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COMMONWEALTH of AUSTRALIA
Patents Act 1952

APPLICATION FOR A STANDARD PATENT

I/We

The Babcock & Wilcox Company

of

1010 Common Street, New Orleans, Louisiana, 70112, United States of America

hereby apply for the grant of a Standard Patent for an invention entitled:

Indexing sootblower

which is described in the accompanying complete specification.

Details of basic application(s):-

Number	Convention Country	Date
172309	United States of America	24 March 1988

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

DATED this TWENTY EIGHTH day of NOVEMBER 1988

To: THE COMMISSIONER OF PATENTS

.....
a member of the firm of DAVIES & COLLISON for and on behalf of the applicant(s)

Davies & Collison, Melbourne

M004743 28/11/88

FORM 8 Reg. 12(2).

COMMONWEALTH OF AUSTRALIA

The Patents Act 1952-1973

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of the Convention application made for a patent for an invention entitled INDEXING SOOTBLOWER

I, Robert J. Edwards

of 1010 Common Street, New Orleans, Louisiana 70160, United States of America

do solemnly and sincerely declare as follows:

~~1. I am the applicant for the patent.~~

1. I am authorized by THE BABCOCK & WILCOX COMPANY the applicant for the patent to make this declaration on its behalf.

2. The basic application as defined by Section 141 of the Act was made in the United States of America on the 24 day of March 1988, by RONALD EUGENE SHERRICK, DEAN CURTIS ACKERMAN, DEAN ERLE DRAXTON, JOHN CLARENCE MATTHEWS, DON WILLIAM SMITH, and JOHN GREGORY STEVENS

~~3. I am the actual inventor of the invention referred to in the basic application.~~

3. RONALD EUGENE SHERRICK, DEAN CURTIS ACKERMAN, DEAN ERLE DRAXTON, JOHN CLARENCE MATTHEWS, DON WILLIAM SMITH and JOHN GREGORY STEVENS of Lancaster, Ohio, Rapid City, South Dakota and Thornville, Ohio, United States of America, are ~~is~~ the actual inventor of the invention and the facts upon which ~~I am entitled~~ the Company is entitled to make the application are as follows:

by virtue of assignments dated March 13, 1988 and March 22, 1988 whereby the Applicant would, if a patent were granted on an application made by the said actual inventors, be entitled to have the patent assigned to it.

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention, the subject of the application.

DECLARED at New Orleans, Louisiana, U.S.A. this 15th day of November 19 88.

M005592 05/01/89

.....

Robert J. Edwards
Chief Patent Counsel

To:
The Commissioner of Patents.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-25925/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 615967

(54) Title
INDEXING SOOTBLOWER

International Patent Classification(s)
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172309	**24.03.88**	**US UNITED STATES OF AMERICA**

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THE BABCOCK & WILCOX COMPANY

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(57) Claim

1. A sootblower having a lance tube with one of more nozzles for projecting a stream of blowing medium against surfaces within a boiler, said lance tube being periodically advanced into and out of the boiler and simultaneously rotated such that the stream of blowing medium projecting from the nozzle traces a helical path, said sootblower comprising;

a frame,

at least one longitudinally extending toothed rack assembly affixed to said frame,

a carriage for travelling along said frame and coupled to said lance tube for controlling the longitudinal and rotational motion of said lance tube, said carriage including drive train means driven by a motor for rotating said lance tube and moving said carriage longitudinally through one or more pinion gears engagable with said toothed rack assembly, said drive train establishing a synchronized relationship between said longitudinal and said rotational motions of said lance tube thereby causing said nozzle to trace said helical path, and

said rack assembly including interengaging fixed and movable portions, said movable portion being longitudinally movable between a first and second position, and biasing means urging said movable portion toward said first position, whereby during a portion of the operating cycle of said sootblower, said pinion gear engages said movable portion moving it to said second position against said biasing means and thereafter moves out of engagement with said movable portion allowing said movable

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portion to return to said first position under the influence of said biasing means, whereby said pinion gear is indexed with respect to said rack assembly upon each actuation cycle of said sootblower causing said helical paths to be displaced between successive actuation cycles of said sootblower.

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PATENTS ACT 1952

COMPLETE SPECIFICATION

NAME & ADDRESS
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NAME(S) OF INVENTOR(S):

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Dean Erle DRAXTON
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Don William SMITH
John Gregory STEVENS

ADDRESS FOR SERVICE:

DAVIES & COLLISON
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COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

Indexing sootblower

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

This invention relates to a long retracting sootblower for boiler cleaning and particularly to one having an indexing lance tube drive system.

Sootblowers are used to project a stream of blowing medium such as water, air or steam against heat transfer surfaces within large scale boilers to cause slag and ash encrustations to be removed. The blowing medium impact produces mechanical and thermal shock which causes these adhering layers to be removed. One general category of sootblowers is known as the long retracting type. These devices have a retractable lance tube which is periodically advanced into and withdrawn from the boiler and is simultaneously rotated such that one or more blowing medium nozzles at the end of the lance tube project jets tracing helical paths.

Many conventional sootblowers, such as the so-called "IK" sootblower manufactured by applicant, include a lost motion device which causes the nozzles to return along a helical path that bisects the helical path of forward travel. This indexing enables surfaces that were not cleaned during extension to be subjected to blowing medium upon retraction. Although the lance tube nozzles trace different helical paths upon extension and retraction, the positions of these helical paths are nonetheless fixed. Heat transfer surfaces continually subjected to impact by blowing medium suffer from erosion and wear. Furthermore, areas lying between the helical paths of the nozzle jets can sometimes escape adequate cleaning. In view of the foregoing, there is a need to

provide a long retracting sootblower device having an indexing mechanism which provides a large number of different yet predictable helical paths traced by the lance tube nozzles.

In accordance with this invention, there is provided a sootblower having a lance tube with one of more nozzles for projecting a stream of blowing medium against surfaces within a boiler, said lance tube being periodically advanced into and out of the boiler and simultaneously rotated such that the stream of blowing medium projecting from the nozzle traces a helical path, said sootblower comprising;

a frame,

at least one longitudinally extending toothed rack assembly affixed to said frame,

a carriage for travelling along said frame and coupled to said lance tube for controlling the longitudinal and rotational motion of said lance tube, said carriage including drive train means driven by a motor for rotating said lance tube and moving said carriage longitudinally through one or more pinion gears engagable with said toothed rack assembly, said drive train establishing a synchronized relationship between said longitudinal and said rotational motions of said lance tube thereby causing said nozzle to trace said helical path, and

said rack assembly including interengaging fixed and movable portions, said movable portion being longitudinally movable between a first and second position, and biasing means urging said movable portion toward said first position, whereby during a portion of the operating cycle of said sootblower, said pinion gear engages said movable portion moving it to said second position against said biasing means and thereafter moves out of engagement with said movable portion allowing said movable portion to return to said first position under the influence of said biasing means, whereby said pinion gear is indexed with respect to said rack assembly upon each actuation cycle of said sootblower causing said helical paths to be displaced between successive actuation cycles of said sootblower.

Additional benefits and advantages of the present invention will become apparent to those skilled in the art to which this invention

relates from the subsequent description of the preferred embodiments and the appended claims, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a pictorial view showing a long retracting sootblower incorporating the indexing features of the present invention.

Figure 2 is a pictorial side view showing the helical paths traced by the lance tube nozzles upon extension and retraction for the sootblower shown in Figure 1.

Figure 3 is a simplified pictorial view showing the drive train arrangement of the sootblower carriage which causes extension and rotation of the lance tube of the sootblower shown in Figure 1.

Figure 4 is a cross-sectional view taken along lines 4-4 from Figure 1 showing internal components of the carriage.

Figure 5 is an inverted pictorial view of an indexing rack assembly according to the present invention shown with a carriage driving pinion.

Figure 6 is a side view of the rack shown in Figure 5.

Figure 7 is a top view of the rack shown in Figure 5.

DETAILED DESCRIPTION OF THE INVENTION

A sootblower including the improvements of the present invention is shown in Figure 1 and is generally designated there by reference number 10. Sootblower 10 principally comprises frame assembly 12, lance tube 14, feed tube 16, and carriage 18. Sootblower 10 is shown in its

normal resting position. Upon actuation, lance tube 14 is extended into and retracted from a boiler (not shown) and is simultaneously rotated.

As best shown in Figure 4, frame assembly 12 includes a generally rectangularly shaped frame box 20 which forms a housing for the entire unit. Carriage 18 is guided along two pairs of tracks located on opposite sides of frame box 20, including lower tracks 22 and 24, and upper tracks 26 and 28. Tracks 22 through 28 are made from angle iron stock which is connected to frame box 20 by threaded fasteners or welding. Toothed rack assemblies 32 and 34 are rigidly connected to upper tracks 26 and 28, respectively, and are provided to enable longitudinal movement of carriage 18. Frame assembly 12 is supported at a wall box (not shown) which is affixed to the boiler wall or another mounting structure, and is further supported by rear support bracket 36.

Carriage 18 drives lance tube 14 into and out of the boiler and includes drive motor 40 and gear box 42 which is enclosed by housing 44. Carriage 18 drives a pair of pinion gears 46 and 48 which engage rack assemblies 32 and 34 to advance carriage 18 and lance tube 14. Bearings 58 and 59 engage with tracks 22 through 28 to support carriage 18.

Feed tube 16 is attached at one end to rear bracket 52 and conducts blowing medium which is controlled through the action of poppet valve 54. Poppet valve 54 is actuated through linkages 56 which are engaged by carriage 18 to begin blowing medium discharge upon extension of lance tube 14, and cuts off the flow once the lance tube and carriage return to their idle retracted position. Lance tube 14 overfits feed tube 16 and a fluid seal between them is provided by a packing gland (not shown) so that blowing medium is conducted into the lance tube for discharge from nozzles 64.

Coiled electrical cable 60 conducts power to drive motor 40 as it moves with carriage 18. Front support bracket 62 includes bearings which support lance tube 14 during its longitudinal and rotational motion. For long lance tube lengths, an intermediate support 66 may be provided to prevent excessive bending deflection of the lance tube. Additional details of the construction of a well-known design of an "IK" type sootblower is found in U.S. patent 3,439,376, issued to the assignee of this application which is hereby incorporated by reference.

Figure 3 provides a pictorial view of the drive train within gear box 42 of carriage 18. Drive motor 40 transmits power through output shaft 68, then through primary spur gears 70 and 72, and into primary output shaft 74. Primary output shaft worm gear 76 meshes with worm spur gear 78 causing rotation of shaft 80. Shaft 80 directly drives rotation bevel gear 82 which meshes with hub bevel gear 84, which is fixed to lance tube 14. Accordingly, bevel gears 82 and 84 impart rotational motion onto lance tube 14 in response to energization of motor 40. Shaft 80 also drives a pair of translation spur gears 88 and 90 which drive translation shaft 92. Pinion gears 46 and 48 (not shown) are affixed to the opposite ends of shaft 92 and mesh with rack assemblies 32 and 34, as previously explained.

As is evident from Figure 3, due to the direct gear interconnections between the translation and rotational movements of lance tube 14, a fixed relationship in these motions is provided. Figure 2 graphically illustrates the helical paths traced by a pair of diametrically opposed lance tube nozzles 64 during the extension and retraction movements of lance tube 14 for a conventional sootblower. Helical path 96 shown in full lines represents the paths traced by

nozzles 64 during extension. For some designs of sootblowers 10, a lost motion device is positioned at hub 84 which introduces an indexing of the helical paths, such that upon retraction, the helix represented by phantom line 98 traces a path which lies between the paths of helix 96. Even without such a specific lost motion mechanism, drive train backlash is often sufficient to cause such displacement of the extension and retraction helical paths. As mentioned previously, such indexing is provided to enhance cleaning performance and somewhat reduces erosion and wear of the impacted surfaces. However, such indexing does not eliminate such problems since the path positions are fixed. Moreover, significant areas remain between the paths which may not be cleaned adequately. An indexing system is provided in accordance with this invention which changes the positioning of helical paths 96 and 98 in a predictable manner each time sootblower 10 is actuated.

Figures 5 through 7 illustrate rack assembly 32 which incorporates an indexing mechanism in accordance with this invention. In order to simplify this description, only rack assembly 32 will be described in detail, it being understood that rack assembly 34 is identical in configuration and operation. Rack assembly 32 includes a fixed toothed segment 106 and a longitudinally indexible toothed segment 108. Both rack sections 106 and 108 include narrowed ends 110 and 112 which allow them to interfit in overlapping fashion as shown in Figure 5, while providing engagement for the full width of pinion gear 46. Other means for overlapping the rack segments could be used with equal success such as a dove-tail joint or side-by-side racks used with a wide pinion gear. Indexible section 108 is mounted to support rail 26 by threaded fasteners 114 which support slide blocks 115 fitting through

longitudinally extending slots 116 and 118. Blocks 115 do not firmly clamp against indexible section 108, thus enabling that section to undergo longitudinal displacements. Spring bracket 120 supports coil spring 122 and adjustable stop screw 124. Coil spring 122 urges indexible section 108 to the position shown in Figures 5 and 6, in which sections 110 and 112 completely overlap each other. In this position, the interengagement of the teeth of rack sections 106 and 108 properly mesh with pinion gear 46. As an alternative to the use of spring 122, numerous other compliant devices could be employed such as pneumatic cylinders, etc. Stop screw 124 is adjusted so that longitudinal movement of indexible rack segment 108 toward the right with respect to Figure 6 is equal to one tooth (pitch) distance, as designated by dimension "P" shown in Figure 6. Alternately, the indexing motion distance could be a multiple of the pitch spacing. Thus, indexible rack 108 is movable between two extreme positions, both of which provide proper meshing with pinion gear 46.

Rack assemblies 32 and 34 are mounted to rails 26 and 28 such that indexible portion 108 is located furthest from the boiler (although the opposite arrangement could be used). Figure 6 shows pinion gear 46 in its initial position in phantom lines prior to sootblower actuation. In operation, once drive motor 40 is energized to advance the lance, pinion gear 46 acts on indexible rack segment 108 which accelerates carriage 18 from rest, causing a reaction force which compresses coil spring 122. Once the indexing motion of section 108 is completed, pinion gear 46 advances carriage 18. Once the pinion gear 46 is no longer meshing with indexible segment 108, that rack section is permitted to return to its normal position shown in Figures 5 and 6 under the

influence of coil spring 122. Once carriage 18 is advanced to fully extend lance tube 14, it reverses its motion to return to the idle position. Upon such reverse motion, pinion gear 46, as shown in full lines in Figure 6, re-engages with indexible segment 108. Accordingly, each actuation cycle of sootblower 10 causes pinion gears 46 and 48 to advance a fixed amount (e.g. one tooth) with respect to the fixed portion of rack segments 106 and 108. This indexing also causes the positioning of helixes 96 and 98 to be displaced since the longitudinal and rotational lance tube drive mechanisms are geared together and the phasing between pinion gears 46 and 48, and rack assemblies 32 and 34 establish the helix orientations. Such indexing is illustrated by lines 126 in Figure 2 which are partial tracings of various helixes displaced over a succession of actuation cycles. The total number of unique helical paths for a particular sootblower is a function of the extent of indexing motion in the rack, and the gearing relationships within gear box 42 between the pinion drive shaft and the driven member connected to lance tube 14.

Due to the constantly changing helix positions, erosion of particular areas of the boiler due to repeated blowing medium impact is reduced. As outlined previously, as a means of increasing the difference in positions between successive helical paths, rack portions 106 and 108 could be modified, or stop screw 124 adjusted to cause indexing motion equal to two or more pitch spacings of the racks. Rack assemblies 32 and 34 are configured to enable them to be used in place of sections of conventional unitary racks presently used in sootblowers. Therefore, many present sootblowers could be retrofitted with rack assemblies 32 and 34 which provide the indexing capability.

While the above description constitutes the preferred embodiments of the present invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope and fair meaning of the accompanying claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A sootblower having a lance tube with one of more nozzles for projecting a stream of blowing medium against surfaces within a boiler, said lance tube being periodically advanced into and out of the boiler and simultaneously rotated such that the stream of blowing medium projecting from the nozzle traces a helical path, said sootblower comprising;

a frame,

at least one longitudinally extending toothed rack assembly affixed to said frame,

a carriage for travelling along said frame and coupled to said lance tube for controlling the longitudinal and rotational motion of said lance tube, said carriage including drive train means driven by a motor for rotating said lance tube and moving said carriage longitudinally through one or more pinion gears engagable with said toothed rack assembly, said drive train establishing a synchronized relationship between said longitudinal and said rotational motions of said lance tube thereby causing said nozzle to trace said helical path, and

said rack assembly including interengaging fixed and movable portions, said movable portion being longitudinally movable between a first and second position, and biasing means urging said movable portion toward said first position, whereby during a portion of the operating cycle of said sootblower, said pinion gear engages said movable portion moving it to said second position against said biasing means and thereafter moves out of engagement with said movable portion allowing said movable portion to return to said first position under the influence of said biasing means, whereby said pinion gear is indexed with respect to said rack assembly upon each actuation cycle of said sootblower causing said helical paths to be displaced between successive actuation cycles of said sootblower.

2. A sootblower according to claim 1 wherein said rack sections include cut-away end portions enabling said end portions to overlap.

3. A sootblower according to claim 1 or 2 wherein said longitudinally displaced first and second positions are displaced a distance equal to a multiple of the tooth pitch spacing of said rack fixed and movable portions.

4. A sootblower substantially as hereinbefore described with reference to the drawings.

DATED this 23rd day of July, 1991
THE BABCOCK & WILCOX COMPANY
By its Patent Attorneys
DAVIES & COLLISON

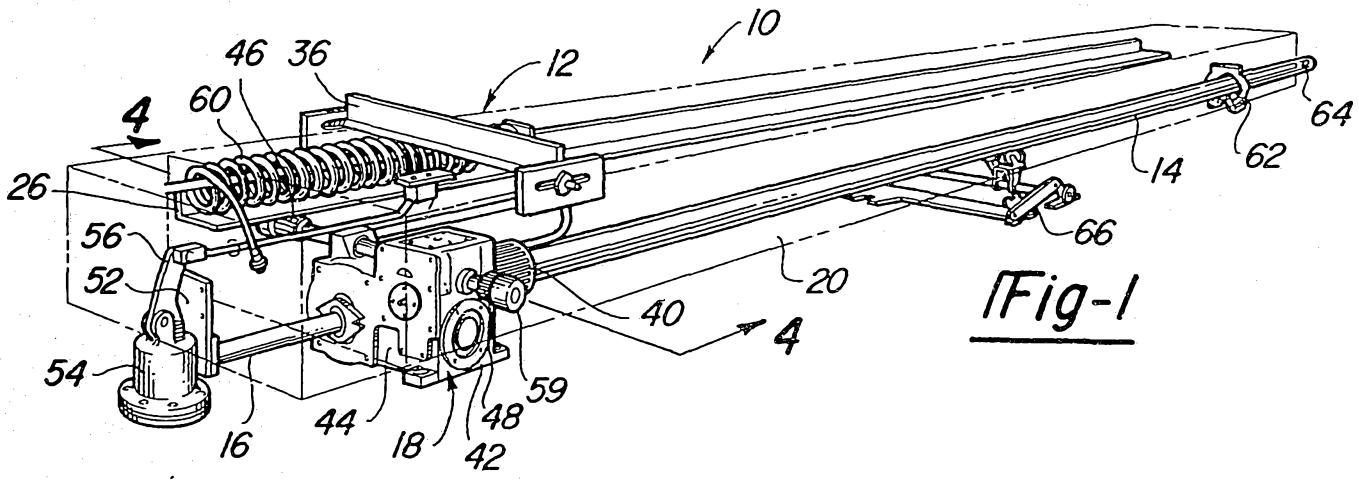

Fig-1

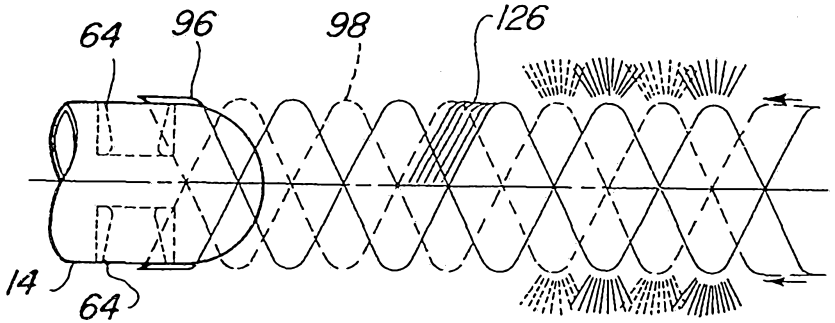

Fig-2

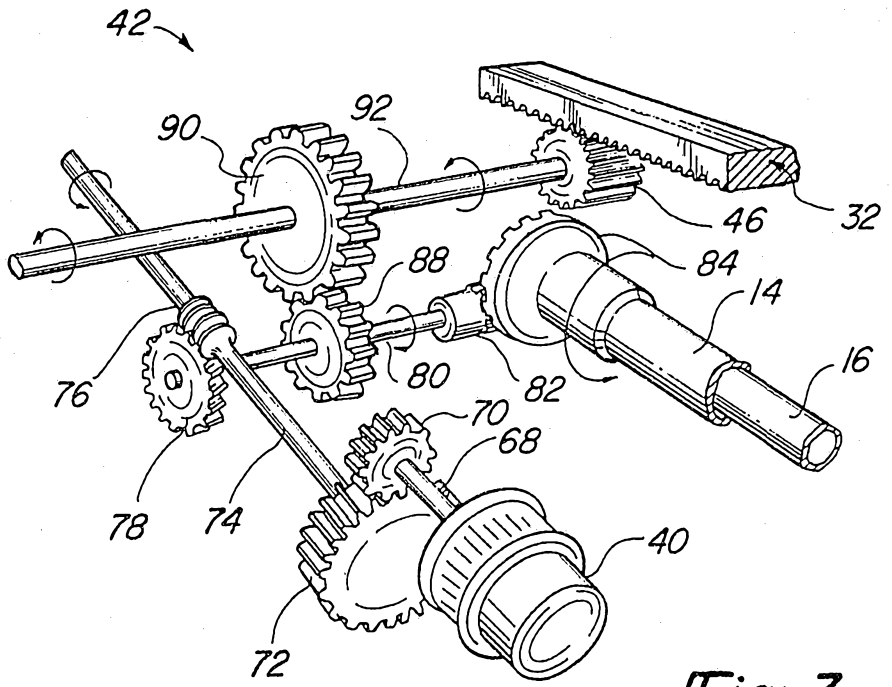
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Fig-3

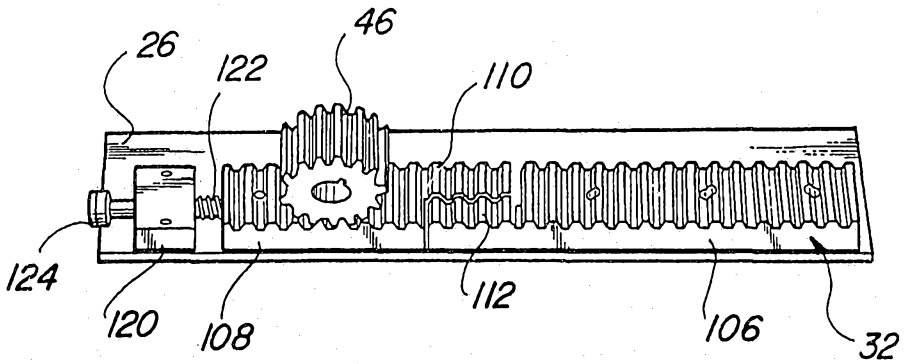
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Fig-5

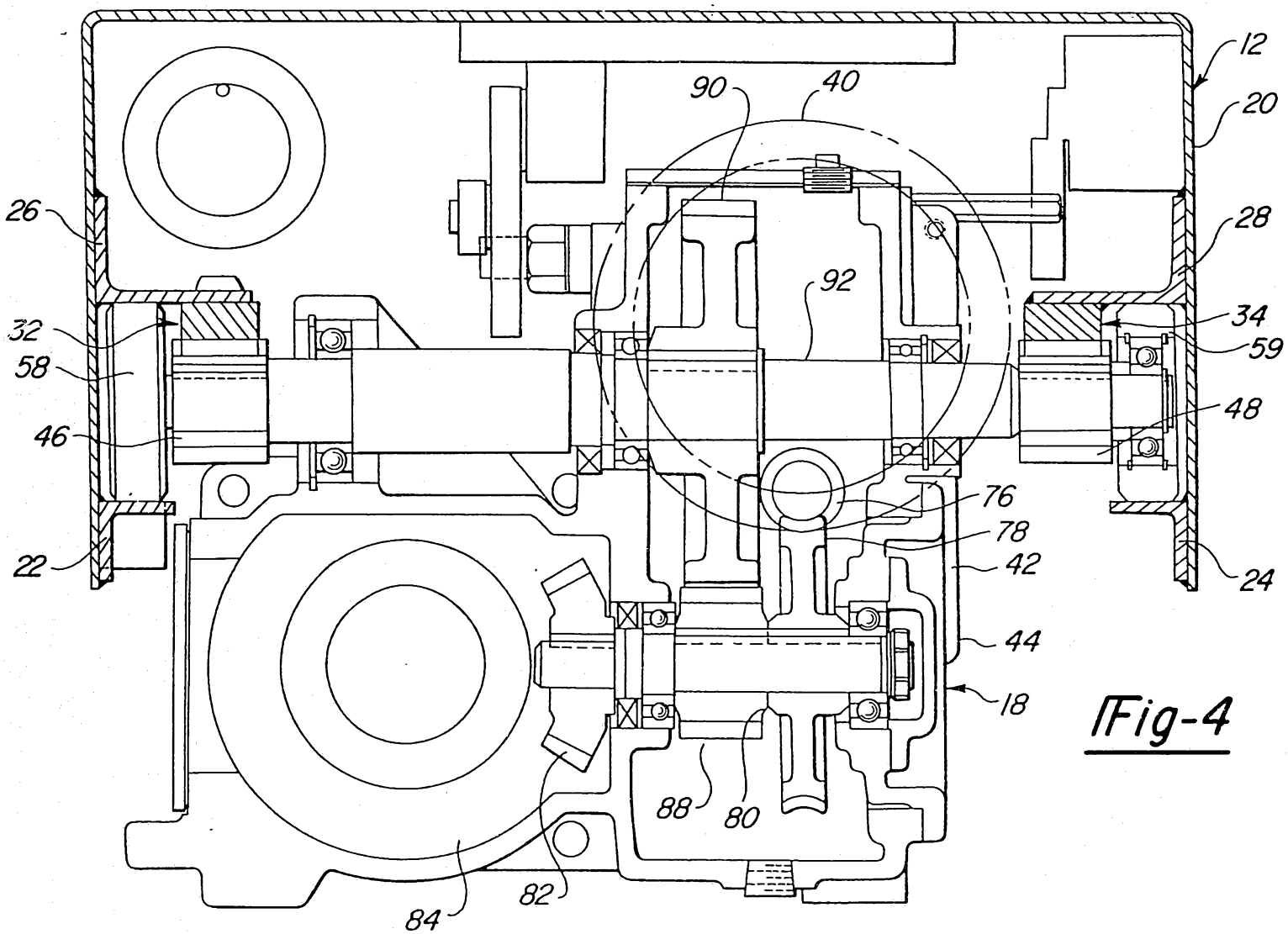

Fig-4

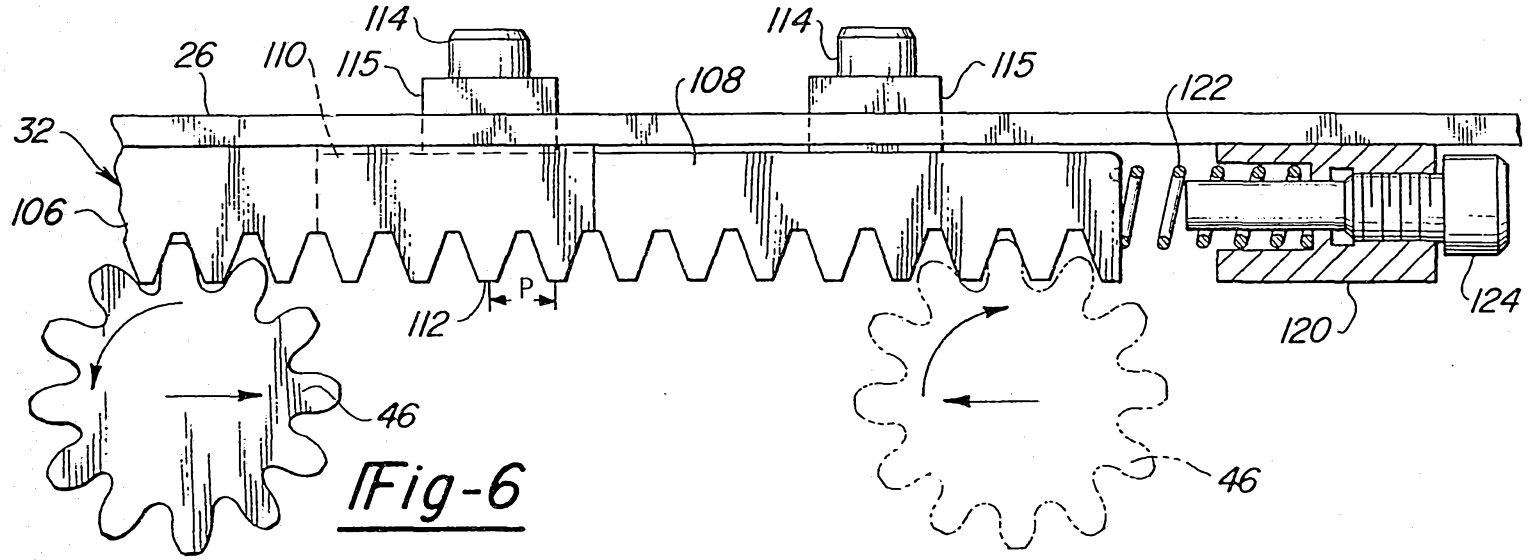
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Fig-6

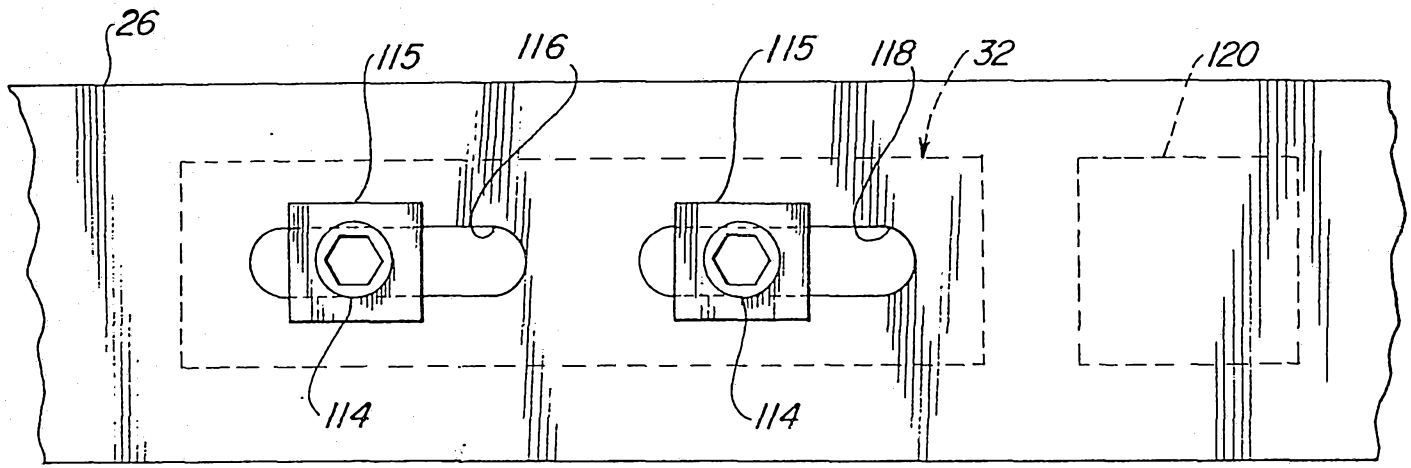
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Fig-7