Dec. 7, 1954 W. D. PETERS 2,696,130

METHOD AND APPARATUS FOR APPLYING BANDS TO CYLINDERS

Filed Jan. 29, 1952 4 Sheets-Sheet 1

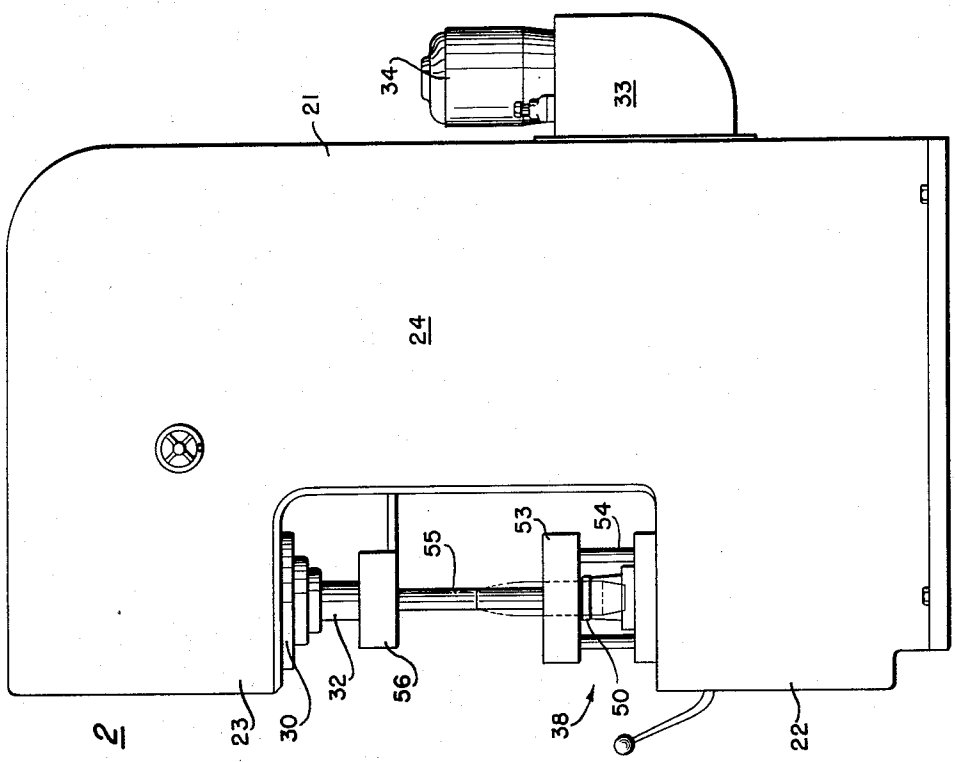


FIG. 2

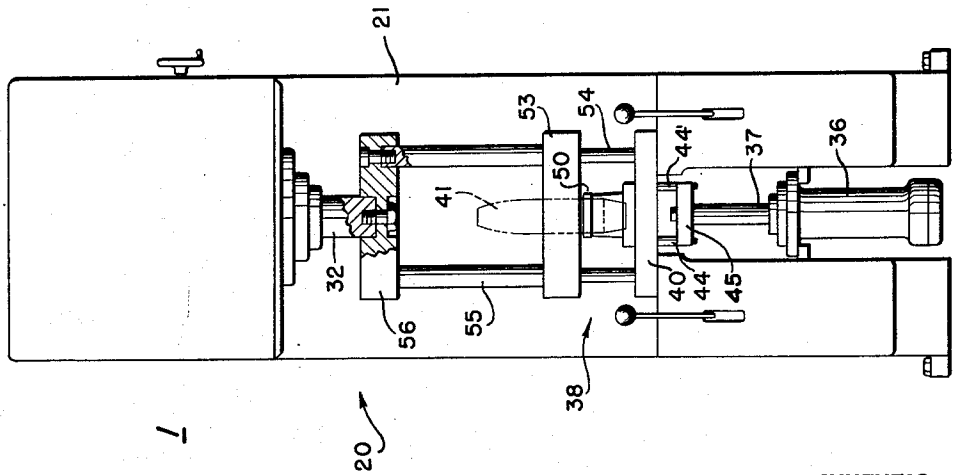


FIG. 1

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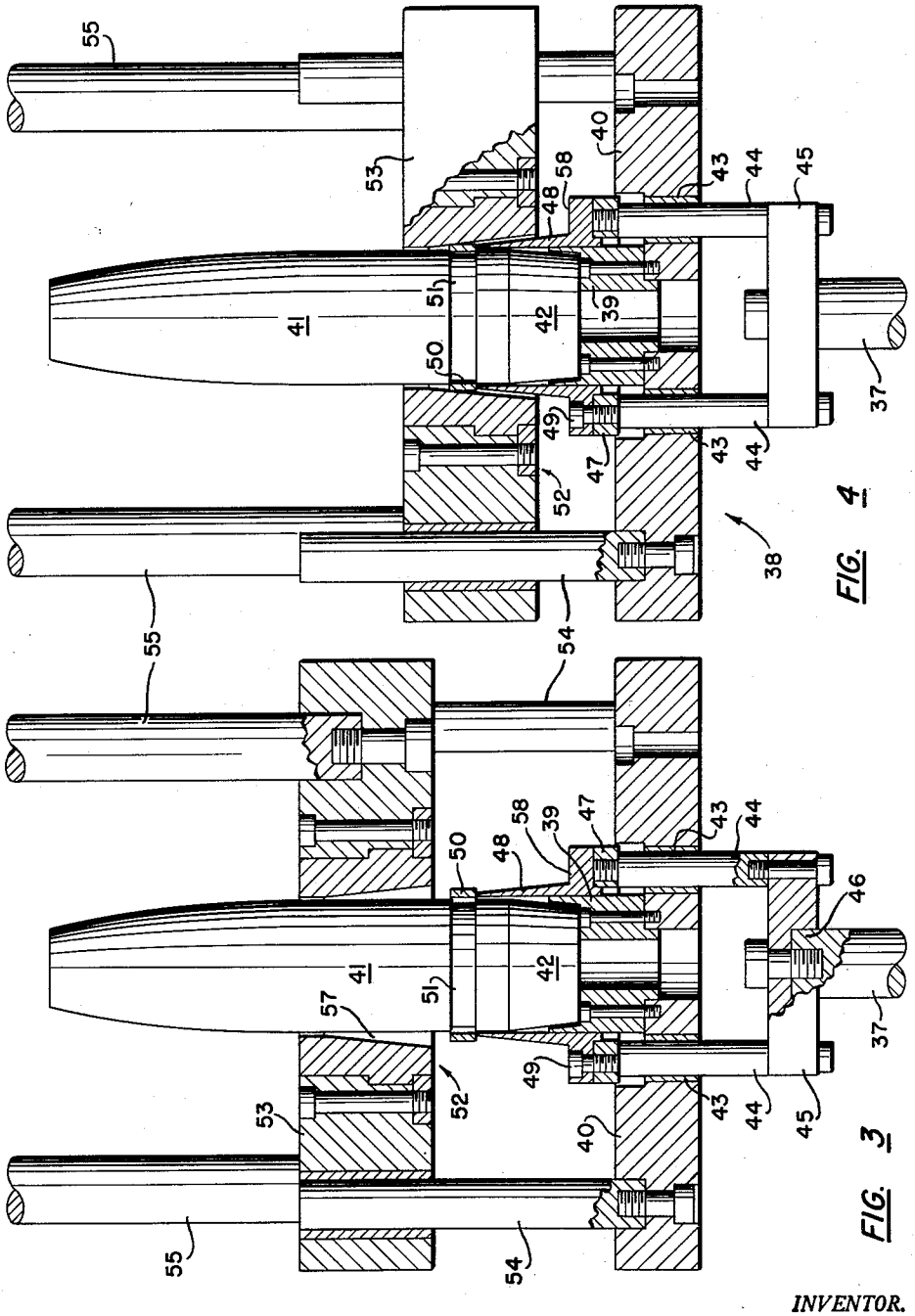


FIG. 4

FIG. 3

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METHOD AND APPARATUS FOR APPLYING BANDS TO CYLINDERS

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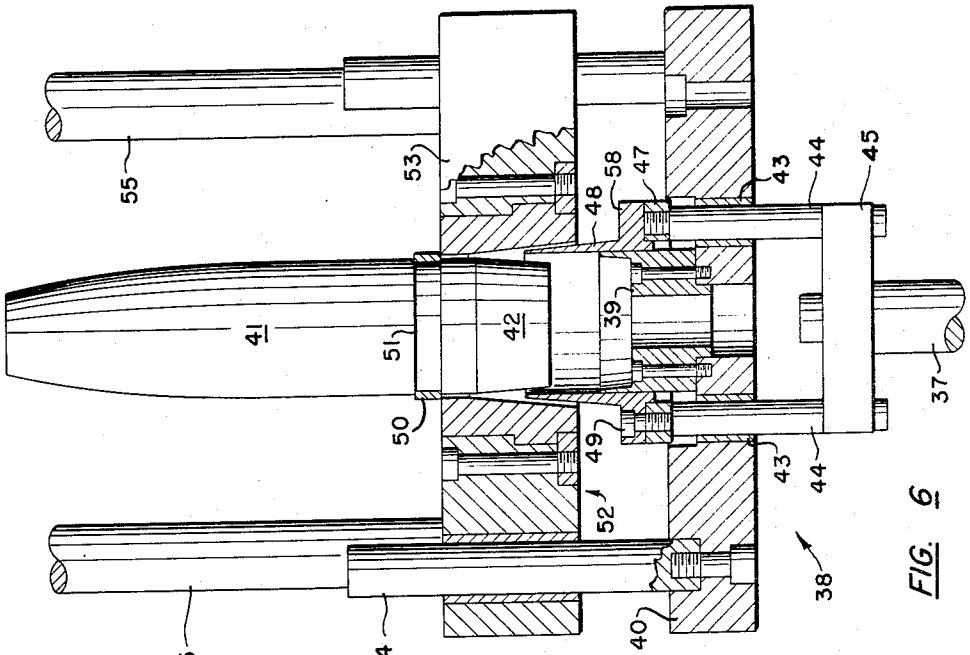


FIG. 6

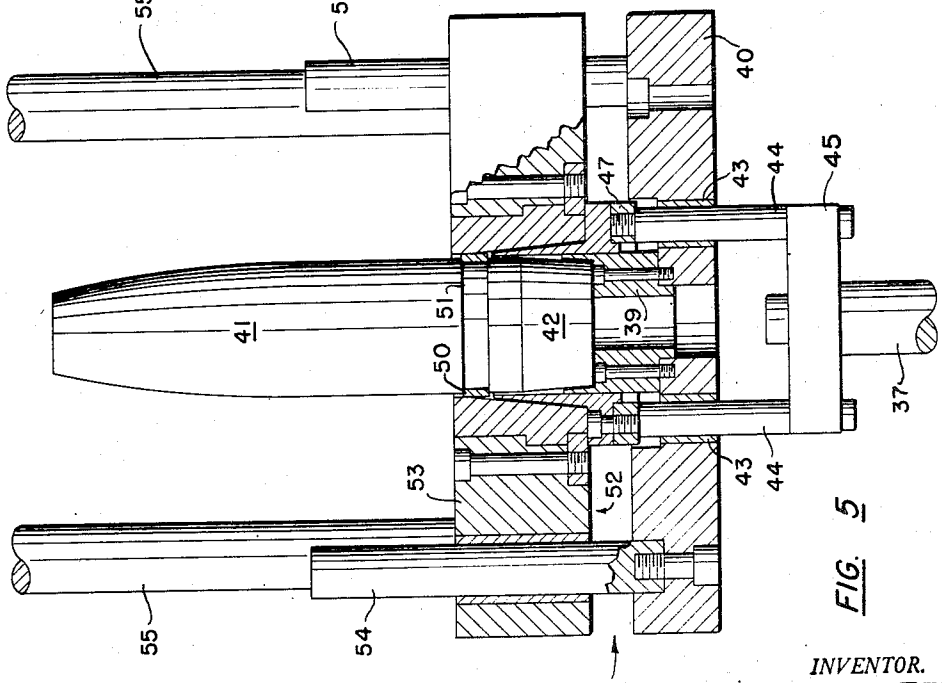


FIG. 5

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METHOD AND APPARATUS FOR APPLYING BANDS TO CYLINDERS

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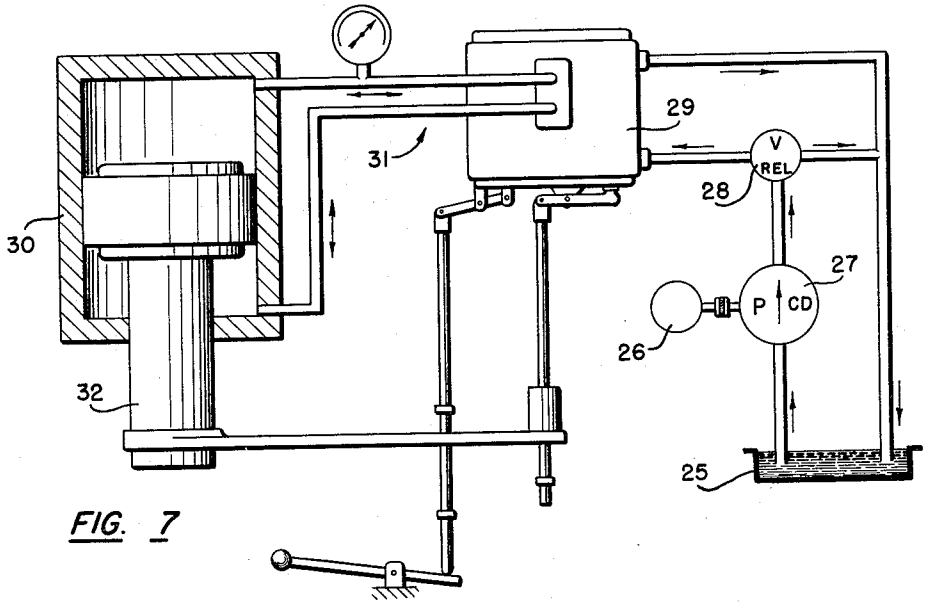
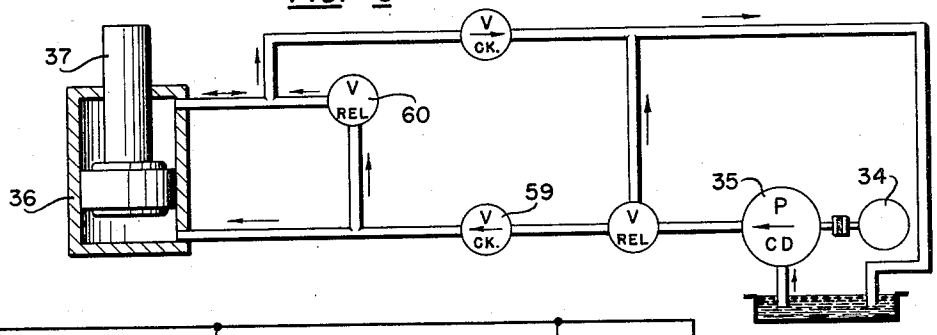


FIG. 7

FIG. 8



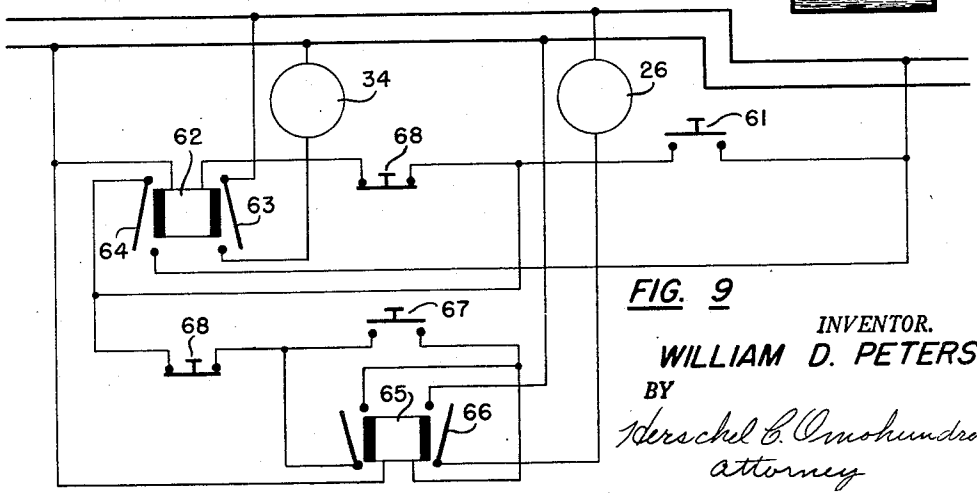


FIG. 9

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2,696,130

METHOD AND APPARATUS FOR APPLYING BANDS TO CYLINDERS

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Application January 29, 1952, Serial No. 268,833

12 Claims. (Cl. 78—15)

This invention relates generally to metal working; more particularly, the invention relates to the attachment of a metal band to a cylindrical metal body without the use of fastening devices, one example of the invention being the application of a band to the body of a projectile.

An object of this invention is to provide a method and apparatus for quickly and expeditiously applying bands to shell casings or other cylindrical bodies.

Another object of the invention is to provide a method and apparatus for contracting or compressing ring-like bands into grooves in cylindrical bodies by passing a contracting instrument or die over the bands while they are supported in registration with the grooves.

A further object of the invention is to provide tooling for carrying out the method outlined above, the tooling being so constructed and operated that a minimum of wear or breakage will occur thus increasing the efficiency of the mechanism and the operators.

A still further object of the invention is to provide band applying tooling having means for supporting the shell or other body against longitudinal movement, other means for supporting a band in registration with the groove in the body, and also against longitudinal movement and a die with a tapered opening for contracting the band into the groove in the body, the relation of the band supporting means and the die being such that after the die has compressed the band a part of the distance into the groove, it will engage the band supporting means and move it away from the band, the die completing the band compressing or contracting operation as it moves the band support thus preventing either of the pieces of the tooling from injuring the other.

Another object of the invention is to provide tooling for applying bands to cylindrical bodies, the tooling having a collar-like support for the bands and a die with a tapered opening for compressing the bands into grooves in the bodies, the support for the band being held against movement with sufficient force to allow the band to be contracted when the band is engaged by the die, the force being insufficient, however, to prevent the support from moving when it is engaged directly by the die.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of embodiment of the invention is clearly shown.

In the drawings:

Fig. 1 is a front elevational view of mechanism for applying bands to cylindrical bodies formed in accordance with the present invention.

Fig. 2 is a side elevational view of the mechanism shown in Fig. 1.

Figs. 3, 4 and 5 are detail longitudinal sectional views on an enlarged scale taken through a portion of the mechanism showing parts thereof in different stages of operation.

Fig. 6 is also a longitudinal sectional view showing the mechanism after the last stage of operation has been completed.

Fig. 7 is a diagrammatic view of the hydraulic system used with the main ram of the press mechanism shown in Figs. 1 and 2.

Fig. 8 is a similar view of the hydraulic system used with the secondary or band holding ram of the press mechanism shown in Figs. 1 and 2.

Fig. 9 is a diagrammatic view of the electric circuit

for the motors used to operate the hydraulic pumps in the systems shown in Figs. 7 and 8.

Referring more particularly to the drawings, the numeral 20 designates a press which may be employed to carry out the method and operate the banding mechanism of the invention. In this instance, a hydraulic press has been selected for purposes of illustration only and is should be obvious that other types of presses may be adapted to the operation as well. The press 20 includes a modified C-frame 21 having a forwardly projecting base portion 22 and a similarly projecting head section 23, these sections being spaced by a back section 24.

The base, back and head sections house a reservoir 25, a motor 26, a pump 27, a relief valve 28, a control valve 29, a power cylinder 30 and conduits which connect these elements and complete a hydraulic system 31 which has been diagrammatically illustrated in Fig. 7. This hydraulic system is employed in the operation of a main ram 32 which effects the banding of the cylindrical bodies.

The back section is provided with a rearwardly projecting shelf-like portion 33 for supporting a motor 34 used to operate a hydraulic pump 35, see Fig. 8, to generate hydraulic pressure to operate a second power cylinder 36 disposed in a recess provided in the forwardly projecting portion of the base section of the press. The second power cylinder 36 is equipped with a secondary ram 37 used to yieldably hold the bands, for the cylindrical bodies, in the banding position.

The invention is primarily directed to apparatus in the form of tooling actuated by the press 20 to apply bands to grooved cylindrical bodies, this tooling or otherwise designated apparatus being indicated generally by the numeral 38. The tooling 38 includes a seat member 39 which is mounted on a plate 40 carried by the base section 22. The seat member 39 is disposed in axial alignment with the rams 32 and 37 and is provided for the reception and support of a cylindrical body 41 which in this instance has been illustrated as the case of a projectile. The lower end of this case is tapered as at 42, the seat member 39 being similarly formed for the accommodation of the member 41. If the lower end of the member 41 should be otherwise shaped the seat would also be modified to conform thereto.

The plate 40 is provided with a plurality of openings in which bearing sleeves 43 are disposed, these sleeves serving as guides for pins 44 which extend upwardly from a crosshead 45, this crosshead being secured as at 46 to the upper end of ram 37. The upper ends of the pins 44 are secured to a ring member 47 on which a sleeve-like band support 48 is secured by screws or other fastening devices 49. This band support is disposed for sliding movement around the seat 39 and projects upwardly beyond this seat a distance sufficient to hold a band 50 in registration with an annular groove 51 formed in the body 41 disposed in the seat 39. The band is supported in this position so that it may be compressed and forced into the groove 51 so that it will become firmly united with the member 41. It is an object of the invention to force the band into such firm engagement with the body that the band will be immovable relative to the body.

To force the band into the groove a compressing die, indicated generally by the numeral 52, has been provided; this compressing die is carried by a shoe 53 which is mounted for sliding movement on upwardly directed guides 54 carried by and secured to the plate 40. The shoe 53 is secured to the lower ends of rods 55 the upper ends of which are secured to a crosshead 56 which is in turn fixed to the lower end of ram 32. When ram 32 is reciprocated, the die 52 will be moved toward and away from the band support 48 and the seat 39.

The die 52 is formed with a tapered opening 57 which is in axial registration with the seat 39 and band support 48 and consequently the shell body 41. As the die moves in a downward direction when a shell body and band are disposed in the seat and on the support 48, respectively, the tapered sides of the opening 57 will engage the band and compress the same from all sides toward the center causing the band to enter the groove 51. The band support 48 has its exterior wall tapered similarly to the

taper of the opening **57**. It will be obvious that in order to cause the band to compress, and be reduced in diameter it will be necessary to resist longitudinal movement of the band in the direction in which the die **52** is moved. The band support is, therefore, carried by the ram **37**, of the lower power cylinder **36** and fluid under pressure is supplied to the lower end of this power cylinder to resist movement of the ram. It will be noted from Figs. 3 to 6, inclusive, that the upper end of the opening in the die **52** is only slightly greater in diameter than the exterior of the body **41**.

If the die **52** is permitted to move downwardly far enough relative to the support **48**, the latter may be engaged and damaged by the die or in turn cause damage to the die. It is, therefore, a feature of the invention to cause the support **48** to move in unison with the die after the band **50** has been partially compressed into the groove **51**. To facilitate this operation, the support **48** is provided with a shoulder **58** which will be engaged by the die **52** after the latter has moved a distance sufficient to partially compress the band **50** into the groove **51**, this distance being insufficient to permit the sides of the die at the opening **57** to engage the exterior of the support **48**. After the die **52** engages the shoulder **58**, the band support **48** will be moved by the die away from the band **50**. The band will be prevented from movement longitudinally, however, through engagement of the band with the shoulder at the lower side of the groove **51**. Continued movement of the die will cause the continued compression of the band **50** into the groove **51** until the band is finally compressed by the smallest diameter of the die opening **57**. The die is moved relative to the body **41** until it passes completely beyond the band **50**. After the die has engaged the shoulder **58** the support **48** will move with the die. As has been mentioned, the lower power cylinder tends to resist movement of the band support **48**. This resistance is supplied by fluid trapped in the lower end of the power cylinder **36**. As shown in the diagrammatic view in Fig. 8, cylinder **36** receives fluid from pump **35** through a line in which a check valve **59** is positioned. This check valve prevents reverse flow of fluid so that when the die **52** engages the band **50** the latter will be prevented from moving and imparting motion to the support **48** and ram **37**. By resisting longitudinal movement of the band, while the die **52** is moving, the band will be caused to contract and move into the groove **51**. After the die has engaged shoulder **58**, however, the support **48** must move with the die. This movement is made possible by disposing a relief valve **60** in a line connecting the ends of cylinder **36**. This relief valve **60** will be set to resist fluid flow from the lower to the upper end of the cylinder until the pressure on the fluid is in excess of that necessary to resist longitudinal movement of the band by the die. When the die imparts force directly to the ram **37** through the shoulder **58**, however, the valve **60** will permit fluid flow and ram **37** and support **48** will move downwardly at the same rate as the ram **32**. As previously pointed out, the initial movement of the die **52** downwardly around the band forces the band partially into the groove **51**, then, when the die moves the support **48** away from the band, the bottom wall of the groove will support the band against longitudinal movement and the continued movement of the die will complete the compression of the band into the groove.

After the die has moved beyond the band the flow of fluid to the power cylinder **30** will be reversed causing the die to be retracted. Due to the inherent resiliency of the material of the band the latter will expand slightly after the die has passed beyond it permitting the lower edge of the band to engage the top surface of the die and be elevated together with the body **41** from the seat **39** as the die is retracted. The fluid pressure being supplied to the power cylinder **36** by the pump **35** will cause the band support **48** to move or be returned to its operative position as the die **52** is retracted. The parts of the mechanism will then be in position for the next succeeding operation. The first step in the operation is the placing of a band **50** on the support **48**; this operation may be performed manually or by any other suitable means. The next step consists in inserting the body **41** through the opening in the die, through the band **50** and support **48** and into the seat **39**.

It will be obvious from the foregoing that the seat **39** is rigidly secured to the forwardly projecting base portion of the press and is immovable.

Due to the mounting of the band support on the ram of the power cylinder **36** the band support is yieldably held against longitudinal movement until the shoulder on the band support is engaged by the die during its movement to compress the band.

Fig. 5 shows the mechanism immediately after the die has engaged the shoulder on the band support and partially withdrawn the support from the band. It will be noted from this figure that the band has been partially compressed into the groove **51** so that the lower edge of the band is in engagement with the lower edge of the groove **51**. This engagement prevents the band from moving longitudinally as the die is moved, consequently, the compression of the band into the groove will continue as the die moves. By this method the life of the banding tools or mechanism will be lengthened and the banding operation expedited. It will be obvious that the mechanism may be modified in many ways without affecting the method.

To avoid possible jamming and injury to the tooling, the electrical circuits for the motors **26** and **34** are arranged so that the motor **34** for the cylinder **36** is started before the other motor. The electrical circuits are shown in Fig. 9. It will be seen from this figure that the closing of manual switch **61** will complete the circuit for relay **62** which operates a switch **63** to energize motor **34**. Relay **62** also operates a switch **64** which partially controls a circuit for a second relay **65**, the latter in turn controlling a switch **66** for the motor **26**. A second manual switch **67** cooperates with switch **64** to control the second relay **65**. After switches **61** and **67** are momentarily closed, the relays will maintain the circuits closed until normally closed switches **68** are operated to break the circuits. After the circuits are broken it will be necessary to first close switch **61** before the circuit for motor **26** can be completed by closing switch **67**.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

1. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for a body; a second movable support for a band; a die having a conical opening guided for movement around the body and band to contract the latter into a groove in the body; power operated means for yieldably holding the second support against movement; and a second power operated means for moving said die to effect the contraction of the band, said second power operated means serving to move said second support away from the band after said die has partially contracted said band.

2. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for one of said bodies; a second support surrounding the first and holding a band in registration with a groove in a body held by the first support; a die having a conical opening guided for movement toward and away from said supports; power operated means tending to resist movement of said second support; and a second power operated means for moving said die to contract said band into the groove in the cylindrical body, said second power operated means serving to move said second support away from the band after said die has initiated the contraction of said band into the groove in said body.

3. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for one of said bodies; a second support for holding a band in registration with a groove in a body held by the first support; said second support being movable relative to said first support; and a die with a conical opening guided for movement toward and away from said supports, said die engaging said second support to transmit movement thereto following the initial contraction of the band into the groove in the body.

4. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for one of said bodies; a second support having a band-receiving portion and a shoulder, said band-receiving portion holding a band in registration with a groove in a body held by the first support; said second support being movable relative to said first support; and a die with a conical opening guided for movement toward and away from

said supports, said die being movable to a position surrounding the band-receiving portion of said second support and engaging said shoulder prior to the complete contraction of the band into the groove.

5. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for one of said bodies; a sleeve-like supporting member having an external shoulder said sleeve-like member being disposed in movable telescoping relationship with said stationary support; and a die with a tapered opening disposed for telescoping relationship with said sleeve-like member, said die engaging said external shoulder after predetermined telescoping movement relative to said sleeve-like member.

6. The method of applying a band to a cylindrical body with a groove comprising the steps of supporting the body against longitudinal movement; supporting a band around the body in registration with the groove with a yieldable force of sufficient intensity to resist longitudinal movement; initially partially compressing the band into the groove in the body and then simultaneously overpowering the yieldable force and completely compressing the band into the groove.

7. The method of applying a band to a cylindrical body with a groove comprising the steps of supporting the body against longitudinal movement; supporting a band around the body in registration with the groove against longitudinal movement; initially partially compressing the band into the groove in the body; discontinuing the support of the band after it has been partially compressed into the groove; and then completely compressing the band into the groove.

8. The method of applying a band to a cylindrical body with a groove comprising the steps of supporting the body against longitudinal movement; supporting a band around the body in registration with the groove and against longitudinal movement; compressing the band to cause it to partially enter the groove; interrupting the support of the band; and completely contracting the band into the groove.

9. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for one of said bodies; a second support having a band-receiving portion and a shoulder; a fluid pressure operated ram holding said second support in position to dispose a band thereon in registration with a groove in a body held by said stationary support; a band compressing die guided for movement toward and away from said supports; and a second fluid pressure operated ram carrying said die and moving the same to engage and compress said band into the groove

in said body, said second ram moving said second support away from said band in opposition to the force of said first-mentioned ram after said band is partially compressed into said groove.

10. Apparatus for applying bands to grooved cylindrical bodies comprising a stationary support for one of said bodies; a second support having a band-receiving portion and a shoulder; a fluid pressure operated ram holding said second support in position to dispose a band thereon in registration with a groove in a body held by said stationary support; a band compressing die guided for movement toward and away from said supports; and a second fluid pressure operated ram having a force of predetermined value in excess of said first mentioned ram, said second ram carrying said die and moving the same to engage and compress said band into the groove in said body, said second ram moving said second support away from said band in opposition to the force of said first-mentioned ram after said band is partially compressed into said groove.

11. Apparatus for applying bands to grooved cylindrical bodies comprising a pair of opposed rams of different capacities; a band diameter reducing die carried by the ram with the greater capacity; a band support carried by the other ram; and a stationary support for holding a grooved body in a position within a band on said band support with the band in registration with a groove in the body, advancement of the ram of greater capacity causing the die to initially press the band into the groove then cause the retraction of the other ram and band support and complete the pressing of the band into the groove.

12. The method of applying a band to a cylindrical body with a groove comprising the steps of supporting the body against longitudinal movement; supporting against longitudinal movement an endless band around the body in registration with the groove; initially reducing the diameter of the band to cause it to partially enter the groove; and simultaneously interrupting the support of the band and continuing the reduction of the diameter thereof.

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