March 3, 1970 W. J. WISE 3,497,940

SHELL AND PLUG ASSEMBLY MACHINE

Filed Jan. 30, 1967 3 Sheets-Sheet 1

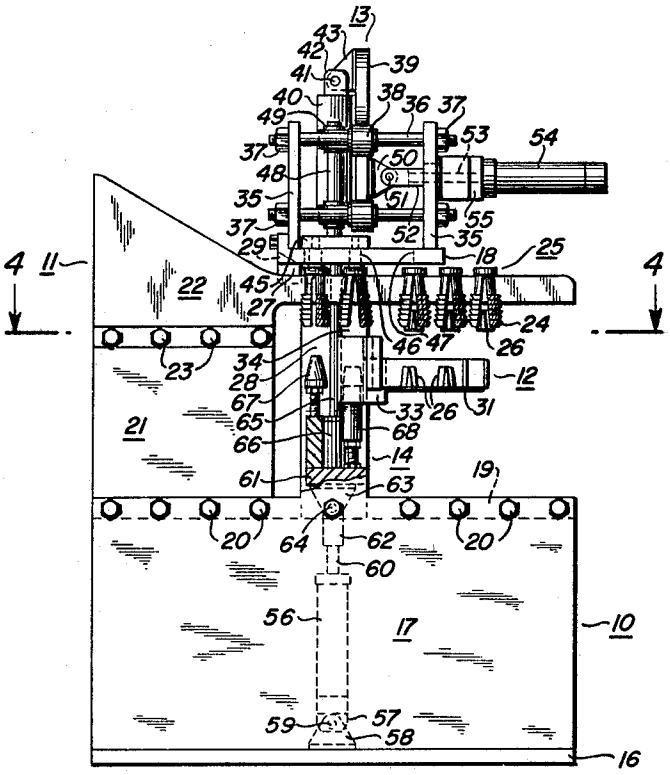


Fig. 1

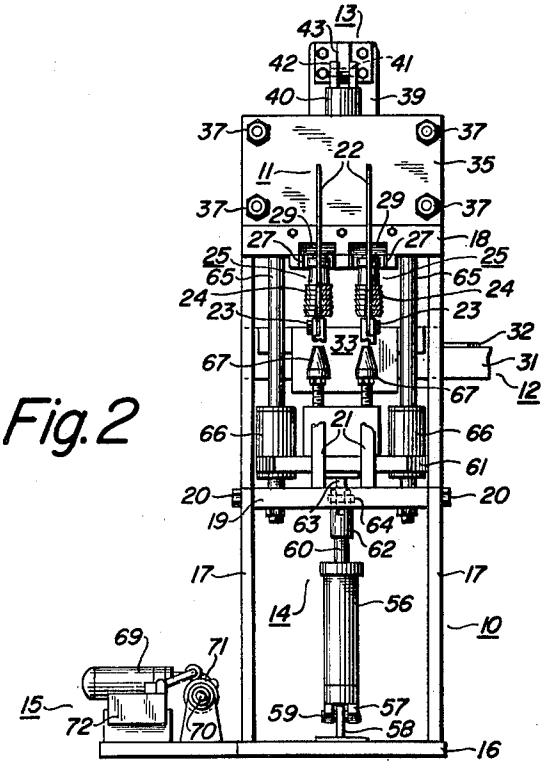


Fig. 2

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Fig.3

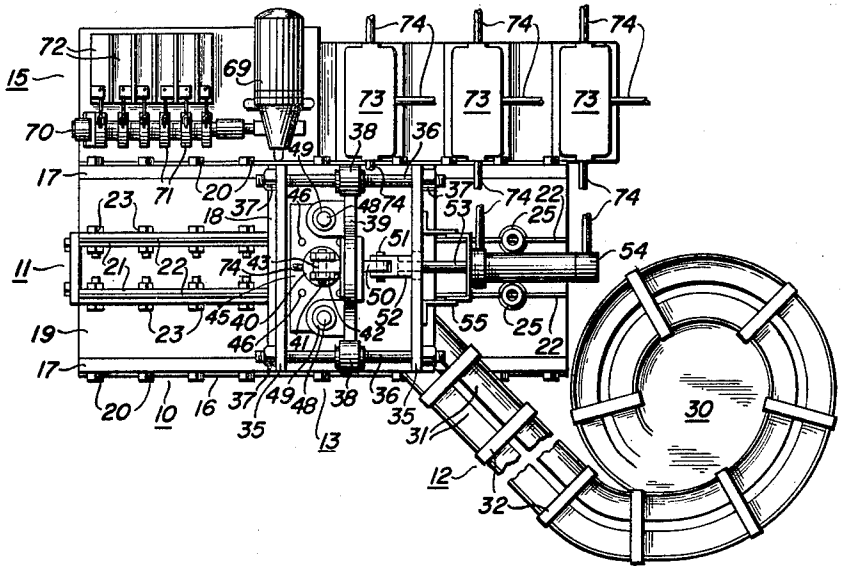


Fig.4

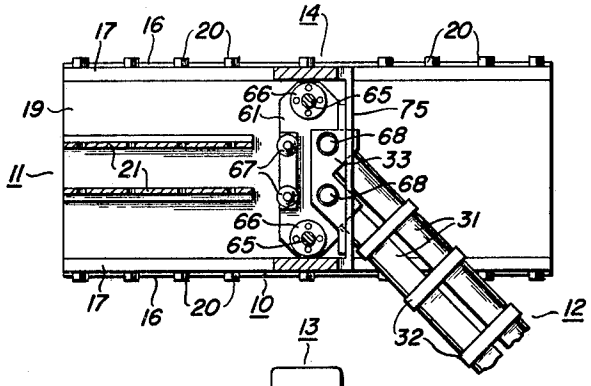
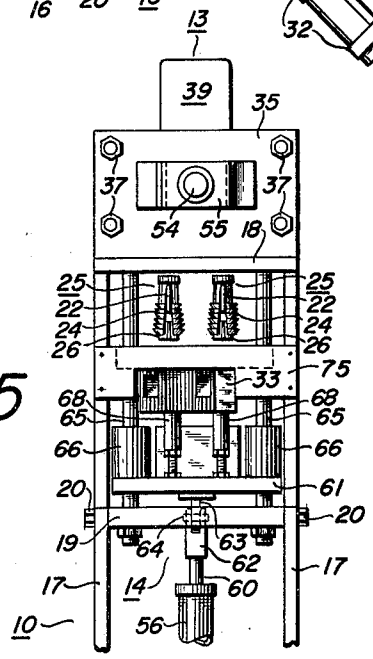


Fig.5



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SHELL AND PLUG ASSEMBLY MACHINE

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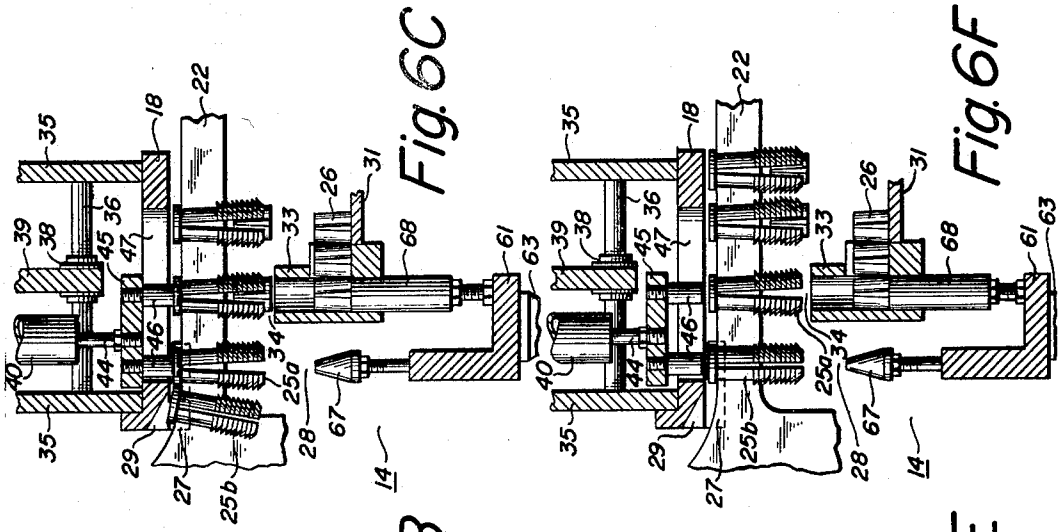


Fig. 6C

Fig. 6F

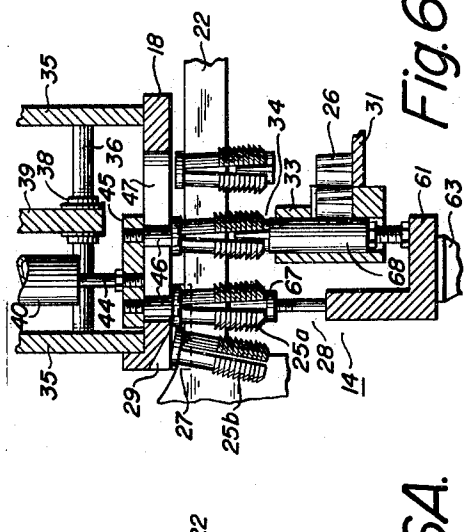


Fig. 6B

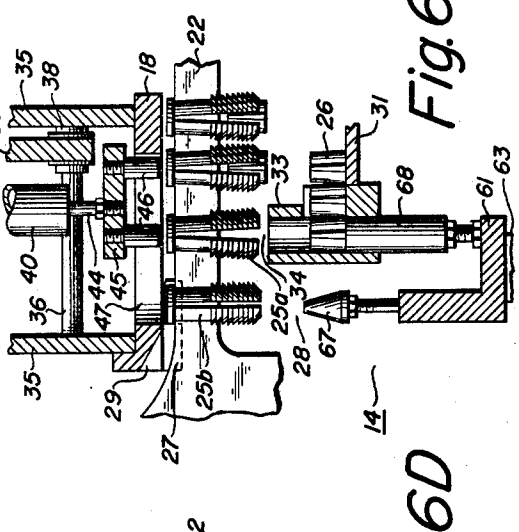


Fig. 6E

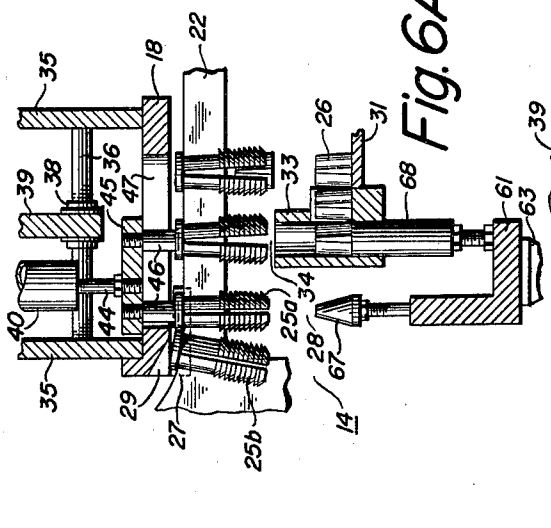


Fig. 6A.

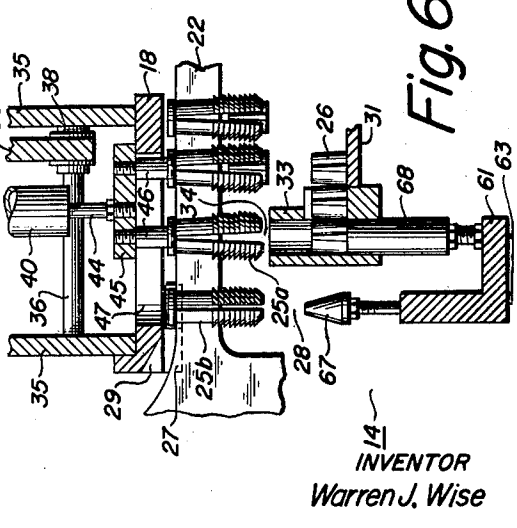


Fig. 6D

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SHELL AND PLUG ASSEMBLY MACHINE

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Int. Cl. B23p 19/04; B23a 7/10
U.S. Cl. 29—208 6 Claims

ABSTRACT OF THE DISCLOSURE

A machine for automatically inserting a plug in an expansion shell having a first station for expanding the depending leaves of the shell and a second station in horizontal alignment with the first station for inserting a plug between the leaves of the shells. Shells are fed to the first station and transferred horizontally to the second station. Plugs are fed beneath the shells to the second station, and the assembled plug and shell is discharged from the machine.

Background of the invention

This invention relates to a machine for assembling parts, and more particularly to a machine for automatically inserting a plug in an expansion shell.

In the past, the assembling of a plug and expansion shell has been accomplished by hand or semi-automatic means. Thus, the cost of assembly was high and the production rate low.

Summary of the invention

It is an object of this invention to provide an automatic machine to economically and rapidly insert a plug in an expansion shell.

The foregoing object can be attained by providing a machine which automatically feeds shells from one source of supply and plugs from another source of supply to a common station in the machine for assembly.

Brief description of the drawings

FIG. 1 is a side view, partly in section and partly broken, of the machine.

FIG. 2 is a partial left end view, partly broken, of the machine.

FIG. 3 is a top view of the machine.

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 1.

FIG. 5 is a partial right end view of the machine.

FIGS. 6A, B, C, D, E and F are partial sectional views showing one complete cycle of the machine.

Description of the preferred embodiments

The following description is directed to a machine for inserting a tapered threaded plug in a four leaf expansion shell of a well known type used in conjunction with a mine roof bolt. However, it would appear obvious that other types of shells and plugs or other similar parts may be assembled by the machine to be described without departure from this invention.

The following description is also directed to a machine to assemble two shell and plug units at one time. It should be understood that the machine may be modified to provide for the assembly of one or more than two such units and remain within the scope of this invention.

In addition, the following description includes air operated cylinders. It is obvious that other fluids could be used to operate these cylinders.

The machine comprises generally a frame **10**, shell feed means **11**, plug feed means **12**, shell indexing and holding unit **13**, shell expanding and plug inserting unit **14**, and timing mechanism **15**.

Frame

As best shown in FIGS. 1 and 2, the frame **10** includes a base plate **16** which may be suitably secured to a foundation. Side plates **17**, **17** of inverted T-shape have their lower ends secured to the base plate **16**, and their upper ends joined together by a top plate **18**. Intermediate plate **19** extends between and perpendicular to side plates **17**, **17** and is secured thereto by fasteners **20**. To form a support for the shell feed means **11**, vertical plates **21**, **21** are secured at their lower ends to intermediate plate **19**.

Shell feed means

As best shown in FIGS. 1 and 2, the shell feed means **11** comprises two parallel feed plates **22** secured to vertical plates **21**, **21** by fasteners **23**. The upper edge of feed plates **22** slopes downwardly toward indexing and holding unit **13** and then extends horizontally between indexing and holding unit **13** and shell expanding and plug inserting unit **14**. The thickness of feed plates **22** is such as to fit freely in a slot between the leaves **24** of the shell **25**. The height of the horizontal portion of the feed plates **22** is such as to allow a shell **25** with a plug **26** inserted between its leaves **24** to slide freely along the feed plate. A leaf spring **27** is secured to top plate **18** and positioned adjacent feed plates **22**. Leaf spring **27** retards the downward movement of a shell **25** along the sloped portion of feed plates **22** in order to properly position the shell **25** at a first station **28** between indexing and holding unit **13** and shell expanding and plug inserting unit **14**. Top plate **18** has a portion **29** cut therefrom in order to allow shell **25** to freely slide along feed plate **22**.

Plug feed means

As best shown in FIGS. 1, 3 and 4, the plug feed means comprises a vibratory bowl **30**, well known in the art, with two feed chutes **31** extending therefrom. Feed chutes **31** have a width such as to allow a plug **26** to pass freely therethrough. Feed chutes **31** are connected together by braces **32**. The discharge ends of feed chutes **31** are secured to and aligned with a plug guide block **33** which is secured to bracket **75** which is fixed to side plates **17**. Plug guide block **33** is positioned directly below the shell **25** depending from shell feed means **11** at second station **34**.

Shell indexing and holding unit

As best shown in FIGS. 1, 3 and 6A through F, this unit **13** includes vertically extending end plates **35** which are secured to the top plate **18** of frame **10**. Extending between and through openings in end plates **35** are four horizontal slide rods **36**. The ends of slide rods **36** are threaded to receive nuts **37** which secure the slide rods **36** to the end plates **35**. Mounted on slide rods **36** by means of bearing sleeves **38** is a horizontal slide **39**. Air operated cylinder **40** is secured to slide **39** by means of a pin **41** passing through a clevis **42** attached to the upper end of cylinder **40** and a bracket **43** attached to slide **39**. In threaded engagement with the end of piston rod **44** of cylinder **40** is a slide plate **45**. Four holding and indexing pins **46**, two located above each feed plate **22**, have their upper ends secured to slide plate **45** by a threaded connection. As shown in FIGS. 1 and 2, two pins are located at the first station **28** and two at the second station **34**. Pins **46** extend downwardly from slide plate **45** and through a slot **47** in top plate **18**. Secured to slide plate **45** are two vertically extending slide rods **48** which pass through bearing sleeves **49** fixed to slide **39**. Fixed to the side of slide **39** opposite cylinder **40** is a clevis bracket **50**. Pin **51** passes through clevis bracket **50** and clevis **52** attached to the end of piston rod **53** of air operated cylinder **54**. Cylinder **54** extends horizontally

and is secured to end plate 35 by support bracket 55. Air operated cylinder 54 through piston rod 53 moves slide 39, which has cylinder 40, pins 41, and vertical slide rods 48 attached thereto, in a horizontal direction along horizontal slide rods 36. Air operated cylinder 40 through piston rod 44 moves slide plate 45, which has pins 46 and vertical slide rods 48 attached thereto, in a vertical direction. Thus slide plate 45 including pins 46 can be moved both horizontally and vertically.

Shell expanding and plug inserting unit

As best shown in FIGS. 1, 2, 4, 5 and 6A through F, this unit 14 includes an air operated, vertically extending cylinder 56 which is secured at its lower end to the base plate 16 by a clevis 57, clevis bracket 58 and pin 59. The piston rod 60 of cylinder 56 extends upwardly through an opening in intermediate plate 19 and is attached to bottom slide 61 by a clevis 62, clevis bracket 63 and pin 64. Bottom slide 61 is slidably mounted on guide rods 65 by means of bearing sleeves 66 which are fixed to bottom slide 61. Guide rods 65 extend between and are attached to intermediate plate 19 and top plate 18. Adjustably secured to the top of bottom slide 61 at the first station 28 are two tapered probes or expanders 67. These expanders 67 are in axial alignment with the first station 28 holding and indexing pins 46 of slide plate 45. The expanders 67 are shaped to spread the leaves 24 of shell 25 at the first station 28 prior to the insertion of a plug 26 into the shell 25 at the second station 34. Also adjustably secured to the top of bottom slide 61 are two plug inserters 68. These plug inserters 68 are in axial alignment with the second station 34 holding and indexing pins 46 of slide plate 45. The plug inserters 68 are in sliding contact with the vertical opening in the guide block 33 of plug feed means 12.

Timing mechanism

As shown in FIG. 3, this mechanism 15 is mounted on base plate 16 and comprises a variable speed motor 69 for driving a cam shaft 70 having six cams 71 attached thereto. Each cam 71 operates a microswitch 72. These microswitches 72 are connected to solenoids 73 which control the flow of air through hoses 74 to cylinders 40, 54 and 56. Since the timing mechanism 15 is well known in the art, it is believed that the above brief description is sufficient for this invention.

Operation of the machine

The following description of the operation of the machine will be directed to one of the feed plates 22 and the pins 46, probe 67, and plug inserter 68 associated with that feed plate. It should be understood that the same operation occurs simultaneously with the other feed plate 22.

With particular reference to FIGS. 1 and 6A through F, shells are placed by hand or mechanically on the sloped portion of feed plate 22. Leaf spring 27 retards the downward movement of the shell so that a shell 25*a* comes to rest at the first station 28, as shown in FIG. 6A. A single line of plugs 26 are fed through chute 31 by vibratory bowl 30. One plug 26 enters the vertically extending opening in guide block 33, as shown in FIG. 6A. At this time and as shown in FIG. 6F, cylinders 40 and 54 (shown in FIG. 1) locate one pin 46 in the raised position at the first station 28 and the other pin in the raised position at the second station 34. Also, cylinder 56 (shown in FIG. 1) locates the probe 67 of the first station 28 and the plug inserter of second station 34 in their lowermost position. Next, the following sequence of operations takes place: First, cylinder 40 through piston rod 44 lowers slide plate 45 causing the pin 46 of the first station 28 to enter a hole in the top of shell 25*a* and the slide plate 45 to contact the top of shell 25*a* to prevent any upward movement of shell 25*a*. See FIG. 6A. Second, probe 67 attached to bottom slide 61 is moved upwardly by cylinder 56 and enters the opening between the leaves 24 of shell 25*a* and expands the leaves 24. See FIG. 6B. Third, probe 67 is moved downwardly to a position shown in FIG. 6C. Fourth, shell 25*a* is moved to the second station 34 by the movement of slide plate 45 and first station pin 46 to a position shown in FIG. 6D. This movement is accomplished by cylinder 54 moving slide 39 along slide rods 36. Fifth, pins 46 and slide plate 45 are raised by cylinder 40, as shown in FIG. 6E. Sixth, pins 46 and slide plate 45 are moved horizontally to the position shown in FIG. 6F. This movement is accomplished by cylinder 54 moving slide 39 along slide rods 36. After the above steps, the pins 46, probe 67, and plug inserter 68 are in the same position as that prior to the first step above. Thereafter the above first through sixth steps are repeated, and in addition to that described above the following occurs. A shell 25*b* enters the first station and goes through the same steps as above described for shell 25*a*. Under the first step, FIG. 6A, the pin 46 at the second station 34 enters the opening in the top of shell 25*a*. Under the second step, FIG. 6B, a plug is forced upwardly by plug inserter through the vertical opening in guide block and forced between the leaves of expanded shell 25*a*. Thus, shell 25*b* is being expanded at the same time shell 25*a* is having a plug 26 inserted therein. Under the third step, FIG. 6C, another plug 26 is fed into the guide block 33 from chute 31 by vibratory bowl 30. Under the fourth step, shell 25*a* with a plug inserted between its leaves 24 is removed from the second station 34 by the horizontal movement of second station pin 46. As the assembled shell and plug is moved from the second station 34, it forces the prior assembled shell and plug to slide nearer the discharge end of feed plate 22 and eventually fall off the feed plate 22 into a suitable container or conveying means.

In summary, the machine of this invention provides means to feed shells to a first station, means to feed plugs to a second station, an indexing and holding unit which holds a shell at the first station and another shell at the second station, moves the shell of the first station to the second station and moves the shell from the second station, and a shell expanding and plug inserting unit which expands the first station shell leaves while inserting a plug in the expanded shell at the second station.

I claim:

1. A machine for assembling a plug in a shell comprising:
   (a) means to feed a shell having depending leaves to a first station,
   (b) means to feed a plug beneath said shell to a second station positioned in horizontal alignment with said first station,
   (c) means positioned above said shell and adapted to hold a shell at said first station and another shell at said second station and to horizontally move the shell of said first station to said second station and the shell of said second station from said second station, and
   (d) means adapted to move vertically upwardly to simultaneously expand the leaves of the shell of said first station and insert a plug within the leaves of the shell of said second station when the means of subparagraph (c) is holding said shells.

2. The machine as described in claim 1 wherein the means of subparagraph (c) includes a first fluid operated cylinder adapted to hold the shells and a second fluid operated cylinder adapted to horizontally move the shells.

3. The machine as described in claim 2 wherein the said first cylinder has a substantially vertically extending piston rod and said second cylinder has a substantially horizontally extending piston rod.

4. The machine as described in claim 3 wherein the means of subparagraph (a) includes a feed plate having an inclined portion to feed a shell to said first station, a horizontal portion to guide a shell during its movement

from said first and second stations, and a thickness to pass between the slot in adjacent leaves of a shell.

5. The machine as described in claim 3 wherein the means of subparagraph (d) includes a third fluid operated cylinder with a substantially vertically extending piston rod having shell-leaves expanding means attached thereto at said first station and plug-inserting means attached thereto at said second station.

6. The machine as described in claim 5 wherein the means of subparagraph (a) includes a feed plate having an inclined portion to feed a shell to said first station, a horizontal portion to guide a shell during its movement from said first and second stations, and a thickness to pass between the slot in adjacent leaves of a shell.

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THOMAS H. EAGER, Primary Examiner

U.S. Cl. X.R.

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