG. **14.** A further possibility is shown in FIG. **13** which involves utilizing a nozzle **36** or other blast means to blast the ends of parts **10** before they enter the cleaning cabinet **38** which houses barrel **14.**

FIG. **15** shows an arrangement for parts that have ends which are flat or irregular and will not push each other if placed in the barrel in a horizontal position. As

indicated in FIG. 15, the parts are inserted into the barrel at right angles to each other so that positive non-jamming thrust is obtained. FIG. 8 shows the cross shaped basket or barrel for accommodating these alternately disposed work pieces. With this arrangement it is necessary to rotate the barrel 270° or 450° each cycle in order to feed the parts horizontally and yet orient them at right angles to each other. For example a part is fed horizontally into the barrel and the barrel is later rotated so that when the next part is fed horizontally therein the previous part is arranged in a vertical position. A further advantage of this feature is that the ends are more exposed for end cleaning.

As can be appreciated the aforedescribed invention meets all of the desirable conditions previously indicated. For example the parts never leave the blast stream while in the blast cabinet. The blast wheels 28 are located to blast along the axial center line and the work travels along the same center line. Thus all of the blast hits the work. Accordingly the head and tail stream are fully utilized. Moreover the work is rotated in each stop position (or continually) thereby presenting all surfaces to the blast. Additionally the work pieces are close together frequently within one-half inch of each other. This results in no lost blast through gaps between the work. The rotation can also be varied to apply optimum blast to hard to clean areas.

The above described arrangement has other advantages. For example automatic loading and unloading is simplified. With this arrangement the barrel 14 is always in a predetermined position when the parts are inserted and are ejected. This is advantageous because the parts can be fed to the machine by a conveyor 12 or other convenient means. This feeding is done with the part oriented as required by a previous operation. Likewise the parts are also oriented at ejection. This gives an inline flow of parts with the parts always being oriented in a given position for subsequent easy handling.

Moreover the positive rotational control afforded in this arrangement is advantageous over conventional friction rotational means because of the feature of enabling the rotating to be stopped at any given point for effective blast and easy oriented loading. Also to vary the rotational speed through one revolution permits the proper rotation of parts that have their center of gravity off the center line of the barrel.

The construction of barrel 14 may best be understood by reference to FIGS. 4–8. As indicated therein, the barrel 14 comprises a removable unit which includes a replaceable ring gear 40 at both the feed end and the discharge end thereof. A replaceable tire 42 is mounted adjacent each ring gear 40 and in a central portion thereof. The tires 42 ride upon rollers 44. In this manner the entire unit can be raised and lowered into position by a hoist. The barrel always assumes the correct position by the seating of tires 42 upon rollers 44 with the ring gears 40 meshing with pinions 46. The barrel body itself is slotted to permit blasting therethrough, and each barrel is given the desired cross-sectional configuration for the specific work piece. These desired configurations are obtained by joining a plurality of work guide bars 48 to plates 52 in end supports 50 and central tire 42. For example as shown in FIG. 8, the work guide bars 48 create a slotted cross sectional area which is especially adapted for accommodating the right angularly arranged work pieces.

FIG. 4 shows the drive means for rotating pinions 46. This drive means includes the rotary actuator 54 which includes a piston cylinder arrangement 56 for oscillating shaft 58 upon which cams 30 are mounted. The teeth on piston cylinder arrangement 56 mesh, for example, with suitable gearing (not shown) to rotate gear 57 which in turn rotates worm 59 and its shaft 58. Cams 30 contact valves 60 which feed the hydraulic fluid to piston cylinder arrangement 56 to thereby control the speed or rate of rotation of shaft 58. A chain and sprocket drive 62 is mounted at each end of shaft 58 to drive pinions 46 (FIG. 5) and in turn rotate barrel 14.

FIG. 10 shows a hydraulic system for operating rotary actuator 54 wherein the variable rotation is attained in both ways. As indicated therein, the fluid is supplied by source 64 through valve 60 and thence through piston cylinder arrangement 56. Advantageously the same system provides the hydraulic means for driving piston cylinder assemblies 16 and 20 which are shown in FIG. 2.

FIG. 11 shows a more sophisticated hydraulic system which gives two variable rotations. This system includes a pair of valves 60 and is otherwise generally the same as the system shown in FIG. 10.

Another feature of this invention is the provision of a kick-out roller 17 which provides a positive discharge of the work pieces 10. As indicated in FIG. 4, kick-out roller 17 is vertically adjusted by for example jack screw mechanism 66 to properly orient the roller 17 for receiving the work piece 10. FIG. 9 indicates the advantageous shape of roller 17 which includes tapered flanges 68 to provide a convenient cradle like seat for any shaped work piece such as work piece 10A.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A continuous treating apparatus for rapidly cleaning a succession of work pieces, said apparatus comprising a barrel of skeletal wall construction open at both ends and having a length that permits the longitudinal passage of a single line of work pieces therethrough, rotating means for rotating said barrel about its longitudinal axis, said barrel being long enough to hold a multiplicity of the work pieces at one time and its walls being shaped to directly engage the work pieces and keep them from rotating with respect to the barrel, abrasive throwing wheel means positioned alongside the barrel for projecting abrasive particles through the skeletal barrel wall at the work pieces in the barrel, endless conveyor structure connected to carry a succession of work pieces from a lateral direction to one end of the barrel, and pusher means at said barrel end and connected to push the successive work pieces longitudinally part way through the barrel as they arrive at that barrel end and cause each work piece to push other pieces ahead of it through the barrel.

2. An apparatus as set forth in claim 1 wherein said abrasive throwing wheel means comprises a single multiple blast station having a plurality of blast wheels disposed to blast at an axial center line of said barrel.

3. An apparatus as set forth in claim 1 wherein said pusher means includes a piston-cylinder assembly for

transferring said work pieces from said conveyor into said barrel.

4. An apparatus as set forth in claim 1 including spacing means in said barrel for spacing work pieces from each other.

5. An apparatus as set forth in claim 1 wherein said barrel has an irregularly shaped cross-sectional area for receiving right angularly disposed work pieces.

6. An apparatus as set forth in claim 1 wherein said barrel includes a removable unit, said removable unit including a pair of circular ends, a ring gear on at least one of said ends, said rotating means including a drive gear engaged with said ring gear, a central circular support member between said circular ends, support plates in each of said circular member and said circular ends, and guide bars bridging said support plate for forming a non-circular path of flow for the work pieces.

7. An apparatus as defined in claim 6 wherein a ring gear is provided on each end of said barrel, a tire being mounted adjacent each ring gear, and support rollers being disposed under and in contact with each tire.

8.. An apparatus as set forth in claim 1 wherein said barrel includes a plurality of spaced slats disposed substantially parallel to the axis of rotation of said barrel for closely engaging the work pieces.

9. An apparatus as set forth in claim 1 wherein said barrel of skeletal wall construction has a non-circular cross-section.

10. An apparatus as set forth in claim 1 wherein said rotating means includes means for varying the rate of rotation of said barrel.

11. An apparatus as set forth in claim 1 wherein said abrasive throwing wheel means includes a plurality of throwing wheels disposed at different locations with respect to the circumferential periphery of said barrel for projecting abrasive particles into said barrel from different radial directions.

12. A continuous treating apparatus comprising a barrel, said barrel being open at both ends for allowing an axial flow of work pieces therethrough, said barrel having peripheral openings, treating means for projecting treating media through said openings, feed means at one open end of said barrel for supplying work pieces one at a time into said one open end of said barrel and for moving the work pieces through said barrel, discharge means at the other open end of said barrel for receiving the work pieces one at a time from said barrel, rotating means for rotating said barrel and work pieces therein about a longitudinal axis, and means for holding the work piece against substantial rotation with respect to the rotation of said barrel about said longitudinal axis for providing a positive control of the disposition of the work pieces as they flow through said barrel, said discharge means including conveyor means for transporting the work pieces away from said barrel, a kick-out roller for discharging the work pieces from said barrel onto said conveyor means, means for vertically adjusting said kick-out roller, and said kick-out roller including convergent flanges for receiving the work pieces as they exit from said barrel.

13. Apparatus as defined in claim 12 wherein said rotating means includes a rotary actuator, and cam operated valve means for providing variable rotation to said actuator.

14. An apparatus as set forth in claim 13 wherein said discharge means includes a piston-cylinder assembly for moving the work pieces, said feed means including a second piston-cylinder assembly for feeding the work pieces into said barrel, said rotary actuator including a third piston-cylinder assembly, and all of said piston-cylinder assemblies being hydraulically connected to each other.

15. Apparatus for blast cleaning a succession of work pieces; said apparatus comprising: an elongate barrel having an open feed end and an open exit end and being of skeletal wall construction and long enough to contain and support a plurality of work pieces therein at one time, said barrel having a longitudinal axis; support means mounting said barrel for rotation about said longitudinal axis for causing said barrel and any work pieces contained therein to rotate relative to said support means; particle throwing means positioned outside of and adjacent to said barrel for projecting particles of cleaning media through the skeletal wall construction of said barrel to the interior thereof; means for bringing a succession of work pieces adjacent said open feed end; and pusher means located adjacent said open feed end for pushing successive work pieces into said barrel and simultaneously transmitting a pushing force through work pieces within said barrel to cause successive work pieces at said exit end to move out of said barrel.

16. Apparatus as defined in claim 15 wherein said means for rotating said barrel includes means for varying the rate of rotation of said barrel.

17. Apparatus as defined in claim 15 including means for actuating said pusher means during rotation of said barrel.

18. Apparatus as defined in claim 15 wherein said pusher means comprises a piston and cylinder assembly mounted exteriorly of said barrel, and said means for bringing a succession of work pieces adjacent said open feed end being comprised of a conveyor disposed adjacent to and below said open feed end.

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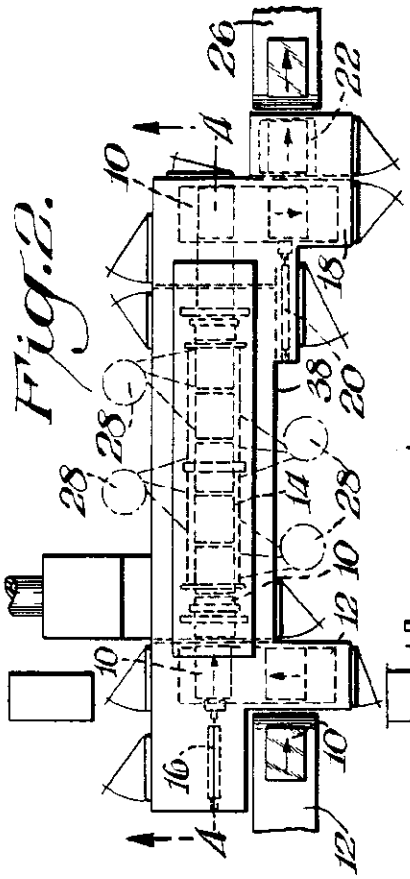


Fig. 2.

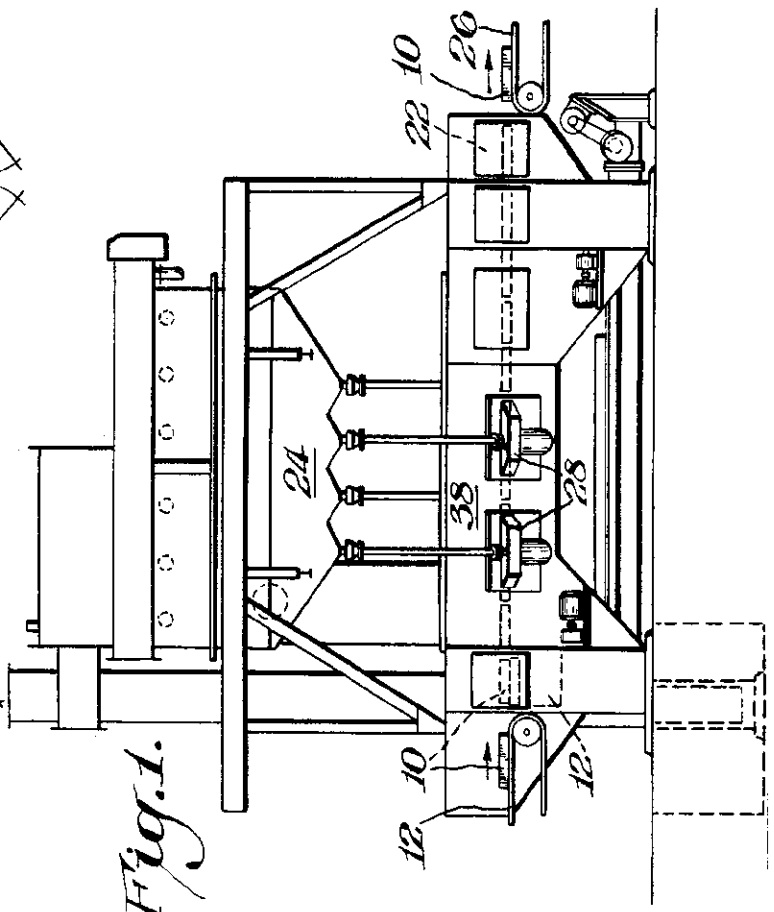


Fig. 1.

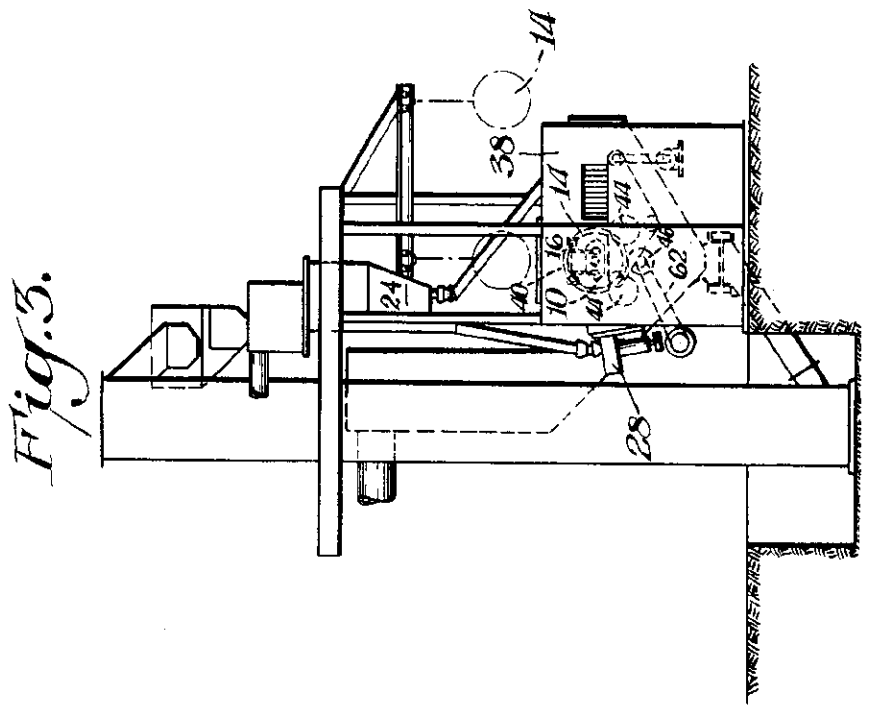


Fig. 3.

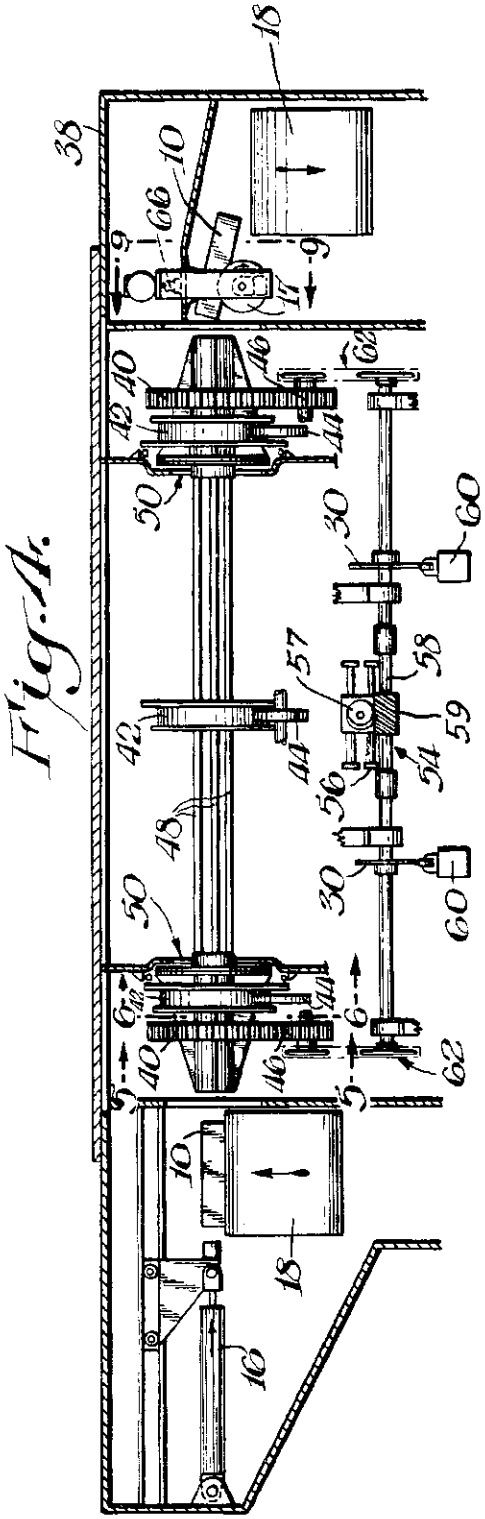


Fig. 4.

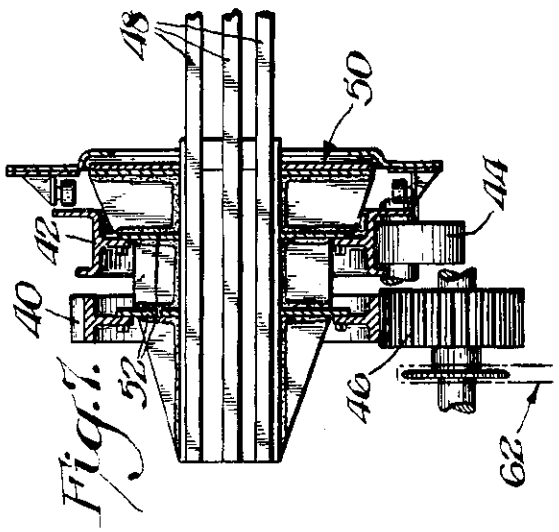


Fig. 7.

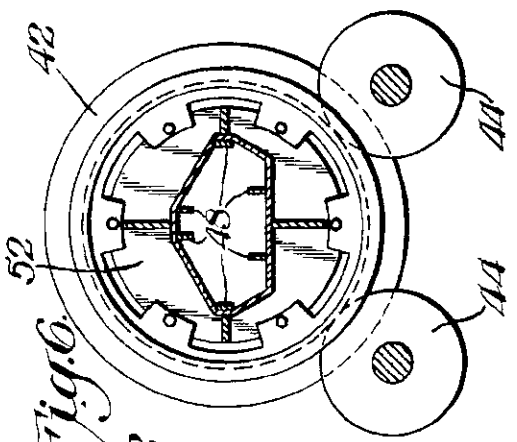


Fig. 6.

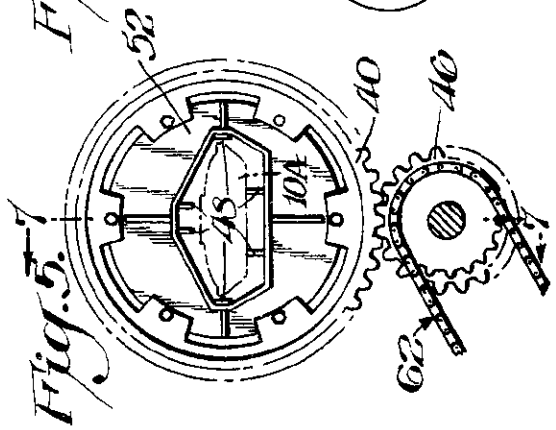


Fig. 5.

Fig. 8.

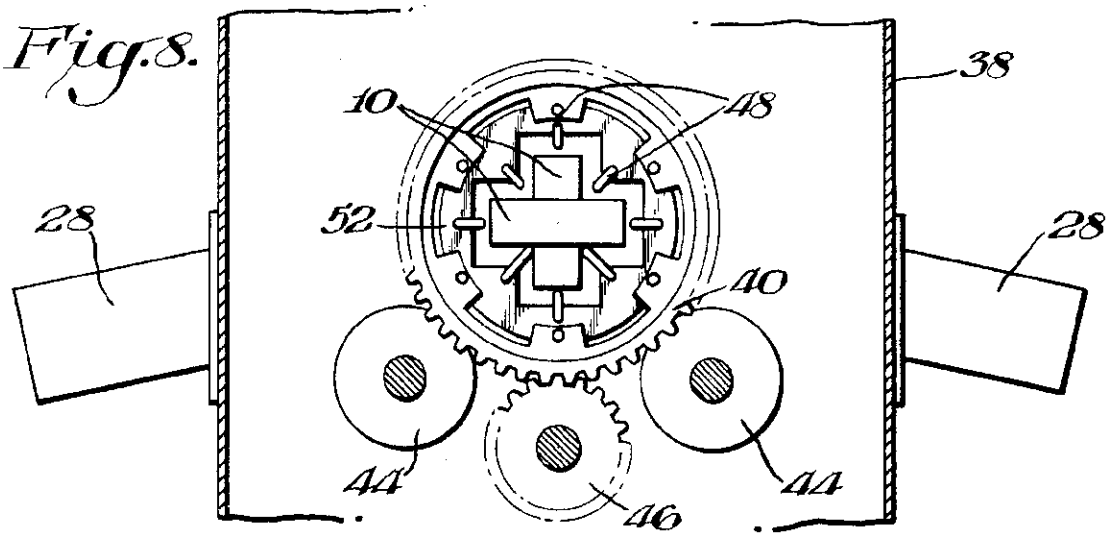
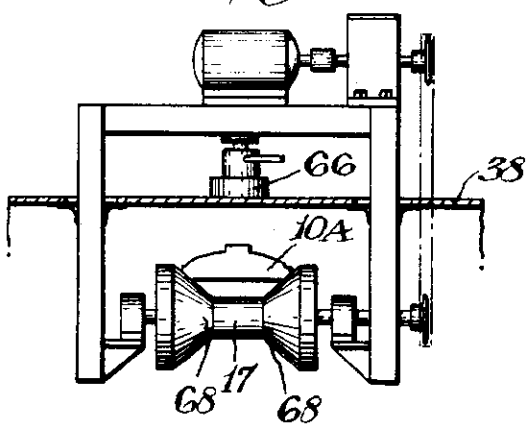


Fig. 9.



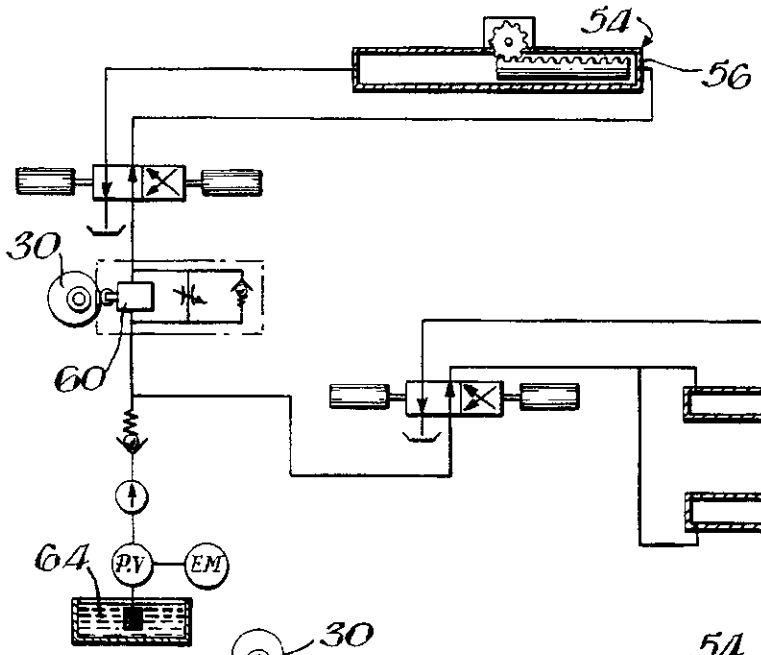


Fig.10.

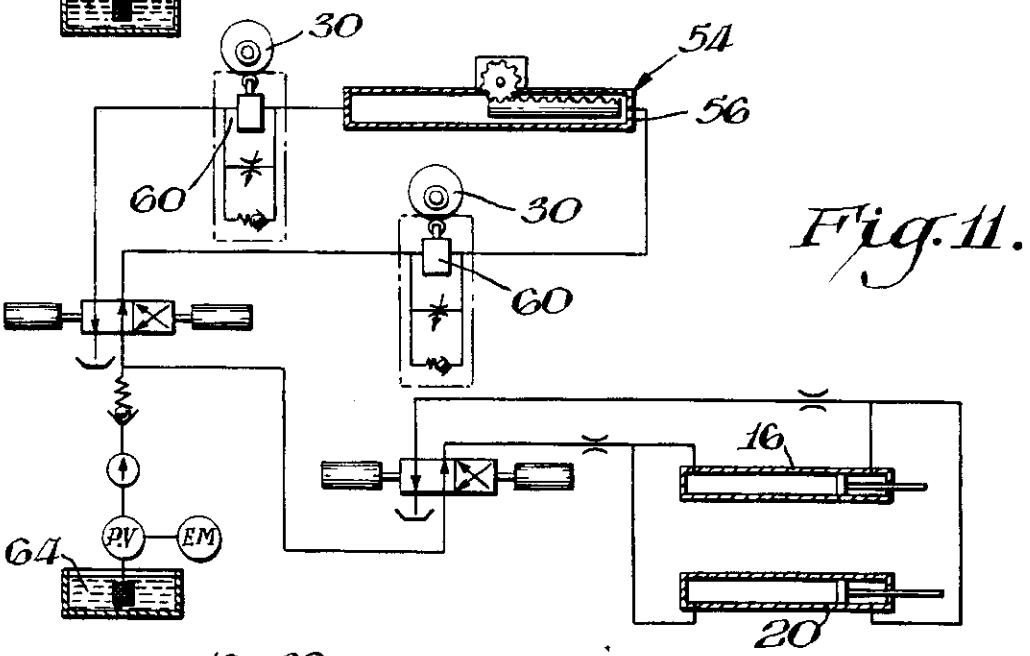


Fig.11.

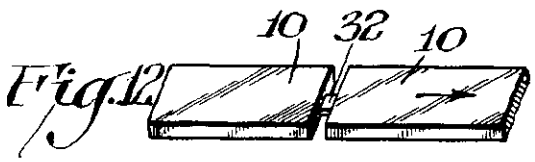


Fig.12

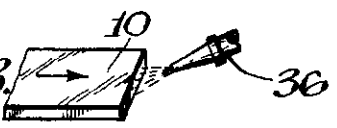


Fig.13

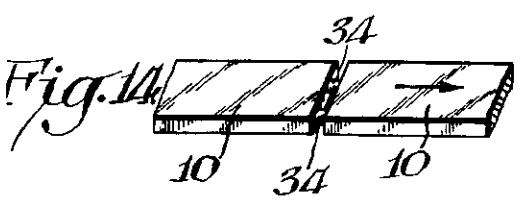


Fig.14

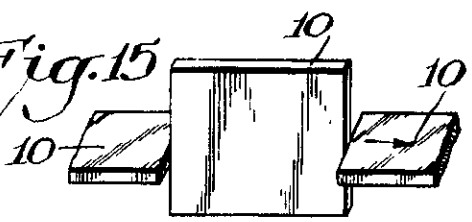


Fig.15