Dec. 14, 1971 G. W. POWELL ET AL 3,626,641

CONTINUOUS CLEANING APPARATUS

Filed Aug. 13, 1969 4 Sheets-Sheet 1

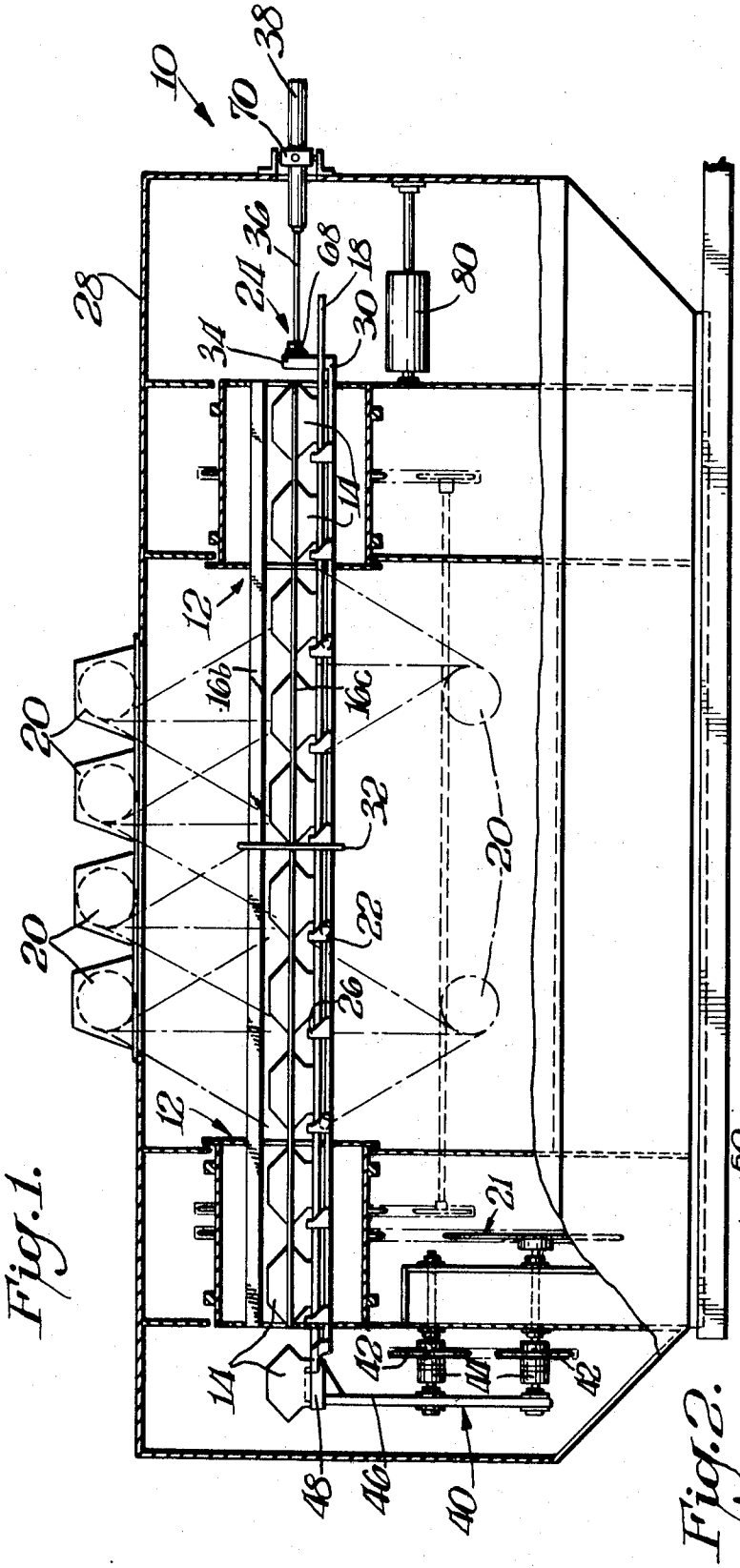

Fig. 1.

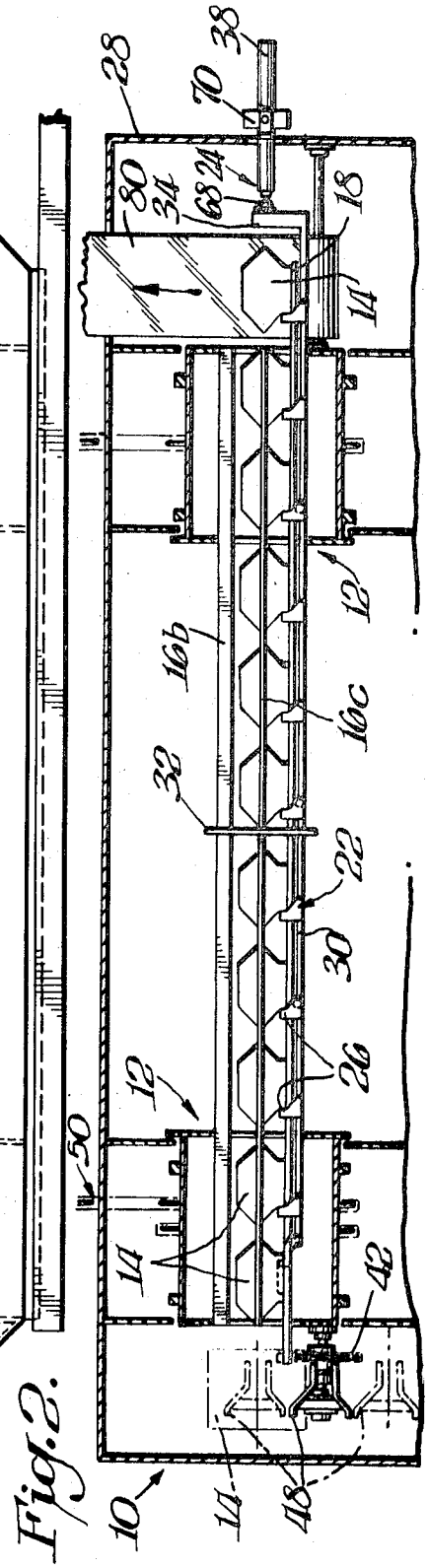

Fig. 2.

CONTINUOUS CLEANING APPARATUS

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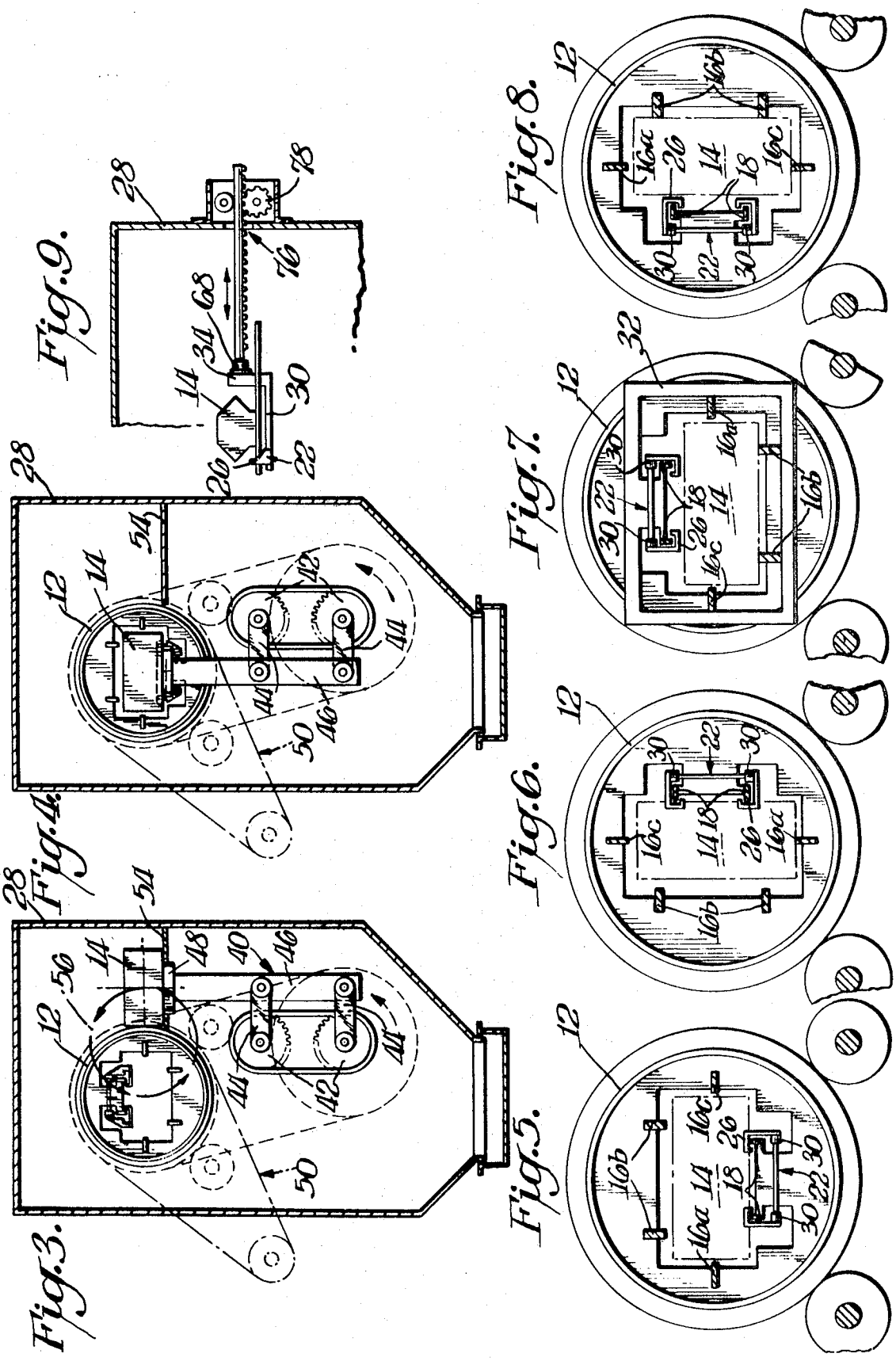

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CONTINUOUS CLEANING APPARATUS

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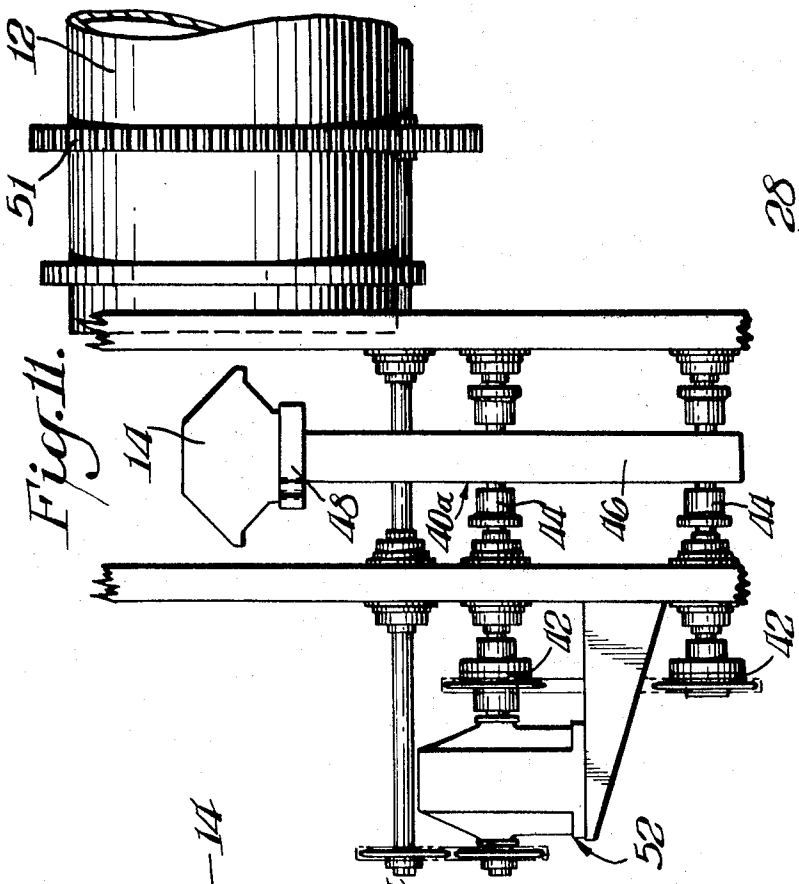

Fig. 11.

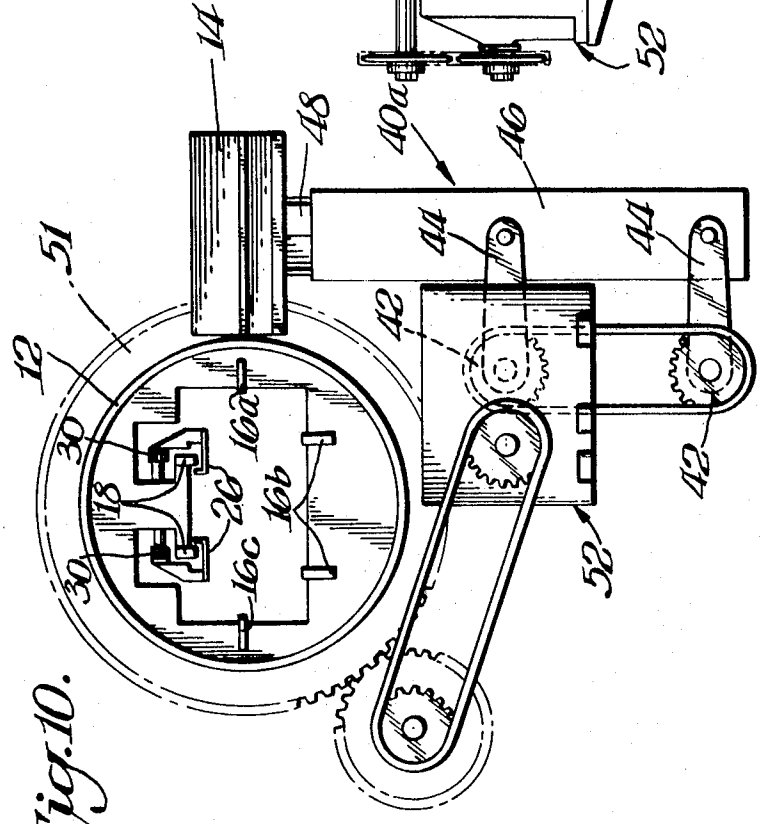

Fig. 10.

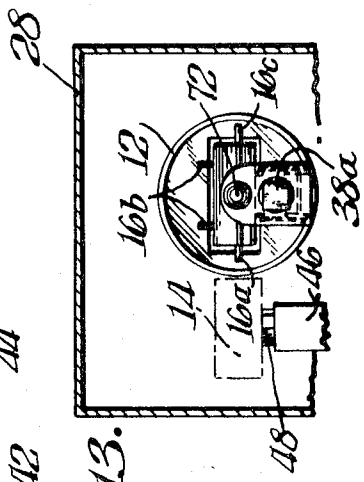

Fig. 13.

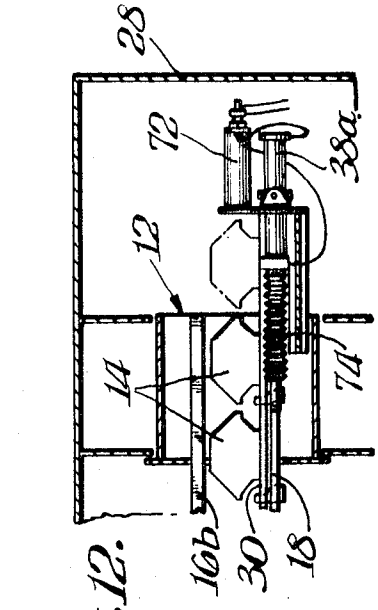

Fig. 12.

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Fig. 14.

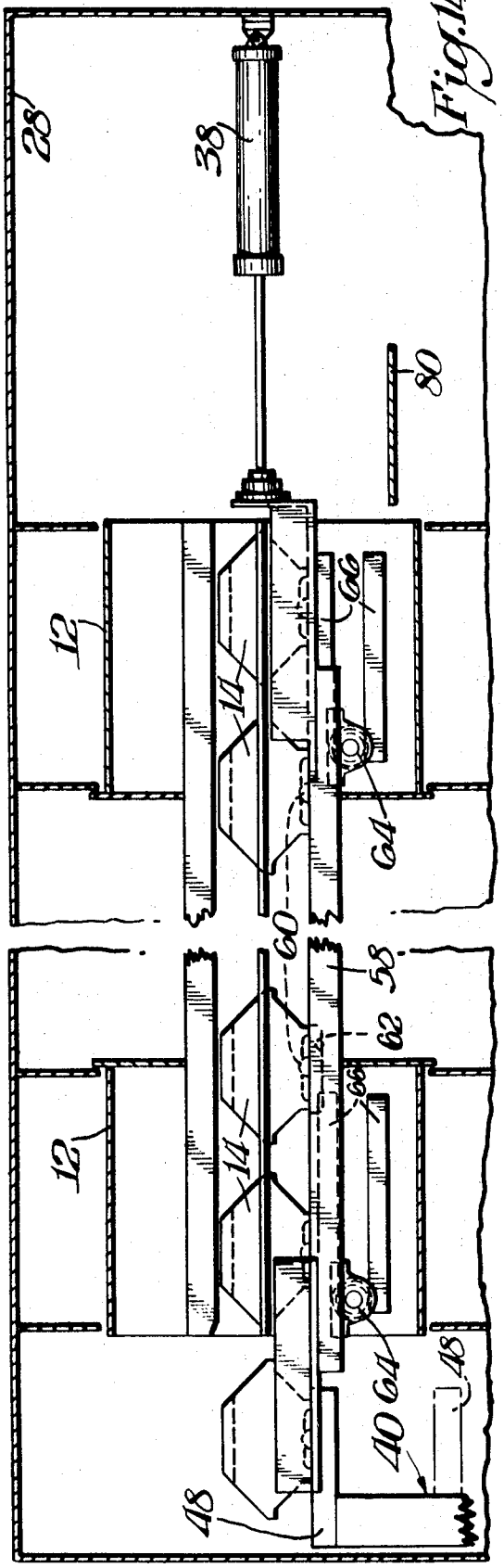
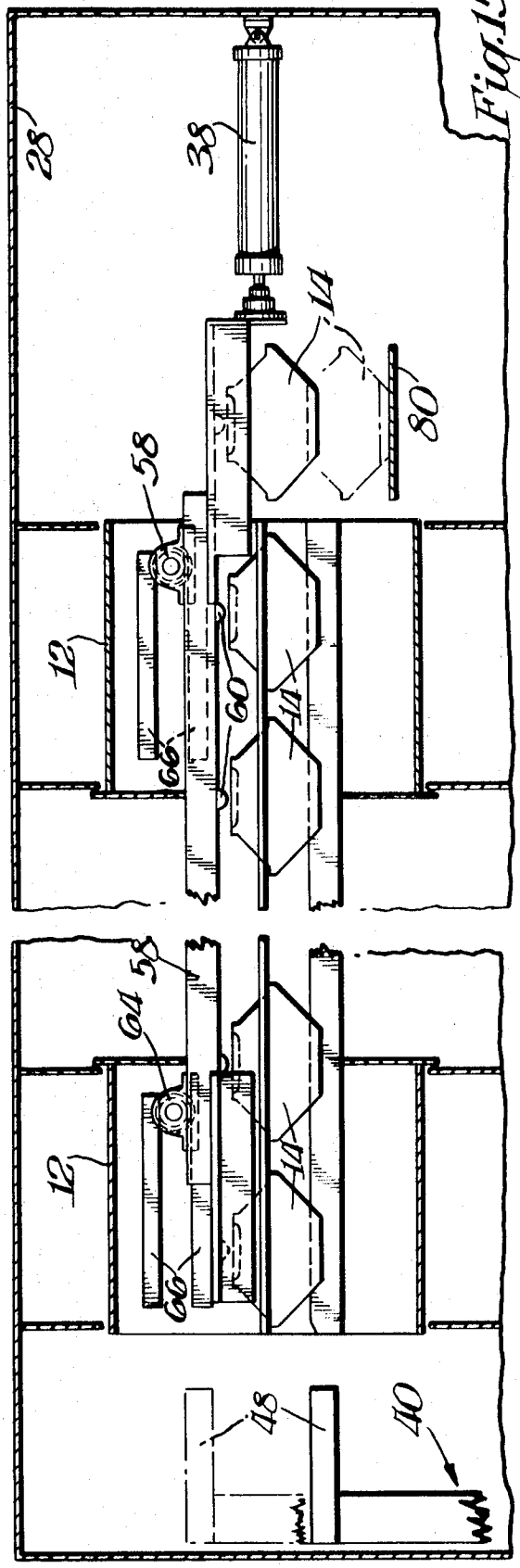


Fig. 15.



United States Patent Office 3,626,641
Patented Dec. 14, 1971

3,626,641

CONTINUOUS CLEANING APPARATUS

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Int. Cl. B24c 3/08
U.S. Cl. 51—15 25 Claims

ABSTRACT OF THE DISCLOSURE

A continuous cleaning apparatus comprises a rotating barrel open at both ends and made in a skeletal form with longitudinal peripheral parts support slats for permitting treating media to pass through the slats and contact the parts. Spacing means move the parts in the barrel and maintain them spaced from each other. The spacing means are driven in a forward stroke and a return stroke by reciprocating means during each revolution of the barrel.

BACKGROUND OF INVENTION

One of the most significant developments in high production treatment, such as blasting, in recent years is the development of the axial flow barrel concept which is described in commonly assigned copending application Ser. No. 533,183, filed May 26, 1966. Such an axial flow barrel is particularly effective on parts whose ends are such that a small space therebetween permits sufficient abrasive to enter and clean the ends. Parts such as automobile heads, manifolds, etc., are particularly adapted to the axial flow concept.

The axial flow concept has been enthusiastically received by the automotive industry because its design improves cleaning with fewer blasting wheels and less horsepower. In most cases axial flow eliminates the need for a second machine to spot blast parts not cleaned by the first blast. Axial flow machines are easily automated thus eliminating expensive labor. All of these advantages have pointed up the need for an axial flow machine that can clean automobile motor blocks. However, one disadvantage of conventional axial flow machines for blocks is that if blocks are pushed end to end, the ends of the blocks cannot be cleaned. This same problem exists for some automobile heads and other parts.

One method for cleaning blocks is to push the blocks oriented bank to bank instead of end to end. This method exposes the ends to the blast and because of the V–8 block shape the sides can be cleaned. This method positions the blocks for effective overall cleaning; many blocks, however, because of their shape, cannot be pushed bank to bank. This problem requires the automobile manufacturer to change this casting which is expensive and sometimes impractical.

SUMMARY OF INVENTION

An object of this invention is to provide an axial flow arrangement wherein parts such as automobile blocks or similar parts which cannot be pushed one against another can be progressed through the barrel.

A further object of this invention is to provide such an arrangement which not only makes it possible to move blocks bank to bank but also blocks or other parts can be spaced far enough apart so that flat ends can be cleaned when the parts are advanced flat end to flat end.

In accordance with this invention the continuous cleaning apparatus comprises a rotating barrel open at both ends and in skeletal form with longitudinal peripheral support slats for permitting treating media to pass through the slats and contact the parts. Spacing means move the parts in the barrel and maintain them spaced from each other. The spacing means are driven in a forward stroke and a return stroke by reciprocating means during each revolution of the barrel.

The spacing means may advantageaously be a longitudinal bar having parts engaging surfaces such as pusher lugs. The bar may be juxtaposed and parallel to one of the support slats with the combined thickness of the bar and its juxtaposed support slat being about equal to the thickness of the remaining support slats.

During operation of the device the forward stroke of the spacing means advantageously begins at the beginning of a barrel revolution when the barrel is in its part loading position. The forward stroke ends when the barrel has rotated about 90° and the return stroke begins at about 180° revolution and ends at about a 270° revolution.

When the barrel continuously rotates parts may be continuously loaded by a walking beam arrangement.

In an alternative form of this invention the reciprocating spacer means may be one of the support slats which has rollers mounted thereon for riding against guide rails.

THE DRAWINGS

FIG. 1 is a cross-sectional view in elevation of a continuous treating apparatus in accordance with this invention;

FIG. 2 is a cross-sectional plan view of the apparatus shown in FIG. 1;

FIGS. 3–4 are end views of the apparatus shown in FIG. 1 in different phases of operation;

FIGS. 5–8 are cross-sectional end views of a portion of the apparatus shown in FIG. 1 in different phases of operation;

FIG. 9 is a fragmentary view of a portion of an alternative form of this invention;

FIG. 10 is an end view similar to FIGS. 3–4 of an alternative arrangement of this invention;

FIG. 11 is a side view of the arrangement shown in FIG. 10;

FIG. 12 is a view similar to FIG. 9 showing still another alternative form of this invention;

FIG. 13 is a plan view of the arrangement shown in FIG. 12; and

FIGS. 14–15 are cross-sectional views of a modified form this invention in different phases of operation.

DETAILED DESCRIPTION

FIGS. 1–2 show a continuous cleaning apparatus **10** in accordance with this invention. As indicated therein the apparatus **10** includes barrel **12** which is open at both ends for receiving and discharging parts **14**. The barrel as best shown in FIGS. 1 and 5–8 is of skeletal form comprising a plurality of longitudinal peripheral support slats **16***a*, **16***b*, **16***c*, and **18** which premit treating media, such as blast particles, to contact the parts **14** when projected from suitable treating means, such as blast wheels **20**. Barrel **12** is rotated by drive **21** to expose all portions of part **14** to the blast wheels **20**. To this point the treating apparatus is similar to the apparatus disclosed in commonly assigned copending application Ser. No. 553,183, filed May 26, 1966.

Apparatus **10** is provided with a spacing device or bar system **22** which is moved in a forward stroke and a return stroke by reciprocating mechanism **24** so that the parts **14** are moved axially in barrel **12** while being spaced from each other to permit the blast particles from blast wheels **20** to thoroughly clean the ends of parts **14**. Thus the movement of the parts through the barrel is achieved by this bar system **22**, rather than by the parts being pushed one against another as in the arrangement of

copending application Ser. No. 533,183, filed May 26, 1966.

Apparatus **10** is particularly designed to overcome four problems which would be expected to occur by the provision of such a bar system. For example the addition of extra bars would be expected to add to masking the part from the blast stream. A second problem is in returning the spacer pusher lugs **26** of the bar system after the lugs push the blocks or parts **14**. The return movement of the pusher lugs would appear to require a walking beam motion which would be difficult to maintain in a blast cabinet such as cabinet **28**. A third problem is apparent from test results which show that continuous rotation of the barrel on blocks or parts **14** positioned bank to bank give the best cleaning. Such positioning, however, would require a barrel load system that would load blocks, etc. onto a rotating barrel. A fourth problem relates to the reciprocating mechanism **24** wherein obtaining a ram motion of the bars in a rotating barrel presents mechanical and air feed problems.

FIGS. 5–8 show a particular bar system **22** which is designed to overcome the problem of masking the parts from the blast stream. As indicated therein the longitudinal bar **30** is disposed directly below or juxtaposed and parallel to support slat **18**. With this arrangement bar **30** and slat **18** occupy the same space as the remaining support slats **16**. Since slat **18**, however, does not have the carrying strength of slats **16***a*, **16***b* and **16***c*, slat **18** is supported directly from the larger bars or slats **16***a*, **16***b* and **16***c* at the center of the barrel by support surface **32** (FIG. 1).

FIGS. 5–8 also exemplify the solution to the second problem of returning the spacer pusher lugs **26** to their original position. As indicated therein pusher lugs **26** are projections from bar **30** which extend into the interior of barrel **12** so that the pusher lugs **26** will engage the parts **14** during the forward stroke of bar **30**. FIG. 5 illustrates the position of part **14** at the instant of loading. At this point any suitable switch (not shown) signals reciprocating mechanism **24** to start bar **30** moving by its connection of portion **34** to the reciprocating mechanism **24** whereby the bar moves in its forward and return stroke in accordance with the movement of the ram **36** (FIG. 1). At the beginning of rotation of barrel **12** a switch (not shown) is contacted and ram **36** is retracted to move the pusher lugs in its forward stroke and thus push each part forward with each part being supported on slats **18**. As the part is being pushed forward and rotating, the part begins to fall away from pusher lugs **26** so that the part is then supported on slat **16***a* as shown in FIG. 6 which is 90° of rotation from the starting position. The forward stroke must thus be completed before the barrel passes this 90° of rotation; otherwise if the barrel rotated further, the part **14** would fall completely away from the pusher lug **26** and cause jamming. When the barrel **12** has rotated 180° (FIG. 7) part **14** is supported on slats **16***b* and is completely out of contact with the pusher lugs **26**. The clearance created between the pusher lugs **26** and part **14** is sufficient that the pusher lugs can return to their original position and remain out of contact with the part **14**. Accordingly, at this point (FIG. 7) when the barrel has rotated 180° a further switch (not shown) signals ram **36** to begin its extension from cylinder **38** and return pusher lugs **26** to their original position. This return stroke must be completed by the time barrel **12** has rotated 270° when the part is supported by slat or bar **16***c* but would still be in the path of motion of pusher lugs **26**.

As shown in FIG. 1 the spacer lug starting position is a short distance (e.g. three inches) behind block **14**. This requires spacer lugs (one of which is provided for each part) to travel this short distance before contacting the block or casting and push it forward. This thereby assures that the spacer lug **26** always returns to a point behind the block **14** before the next push or forward stroke.

FIGS. 3–4 show the loading arrangement whereby blocks **14** are loaded on the continuously rotating barrel to solve the third problem indicated above. As illustrated in FIGS. 3–4 the loading is accomplished by means of a walking beam arrangement **40** which is mechanically interlocked with barrel **12**. For example the walking beam arrangement **40** includes a pair of rotating sprockets **42** having arms **44** attached thereto. Beam **46** is attached to the remote ends of arms **44** with support platform **48** being connected to the upper end of beam **46**. As is apparent from FIGS. 3–4, as sprockets **42** rotate beam platform **48** also rotates in such a manner that the part **14** would be first received on platform **48** (FIG. 3) and deposited in barrel **12** when platform **48** has moved 180° to the position shown in FIG. 4. Chain system **50** interconnects the walking beam arrangement **40** with barrel **12** so that both are driven by a common drive by a ratio of 1:1.

FIGS. 10–11 show an alternative drive arrangement for walking beam **40***a*. In this arrangement barrel **12** is driven by gear **51**. Thus a reducer **52** is provided to reverse the direction of rotation for driving the walking beam **40***a*.

As previously indicated the loading of parts **14** into barrel **12** operates in the following manner: a part **14** is loaded onto platform **54** in any suitable manner. The walking beam platform **48** lifts the part off stationary platform **54**. At this instant barrel **12** is in the position shown in FIG. 7 wherein the spacer lugs **26** have rotated 180°. The walking beam platform **48** continues to move along arc **56** and deposits the part **14** onto barrel **12**. At this time barrel **12** is in the loading position shown in FIG. 5. The walking beam continues along arc **56** to pick up the next part.

FIGS. 14–15 show an alternative spacing arrangement for moving the blocks or parts **14** through barrel **12**. In this arrangement instead of two bars such as **18** and **30** in the previous arrangement, the arrangement of FIGS. 14–15 shows a single bar **58** which acts as both the support bar and the moving or reciprocating bar. In this arrangement the part **14** is carried on the moving bar **58** instead of sliding. If friction is sufficient between part **14** and bar **58** lugs would not be required. As a safeguard, however, to assure sufficient locking or adherence of part **14** to bar **58**, bar **58** may have either a protrusion **60** or an indentation or recess **62** which is shown in phantom. Bar **58** is supported by and moves axially on rollers **64** at each end of barrel **12** which in turn ride against rotating rails **66**. The walking beam loading and sequence of bar motion would be the same as that previously described.

In order to solve the fourth problem relating to ram motion for reciprocating the spacer bar, various alternative arrangements are provided. For example as shown in FIGS. 1–2 a hydraulic cylinder **38** or other mechanical means is disposed at the center of rotation of barrel **12** with its rod or ram **36** extending therefrom. The end of ram **36** is connected to the bar system **22** by a rotating spherical bearing **68** to offset portion **34** of bar **30**. Cylinder **38** is mounted in a universal movement trunnion mount **70**. The universal mount **70** plus the spherical bearing **68** allows the barrel-to-cylinder misalignment while permitting the bar **30** and its offset **34** to rotate about bearing **68**. In this manner the problem regarding air or hydraulic feed lines is obviated since the cylinder itself does not rotate.

FIGS. 12–13 shows an alternative arrangement wherein the cylinder **38***a* is connected to the rotating barrel **12** while a rotary hydraulic joint **72** is mounted at the center of rotation of barrel **12**. A further ramification is also illustrated in FIG. 12 wherein the rod or ram is disposed in bellows **74** to prevent abrasive particles or other debris from being carried by the rod into the cylinder.

A still further reciproctaing drive is illustrated in FIG. 9. In this arrangement the ram motion is achieved by a mechanical drive with rack and pinion drive **76**. With this

type of drive the pinion **78** is powered by any conventional air, hydraulic or electric rotating motor which is interlocked with the barrel rotation.

As previously indicated the parts **14** are conveniently discharged from the barrel when the barrel has rotated 180° such as shown in FIG. 15. In this position the part is disposed outside the barrel and would only be supported by the reciprocating bar. The reciproctaing bar, however, is above the part and thus the part can be freely deposited upon a platform **80**, conveyor or other suitable discharge means.

It is to be understood that various features of these arrangements may be interchanged. For example any of the arrangements can include the bellows **74**. Similarly, the various reciprocating means may be used with the various spacing devices while either of the walking beam arrangements may be used with any of the other devices.

With the axial flow system of this invention it is possible to handle parts that cannot be handled in conventional axial flow machines. For example parts, that, because of their shape, cannot be pushed one against another can be handled by the inventive arrangement. Similarly parts whose ends cannot be cleaned when the parts are pushed one against another can be spaced apart to provide the end cleaning in accordane with this invention. Moreover in some cases if the different parts are close to the same size, various types of parts may be run intermixed through the barrel.

Other advantages of the inventive arrangement are that the ram cylinder can be smaller since the inventive arrangement eliminates all tendency of parts to jam. Additionally, with this arrangement it is possible to empty the barrel of parts with its power system whereas conventional axial flow machines must be emptied manually.

Further with the arrangement shown in FIGS. 14–15 the spacing and support can be accomplished with the same total number of barrel support bars or slats as would be required with a conventional axial flow blast machine. Since these bars are carried on rollers, much less axial movement force is required to progress the parts through the barrel.

What is claimed is:

1. A continuous treating apparatus comprising a barrel having a longitudinal axis, said barrel being open at both ends to permit the axil flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, reciprocating means for moving said spacing means in a forward stroke and in a return stroke during each revolution of said barrel with said forward and return stroke being actuated in different quadrants in the revolution, and said spacing means being mounted for movement in a plurality of radial positions with respect to the longitudinal axis of said barrel.

2. An apparatus as set forth in claim **1** wherein said spacing means includes a longitudinal bar having spaced parts engaging surfaces thereon for maintaining the parts spaced apart from each other.

3. An apparatus as set forth in claim **2** wherein said spaced parts engaging surfaces are non-pivotal pusher lugs.

4. An apparatus as set forth in claim **3** wherein said longitudinal bar is disposed outside of the barrel periphery juxtaposed and parallel to one of said support slats.

5. An aparatus as set forth in claim **4** wherein the combined thickness of said longitudinal bar and said one of said support slats is about equal to the thickness of each of the remaining support slats, and said one support slat being connected to and supported by at least one of said remaining support slats.

6. An apparatus as set forth in claim **2** wherein said longitudinal bar extends beyond said discharge end of said barrel and is disposed for discharging a part when said barrel and said bar has rotated about 180° from its loading position.

7. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of pairs therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slate to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, and reciprocating means for moving said spacing means in a forward stroke and in a return stroke during each revolution of said barrel with said forward and return stroke being actuated in different quadrants in the revolution, said spacing means including a longitudinal bar having spaced parts engaging surfaces thereon for maintaining the parts spaced apart from each other, said longitudinal bar extending beyond said discharge end of said barrel and is disposed for discharging a part when said barrel and said bar has rotated about 180° from its loading position, said reciprocating means being connected to said longitudinal bar in such a manner that said forward stroke of said longitudinal bar begins at the beginning of a revolution of said barrel when said barrel is in its parts loading position, said forward stroke ending when said barrel has rotated about 90° after said loading position, said return stroke beginning when said barrel has rotated about 180° after its loading position, and said return stroke ending when said barrel has rotated about 270° after its loading position.

8. An apparatus as set forth in claim **7** wherein said parts engaging surface is out of contact with its part when said barrel has rotated about 180° from its loading position.

9. An apparatus as set forth in claim **2** wherein said longitudinal bar is one of said support slats.

10. An apparatus as set forth in claim **9** wherein said parts engaging surfaces are spaced protrusions on said longitudinal bar.

11. An apparatus as set forth in claim **9** wherein said parts engaging surfaces are spaced recesses in said longitudinal bar.

12. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, and reciprocating means for moving said spacing means in a forward stroke and in a return stroke during each revolution of said barrel with said forward and return stroke being actuated in different quadrants in the revolution, said spacing means including a longitudinal bar having spaced parts engaging surfaces thereon for maintaining the parts spaced apart from each other, said longitudinal bar being one of said support slats, including rollers mounted on said longitudinal bar adjacent both open ends of said barrel, and guide rails disposed for having said rollers ride thereon during said forward stroke and said return stroke.

13. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, and reciprocating means for moving said spacing means in a forward

stroke and in a return stroke during each revolution of said barrel with said forward and return stroke being actuated in different quadrants in the revolution said drive means being connected for continuously rotating said barrel, a walking beam arrangement being provided adjacent said load end of said barrel for loading parts onto said barrel, and said walking beam arrangement being driven by said drive means.

14. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, and reciprocating means for moving said spacing means in a forward stroke and in a return stroke during each revolution of said barrel with said forward and return stroke being actuated in different quadrants in the revolution, said reciproctaing means including a ram disposed at the axis of rotation of said barrel, and universal joint means connecting said ram to said spacing means whereby said spacing means may rotate with barrel while said ram does not rotate.

15. An apparatus as set forth in claim **14** wherein said ram is hydraulically driven in a hydraulic cylinder disposed at said discharge end of said barrel.

16. An apparatus as set forth in claim **14** wherein said ram is mechanically driven by mechanical drive means disposed at said discharge end of said barrel.

17. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, and reciprocating means for moving said spacing means in a forward stroke and in a return stroke during each revolution of said barrel with said forward and return stroke being actuated in different quadrants in the revolution, said reciprocating means being a ram connected for rotation with said barrel, said ram being mounted in a hydraulic cylinder disposed spaced from the axis of rotation on said barrel, and a rotary hydraulic joint being connected to said hydraulic cylinder with said rotary hydraulic joint being disposed along the axis of rotation of said barrel.

18. An apparatus as set forth in claim **17** wherein said ram is disposed within a bellows.

19. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, reciprocating means for moving said spacing means in a forward stroke and in a return stroke during each revolution of said barrel, and said reciprocating means being connected to and jointly rotatable with said barrel.

20. A continuous treating apparatus comprising a barrel, said barrel having a longitudinal axis, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, spacing means for moving the parts axially in said barrel, reciprocating means for moving said spacing means in a forward stroke and in a return stroke, said spacing means including an elongated bar extending generally parallel to the barrel axis and movable in a plurality of radial positions with respect to the barrel axis, and a plurality of non-pivotal parts engaging lugs fixed on said bar.

21. An apparatus as set forth in claim **20** including means for changing the relative distance between said bar and the axial centerline of the parts flowing through said barrel.

22. An apparatus as set forth in claim **21** wherein said means for changing said relative distance includes said drive means, and said bar being connected to rotate with said barrel whereby during the rotation of said barrel the parts move toward and away from said bar.

23. A continuous treating apparatus comprising a barrel, said barrel being open at both ends to permit the axial flow of parts therethrough with one end being a load end and the other a discharge end, said barrel being of skeletal form with longitudinal peripheral support slats to permit treating media to contact the parts in said barrel, treating means for projecting treating media into said barrel, drive means for rotating said barrel, said drive means being connected for continuously rotating said barrel, a walking beam arrangement being provided adjacent said load end of said barrel for loading parts onto said barrel, and said walking beam arrangement being driven by said drive means.

24. An apparatus as set forth in claim **20** including a blasting cabinet, said barrel being disposed in said blasting cabinet, feed means adjacent said load end of said barrel for delivering parts thereto, discharge means being adjacent said discharge end of said barrel for carrying parts away from said barrel, and said treating means being a plurality of centrifugal throwing wheels.

25. An apparatus as set forth in claim **23** including a blasting cabinet, said barrel being disposed in said blasting cabinet, discharge means adjacent said discharge end of said barrel for carrying the parts away from said barrel, and said treating means comprising a plurality of centrifugal throwing wheels.

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LESTER M. SWINGLE, Primary Examiner

U.S. Cl. X.R.

51—9