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.
the chain 58 at the sprocket 64 to be in a position for the
next finger 42. Each spring 16 will extend at least par-
tially 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 pro-
vided a continuous supply of springs 16 to the first gate
72, the separating and feeding system 54 will automati-
cally 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 posi-
tioned 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 posi-
tioned 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
determined time which is sufficiently short to insure
that no contact is made with a spring 16 passing ther-
through. As a result, the spring 16 is capable of being
positioned at the end of the chain 58 to be further trans-
mitted 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 alterna-
tively be utilized.

The discharge system 56 is provided to insure posi-
tive 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 direc-
tion for continued passage of each spring 16 from the
exit chamber 24 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 pro-
vide 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 be then 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 automati-
cally 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 versatility 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 spring roller 36 must initially be ad-
justed to reduce the space therebetwen 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 pre-
ferred 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 preced-
sing 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 be-
tween 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. How-
ever, 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 spring 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 fea-
tures of the preferred shot peening machine 10 which
should be described in order to provide a better under-
11
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 \( \frac{1}{2} \) 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 mentioned 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 \( \frac{1}{2} \) 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 employed 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 signifi-
cant 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.

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:
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 said 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.