1985098

United States Patent [19]

Lienert

[11] Patent Number: 4,604,881

[45] Date of Patent: Aug. 12, 1986

[54] SHOT PEENING MACHINE

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[21] Appl. No.: 710,723

[22] Filed: Mar. 11, 1985

Related U.S. Application Data

[63] Continuation of Ser. No. 445,394, Nov. 30, 1982, abandoned.

[51] Int. Cl.[4] B24C 1/10

[52] U.S. Cl. ..... 72/53; 51/418; 51/420; 29/90 A; 198/728

[58] Field of Search ..... 72/53; 51/417, 420, 51/410, 418; 29/90 A; 198/728, 733

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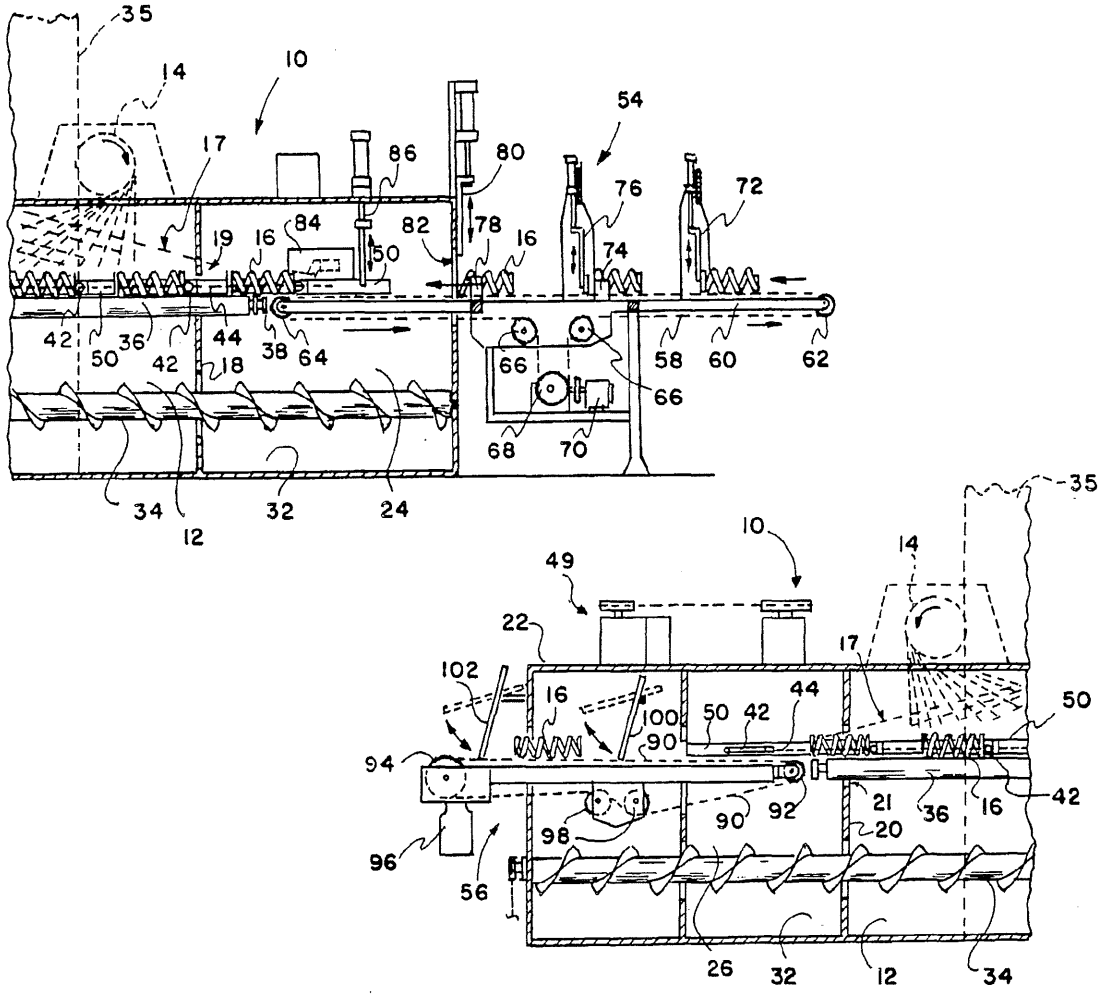
[57] ABSTRACT

An improved shot peening machine is of the type which includes blast wheels capable of propelling a plurality of shot generally downwardly into a critical blast region of the machine for shot peening a plurality of springs passing therethrough. The improvement includes a housing for the machine including a blast cabinet, an entrance chamber and an exit chamber. The blast cabinet generally defines the critical blast region. Horizontally extending spinner rolls for the springs extend through the blast cabinet and terminate at a first end at a first edge of the critical blast region within the entrance chamber and a second end at a second edge of the critical blast region within the exit chamber. The springs are conveyed along a peening path on the spinner rolls from the first end to the second end thereof. A feeding system feeds the springs from an exterior of the housing into the entrance chamber to supply the springs to the first end of the spinner rolls. A discharge system discharges the springs from the exit chamber to the exterior of the housing as the springs are conveyed from the second end of the spinner rolls.

2 Claims, 5 Drawing Figures



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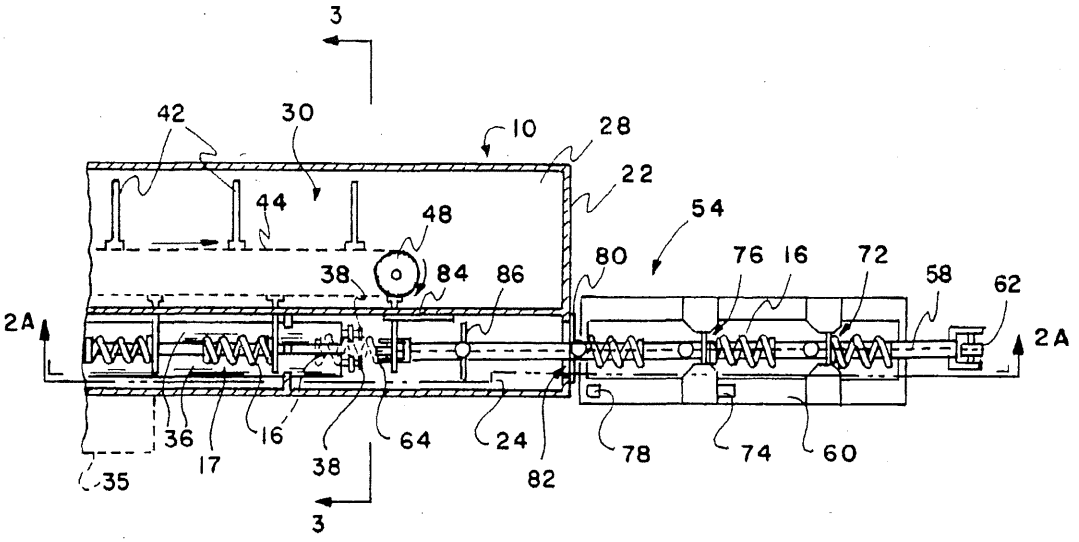

FIG. 1A

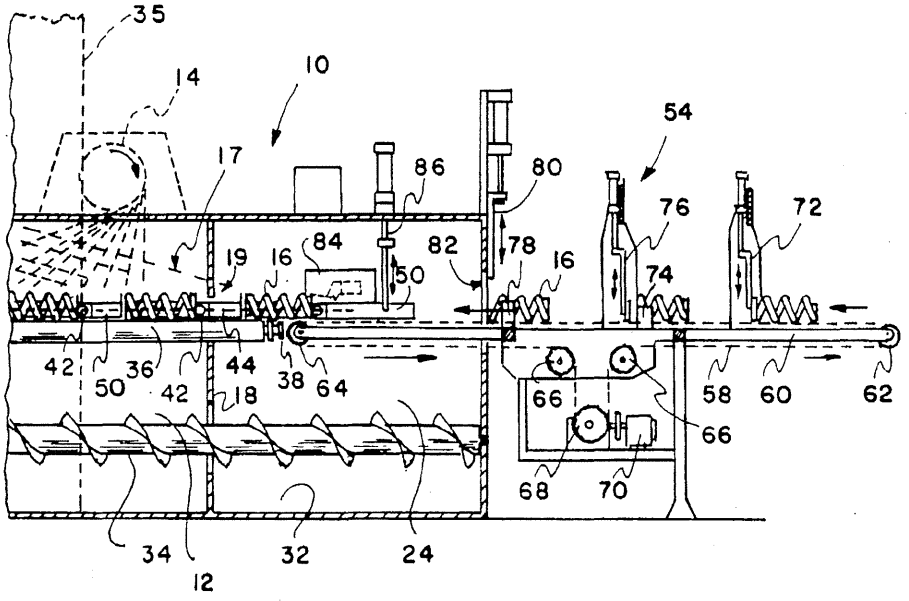

FIG. 2A

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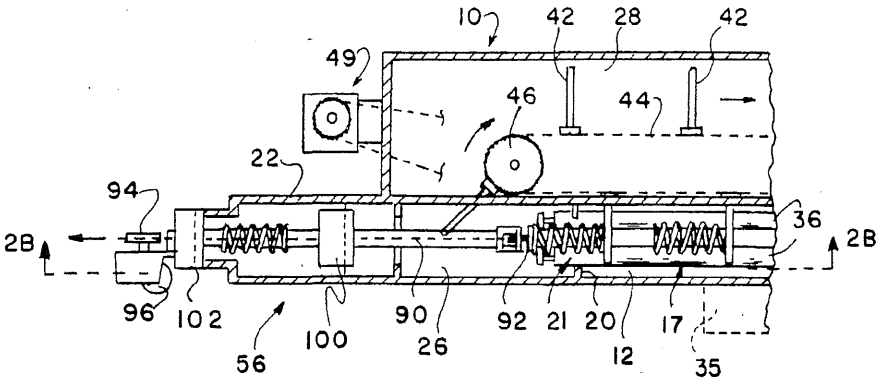

FIG. 1B

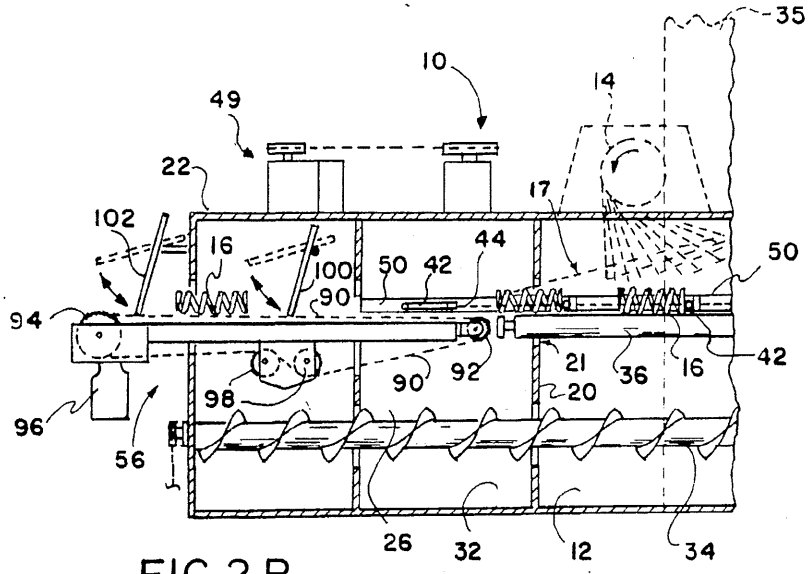

FIG. 2B

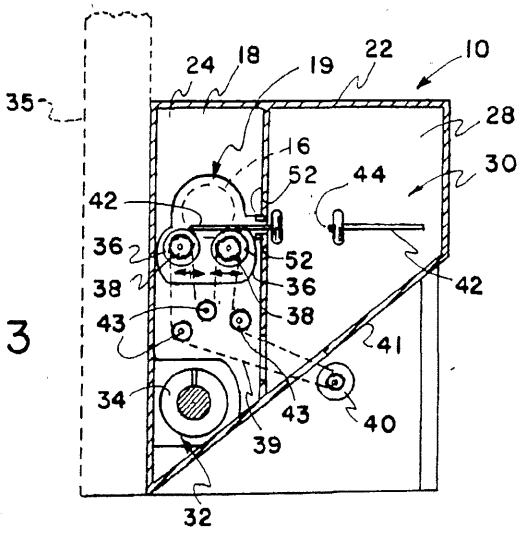

FIG. 3

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the chain **58** at the sprocket **64** to be in a position for the next finger **42**. Each spring **16** will extend at least partially onto the spinner rolls **36** under the frictional force of the chain **58**. However, a spring **16** will not be fully positioned on the spinner rolls **36** or removed from the chain **58** sliding therebeneath until the next, appropriate finger **42** is properly, laterally positioned for conveying it into the critical blast regions **17**.

It should now be clear that as long as there is provided a continuous supply of springs **16** to the first gate **72**, the separating and feeding sytem **54** will automatically space and feed springs **16** to a position within the interior of the shot peening housing **22** as each finger **42** is in a position for its further conveyance through the critical blast region **17**. The first gate **72** tends to initially retard each spring to insure that only one spring is positioned at the second gate **76**. The second gate **76** tends to prevent any spring **16** from being provided to the spring stop and shot sealing gate **80** until a spring initially positioned there has been fully transported into the entrance chamber **24**. Gate **80** will prevent a spring held thereby from entering the entrance chamber **24** until the finger position sensing device **84** indicates that the previously supplied spring **16** is now being moved horizontally onto the rolls **36**. The spring stop and shot sealing gate **80** will then automatically close after the spring has passed completely therethrough and prior to the next spring being provided thereto. The secondary sealing gate **86** will only close to provide a secondary shot sealing means during the time that gate **80** is opened and will then be vertically retracted after a predetermined time which is sufficiently short to insure that no contact is made with a spring **16** passing therethrough. As a result, the spring **16** is capable of being positioned at the end of the chain **58** to be further transmitted by the next finger **42**.

In the preferred separating and feeding system **54**, each of the gates **72**, **76**, **80** and **86** are controlled by air operated cylinders. A control system (not shown) of a type which is well known in the machine control art is capable of actuation and deactuation of the cylinders according to various preplanned signals. Preferably, the spring sensing devices **74** and **78** are photocells but any number of other types of sensing devices might alternatively be utilized.

The discharge system **56** is provided to insure positive discharge of the springs **16** after they have passed through the critical blasting region **17**. The discharge system **56** also includes a horizontally extending chain **90** which is aligned with the exit end of the spinner rolls **36**. The chain **90** extends between a leading end sprocket **92** and a driven sprocket **94** which is driven by a fixed-speed motor **96**.

The upper surface of the chain **90** moves in a direction for continued passage of each spring **16** from the exit chamber **26** to the exterior of the housing **22**. On the return passage of the chain **90**, it is caused to pass through a pair of adjustable idler sprockets **98** to provide proper tension for the chain **90**. The speed of the chain **90** is preset to move much faster than the fingers **42**. As a finger **42** has conveyed a spring **16** through the critical blast region **17**, it continues to convey the spring off of the end of the spinner rolls **36** and onto the upper surface of the chain **90**. Since the chain **90** is traveling at a higher rate, the spring **16** is propelled away from its finger **42** to provide sufficient space therebetween for the finger **42** to then be retracted from the exit chamber **26**. In other words, each finger **42** will no longer be in contact with its spring **16** when that portion of the chain **44** on which it is supported is passing around the driven sprocket **46** and the finger **42** is being returned to the interior of the back chamber **28**.

Again, to prevent inadvertent loss of shot which tends to ricochet within the interior of the housing **22**, the discharge system **56** is provided a pair of gates **100** and **102**. The gates **100** and **102** are both hinged gravity return shot sealing gates which are opened by the spring as it passes therethrough. After each spring **16** passes through the open gate **100**, **102**, the gate will automatically close to retard any shot which may have found its way into the exit chamber **26**.

Having thus explained the overall operation of the preferred shot peening machine **10**, it is appropriate to explain some of the versitility of the preferred shot peening machine and how it is basically operated to perform the shot peening operation on various springs. Initially, the operator must analyze the particular spring to be peened. If the spring has a small diameter, it is possible that the spinner rolls **36** must initially be adjusted to reduce the space therebetween to insure they will properly support and rotate the spring thereon. Further, the operator must determine how long the particular spring should be retained with the critical blast region **17**. The length of time the spring should be retained within the critical blast region **17** will dictate the speed at which the conveyor chain **44** of the preferred conveying means **30** will be operated. Depending on the length of the spring, the fingers **42** may or may not be properly horizontally spaced. It should be kept in mind, that additional fingers **42** can be added to the chain **44** as long as the spacing between each finger **42** and its adjacent fingers **42** is identical. Generally, a spring must not be too close to the immediately preceding spring to insure that the ends of each spring are properly peened. In any case, the operator will realize that for a fixed rate through the critical blasting region **17**, the overall number of springs to be peened can be increased if the distance between adjacent fingers **42** is kept to a minimum. While determining how long the spring will be retained in the critical blast region **17**, a determination of its rotational speed will also be made to establish the speed setting for the motor **40** and the spinner rolls **36**.

Once the speed of the chain **44** and the distance between the fingers **42** thereon is properly determined, the speed of the separating and feeding system **54** can be selected. As indicated hereinabove, the speed of the chain **58** thereof will definitely be faster than will be the speed of the conveyor chain **44**. Regulation of the motor drive **70** of the separating and feeding system **54** will not directly effect the operation of the gates **72**, **78**, **80** and **86**, since they will automatically be controlled by the various spring and finger sensing devices. However, the time delay after initiation of the finger position sensing device **84** will be separately regulated to insure free movement of the spring after it enters the entrance chamber **24**. As mentioned hereinabove, the discharge system **56** is operated at a predetermined speed which is sufficiently great to insure removal of each opring throughout the range of speeds at which the conveying system **30** can be set.

Although the particular components to be found in the machine may vary by design according to the range of springs to be peened therein, there are certain features of the preferred shot peening machine **10** which should be described in order to provide a better under-

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standing of its overall operations. For example, the springs which might be peened in the preferred shot peening machine **10** could have an outside diameter ranging from 2 $\frac{5}{8}$ inches to 11 $\frac{1}{2}$ inches. Springs of various shapes such as cylindrical, conical or barrel springs could all be satisfactorily peened in the machine **10**. To insure proper cold working of this wide range of spring sizes and shapes, the preferred blast wheels are 2 $\frac{1}{2}$ inches wide with a 19 $\frac{1}{2}$ inch diameter and are driven by a 40 horse power motor mounted on top of the blast cabinet **12**.

The critical blast region **17** would be approximately nine feet long. To properly control the springs within the critical blast region **17**, as menitioned hereinabove, the spinner rolls **36** can be adjusted to vary the space therebetween to accommodate springs having any outside diameter within the range mentioned hereinabove while the speed of rotation can be adjusted to insure proper cold working of the particular spring being supported thereby. The variable speed drive for the conveying system **30** can be set to convey the fingers **42** at a speed of 9 to 27 feet per minute. The fingers **42** are approximately 15 inches long and made of $\frac{3}{4}$ inch diameter manganese steel alloy and are aligned to pass through the slot **50** which is approximately 1 inch wide. The chain **58** of the separating and feeding system **54** can be regulated to operate at a speed of 30 to 90 feet per minute. The fixed speed for the discharge system **56** is set at 130 feet per minute and, as indicated hereinabove is adequate for all settings for the conveying system **30**.

As a general rule, the components described hereinabove are capable of accommodating springs at a production rate of between 240 and 720 springs per hour. Assuming a production rate of 600 springs per hour, each spring would be fed into, conveyed through, and discharged from the preferred shot peening machine **10** at a rate of 1 every 6 seconds.

It should be kept in mind that any number of alterations may be made to the preferred shot peening machine **10** without departing from the invention as claimed. For example, even though the blast cabinet of the preferred machine is fairly well defined; a different arrangement of walls and/or baffles could be provided to define an alternative blast cabinet which would generally define but not totally limit the critical blast region. Additionally, although the preferred shot peening machine is intended to shot peen a plurality of springs, other work pieces may be imployed in an alternative machine with various components within the machine being altered to accommodate such work pieces. For example, although the preferred horizontally extending support means for the work pieces is a pair of spinner rolls, if the work pieces were other than a spring, any number of types of horizontally extending support means could be utilized. However, since the horizontally extending support means is located in and limited to the critical blast region to keep its size to a minimum to reduce initial and replacement costs, such alternative machine would still require some means for feeding the work pieces into the housing and discharging the work pieces therefrom. Additionally, although the preferred means for conveying the springs **16** includes a finger and conveyor chain arrangement which is horizontally displaced from the critical blast region, it would be possible to include a conveying system which is located within the critical blast region. Although such an alternative conveying system would be subjected to significant wear and damage, the overall invention as claimed nevertheless includes features which recognize and provide for horizontally extending support means for the work pieces which are relatively inexpensive to initially provide and relatively inexpensive when they must be periodically replaced.

I claim:

1. An improved shot peening machine of the type which includes blast wheel means or the like which is capable of propelling a plurality of shot generally downwardly into a critical blast region of said machine for shot peening a plurality of springs passing therethrough, wherein said improvement comprises:

a housing for said machine including an entrance chamber, an exit chamber, and a blast cabinet therebetween;

said critical blast region being defined by a first edge thereof within said entrance chamber and a second edge thereof within said exit chamber and including the interior of said blast cabinet therebetween;

horizontally extending support means for said springs including a pair of spaced spinner rolls for supporting said springs therebetween, said spinner rolls extending through said blast cabinet and terminating at a first end at a first edge of said critical blast region within said entrance chamber and a second end at a second edge of said critical blast region within said exit chamber;

means for conveying said springs along a peening path on said spinner rolls which said peening path extends from said first end to said second end of said spinner rolls, said means for conveying said springs including a plurality of horizontally extending finger elements which extend transversely of said peening path above said spaced spinner rolls, each of said finger elements being capable of advancing one of said springs along said peening path through said critical blast region, said spinner rolls including a space therebetween free of any means for conveying so that said spaces can be varied without restriction between said spinner rolls to accommodate said springs within a range of different sizes and shapes, and said space can be preselected and fixed to accommodate said plurality of said springs having a particular size and shape,

means for feeding said springs from an exterior of said housing into said entrance chamber to supply said springs to said first end of said spinner rolls; and

means for discharging said springs from said exit chamber to said exterior of said housing as said springs are conveyed by said means for conveying from said second end of said spinner rolls,

whereby said spinner rolls would be subject to wear from said plurality of shot in said critical blast region and require periodic replacement, said spinner rolls would have a minimum overall length needed to support said springs in said critical blast region, and said means for feeding and said means for discharging would be located out of said critical blast region and free of wear by said shot.

2. An improved shot peening machine of the type which includes blast wheel means or the like which is capable of propelling a plurality of shot generally downwardly into a critical blast region of said machine for shot peening a plurality of springs passing therethrough, wherein said improvement comprises:

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a housing for said machine including a pair of spaced vertical walls defining an entrance chamber, an exit chamber and a critical blast region therebetween;

each of said walls being subject to said shot on the critical blast region side thereof;

one of said spaced vertical walls comprising the only barrier between said critical blast region and said entrance chamber;

the other said spaced vertical wall comprising the only barrier between said critical blast region and said exit chamber;

an access hole in each of said spaced vertical walls permitting passage of said springs;

a feed station adjacent said entrance chamber;

a discharge station adjacent said exit chamber,

horizontally extending support means for said springs including a pair of spaced spinner rolls for supporting said springs therebetween, said spinner rolls extending through said critical blast region and terminating at a first end within said entrance chamber adjacent said access hole in said one vertical wall and terminating at a second end within aid exit chamber adjacent said access hole in said other vertical wall;

first conveying means for moving said springs along a peening path on said spinner rolls which said peening path extends from said first end to said second end of said spinner rolls;

second conveying means for moving said springs from said feed station into said entrance chamber to supply said springs to said first end of said spinner rolls adjacent said access hole in said one vertical wall; and

third conveying means receiving said springs from said second end of said spinner rolls adjacent said access hole in said other vertical wall and moving said springs from said exit chamber to said discharge station;

said first, second and third conveying means being substantially axially aligned to provide continuous axial flow of said springs through said machine; and

said pair of spaced vertical walls protect said second and third conveying means from said shot in said critical blast region;

whereby said spinner rolls and said first conveying means which require periodic replacement due to shot wear extend substantially only the axial extent of said critical blast region and, would be of minimum overall length.

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