United States Patent

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[54] **PNEUMATICALLY OPERATED NAILING MACHINE**
37 Claims, 20 Drawing Figs.

[52] **U.S. Cl.** **227/8**, 227/130
[51] **Int. Cl.** **B27f 7/02**
[50] **Field of Search** 227/7, 8, 130

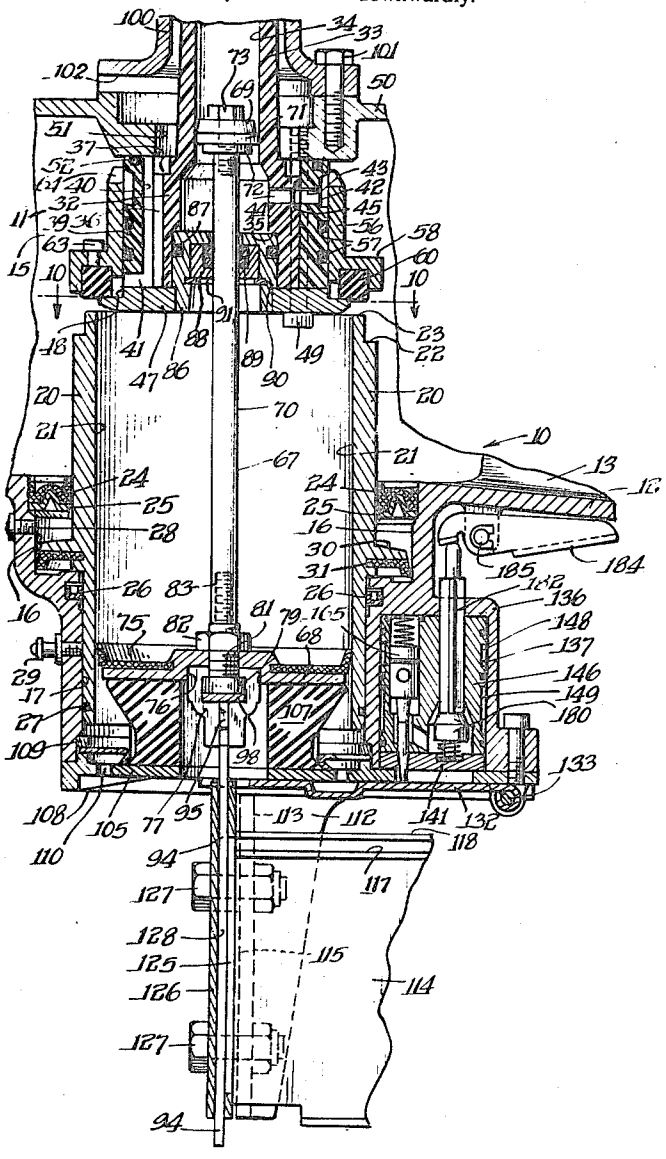
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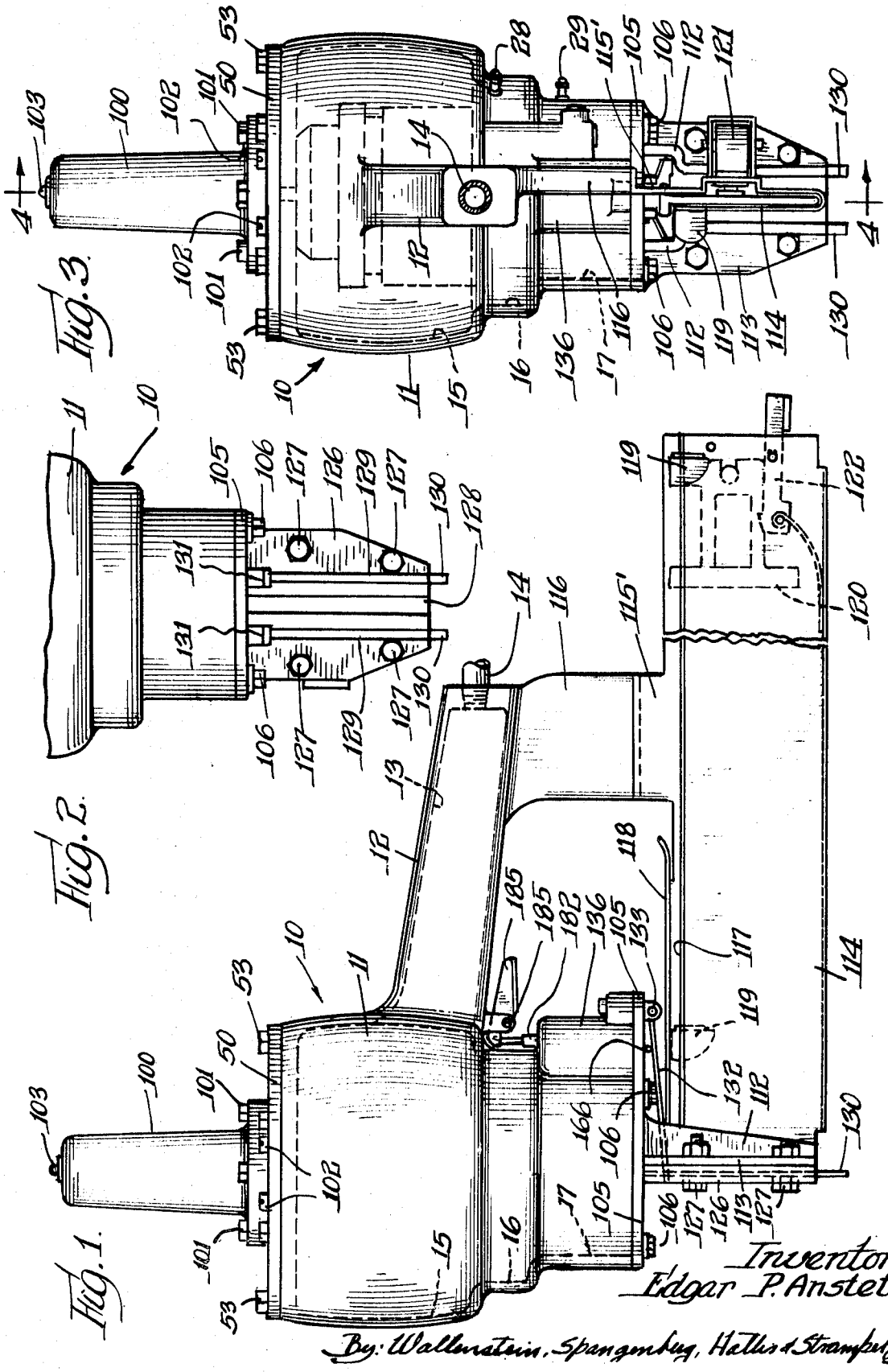
ABSTRACT: A pneumatically operated nailing machine includes a reciprocatable blade for driving nails when advanced and a reciprocatable differential piston unit connected to the blade advances and retracts the blade. A cylinder member reciprocatingly receives the upper small diameter piston of the differential piston unit and a reciprocatable cylinder sleeve reciprocatingly receives the lower large diameter piston thereof. Sealing means seals the cylinder for the lower large diameter piston from the cylinder for the upper small diameter piston. Valving means for the differential piston unit include an annular upwardly facing valve seat on the cylinder sleeve, a stationary annular upwardly facing valve seat adjacent the valve seat on the cylinder sleeve, and a valve sleeve having a downwardly facing annular valve ring adapted to engage said valve seats. Means including passageways supply air under pressure beneath the upper small diameter piston and vent to atmosphere air above the lower large diameter piston to drive the differential piston unit upwardly and retract the blade when the cylinder sleeve is moved upwardly to engage its annular valve seat with the annular valve ring and to disengage the annular valve ring from the stationary annular valve seat. Said means including passageways interrupt the venting of air to atmosphere from above the large diameter piston and supply air under pressure above the large diameter piston to drive the differential piston unit downwardly and advance the blade when the cylinder sleeve is moved downwardly to engage the annular valve ring with the stationary annular valve seat and to disengage its annular valve seat from the annular valve ring. Means including control valve means selectively move the cylinder sleeve and valve sleeve upwardly and downwardly.

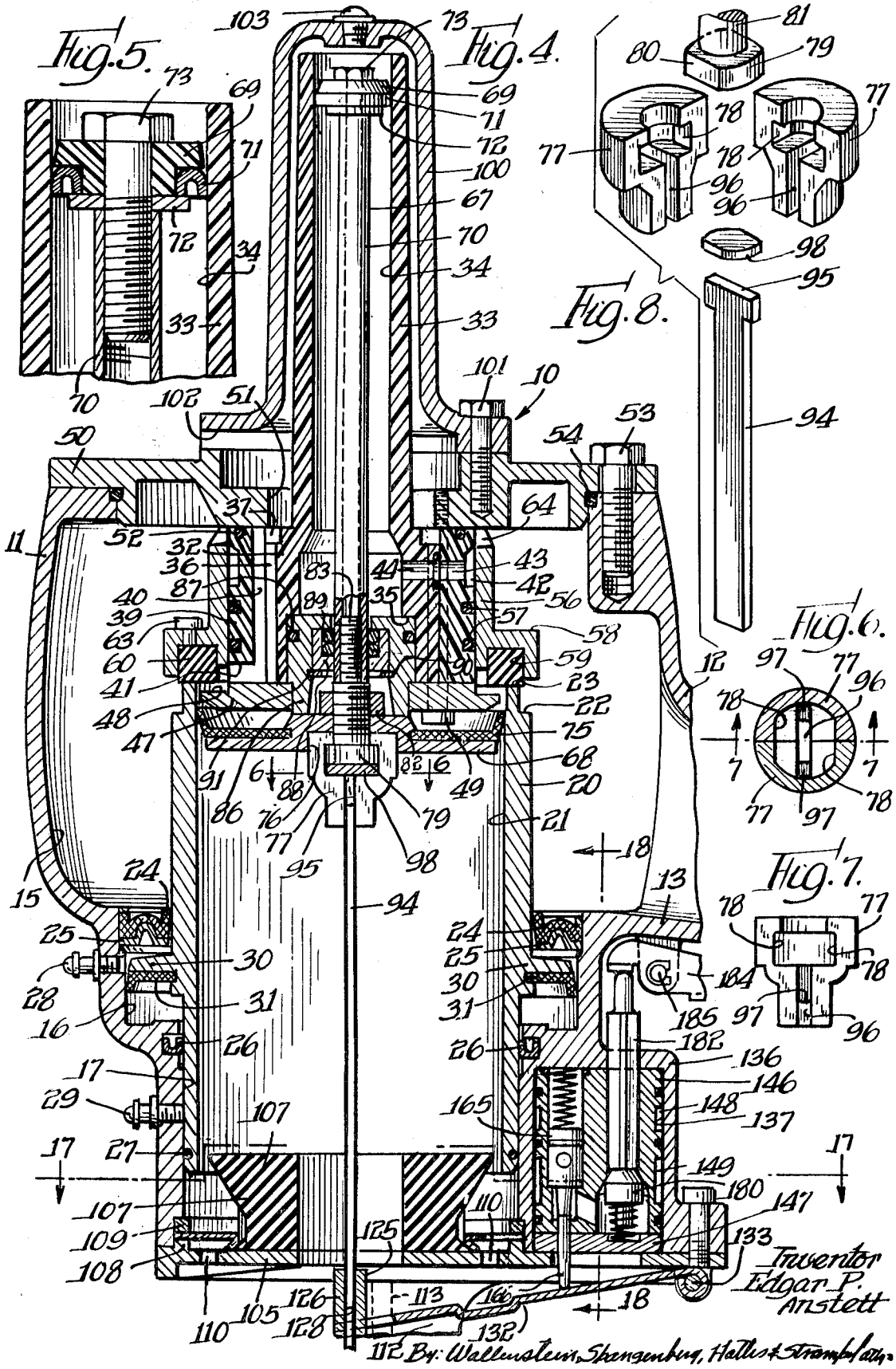


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Fig. 5.
Fig. 4.
Fig. 8.
Fig. 6.
Fig. 7.
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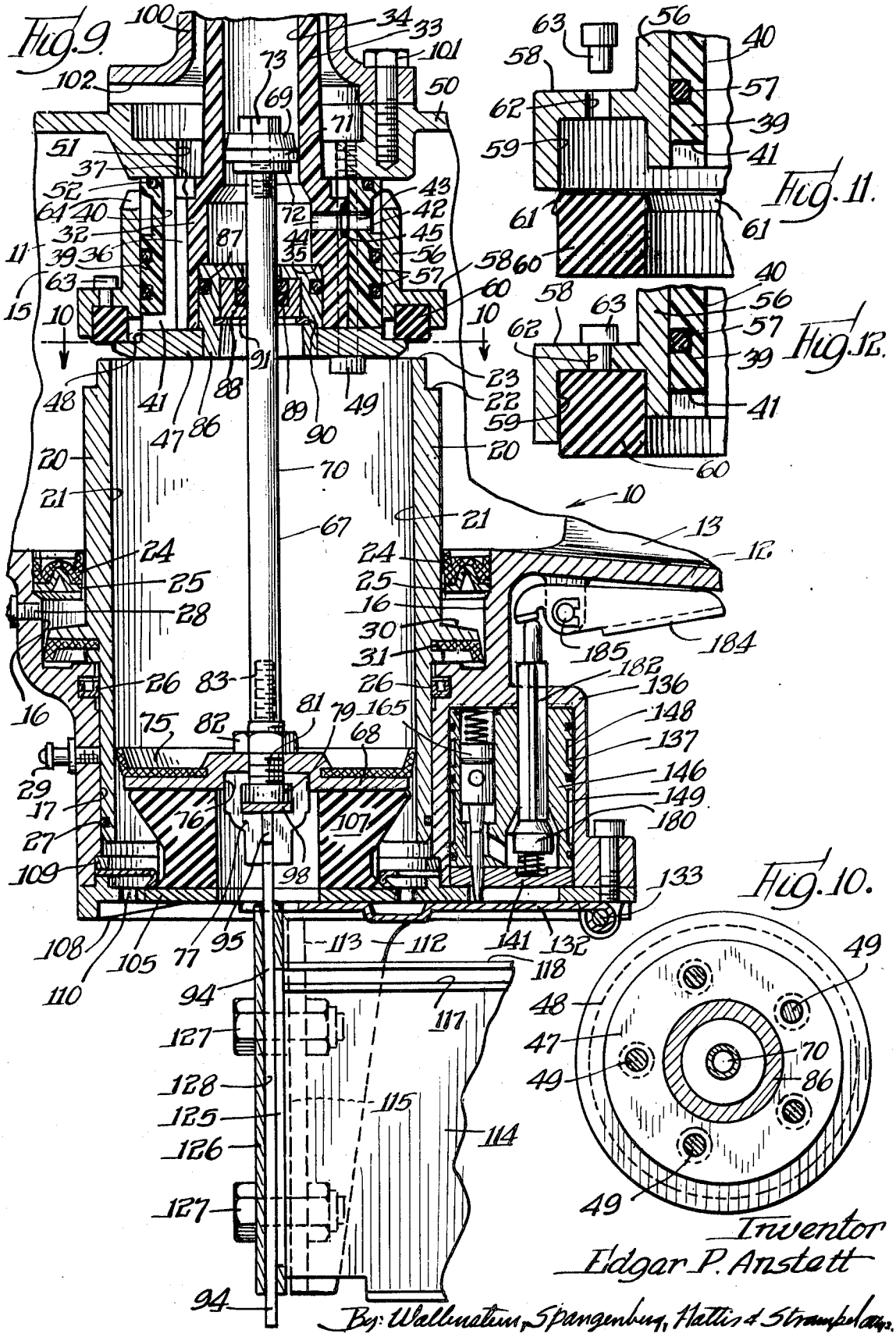

Fig. 9
Fig. 11
Fig. 12
Fig. 10
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Fig. 18.

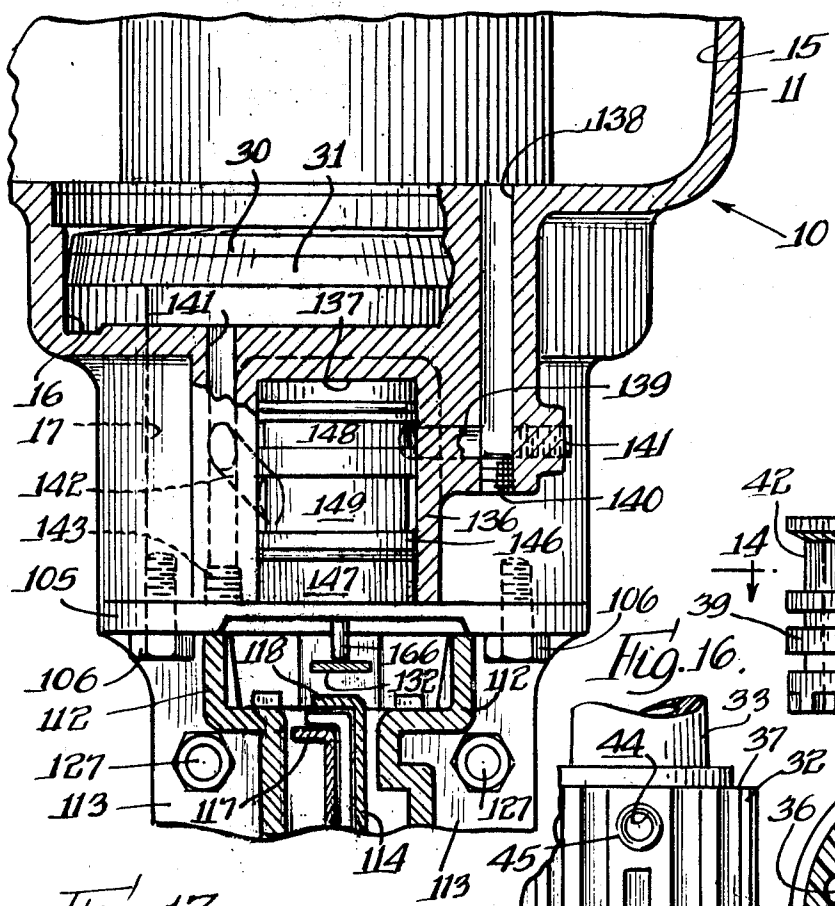


Fig. 13.

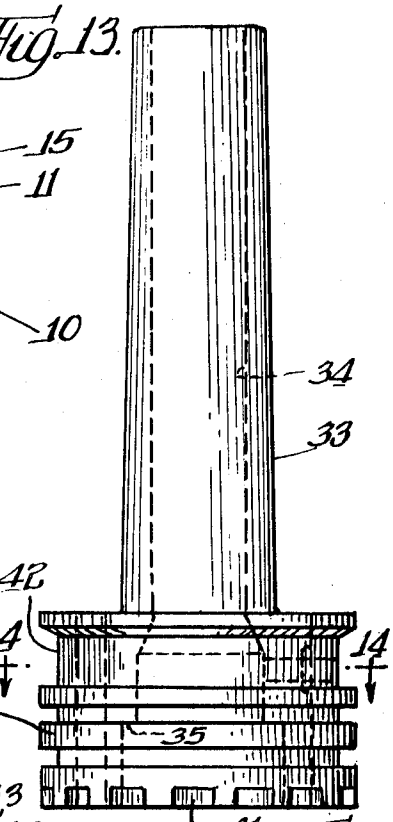


Fig. 16.

Fig. 14.

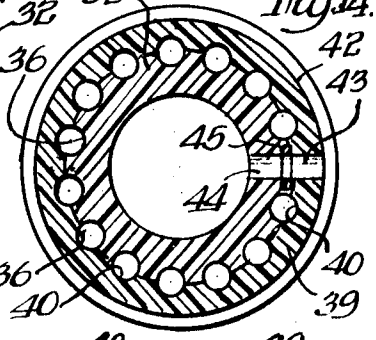


Fig. 17.

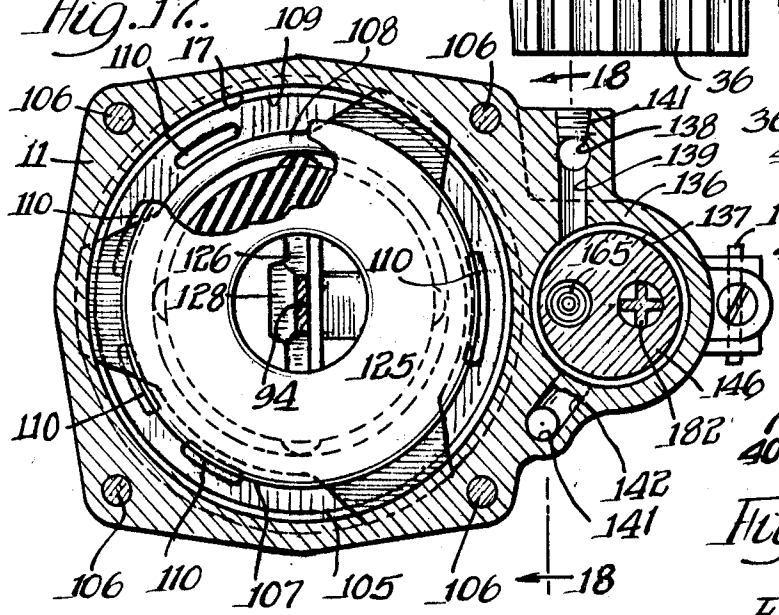
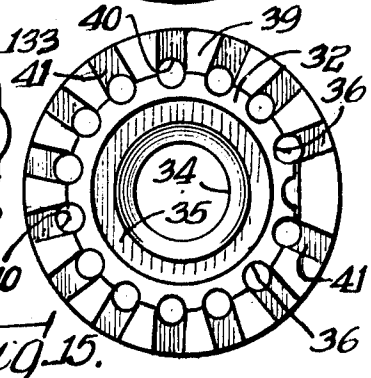


Fig. 15.



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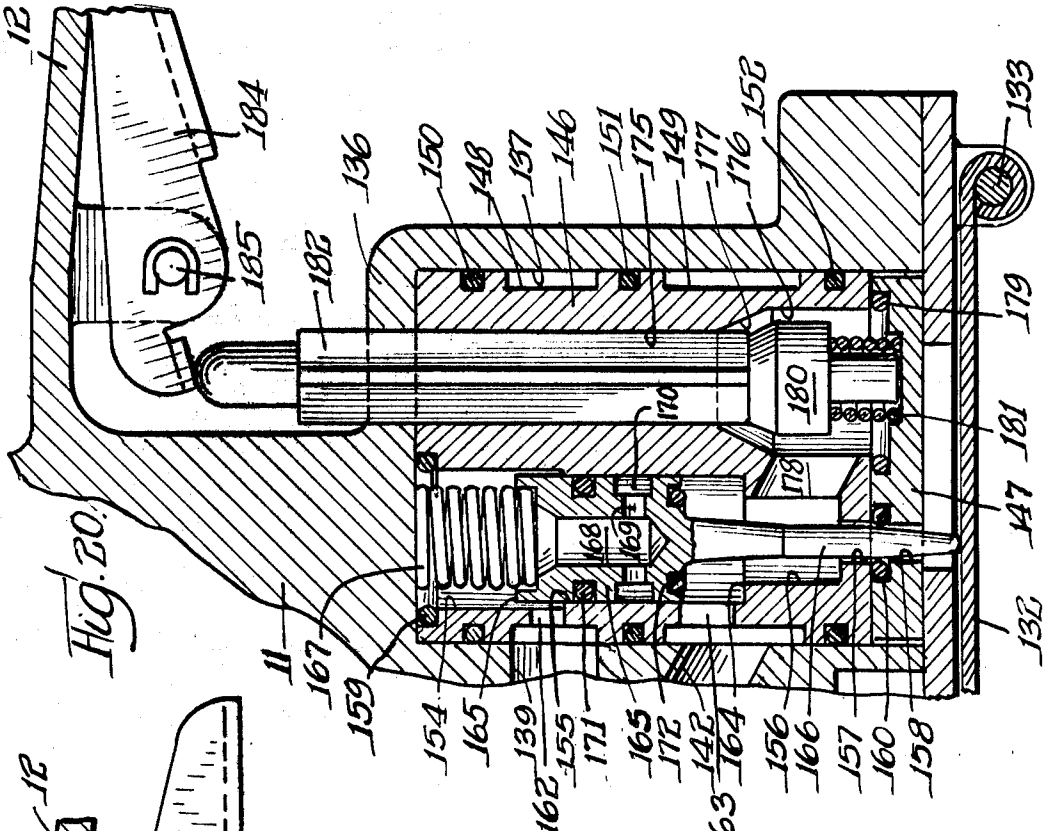


Fig. 20.

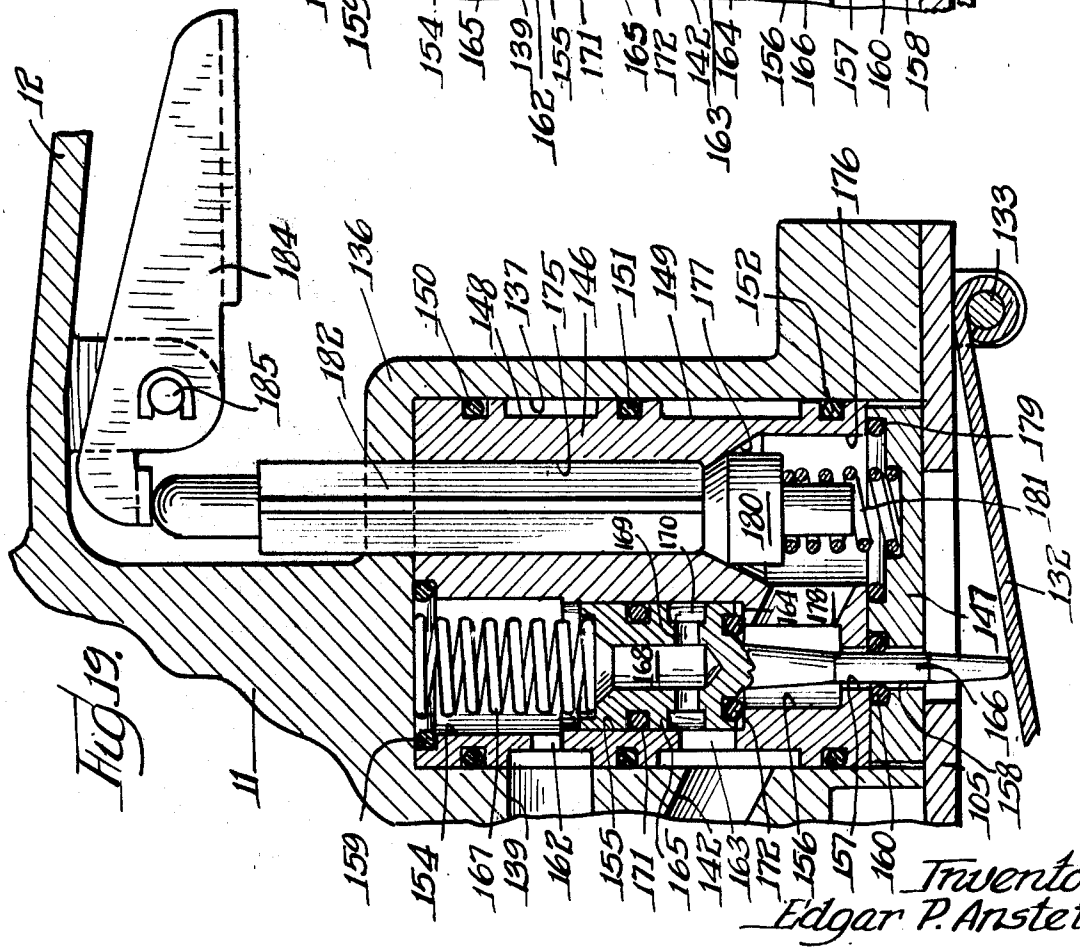


Fig. 19.

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PNEUMATICALLY OPERATED NAILING MACHINE

The principal object of this invention is to provide an improved pneumatically operated nailing machine which is simple in construction and rugged and foolproof in operation, which may be inexpensively manufactured and assembled, which is economical in operation, which utilizes a minimum amount of compressed air but provides maximum nailing force, and which eliminates unwanted escape of air by reason of its valving action.

Briefly, in accordance with the preferred embodiment of this invention, the pneumatically operated nailing machine includes a hollow housing which is supplied with air under pressure, a reciprocatable blade which extends through the bottom of the housing for driving nails when advanced, a reciprocatable differential piston unit which is located in the housing and which has a lower large diameter piston and an upper small diameter piston connected by a piston rod, and means which secures the blade to the lower end of the differential piston unit so as to advance and retract the blade as the differential piston unit is reciprocated. A cylinder sleeve is reciprocatably mounted in the housing and it has a cylinder portion reciprocatingly receiving the lower large diameter piston of the differential piston unit. This cylinder sleeve has at its upper end an upwardly facing annular valve seat and an annular piston shoulder of small area therearound subject to the air under pressure in the housing and it also has intermediate its ends an annular piston flange of large area therearound. A cylinder member is located in the housing and it has a cylinder reciprocatingly receiving the upper small diameter piston of the differential piston unit.

The cylinder member also has sealing means for the piston rod of the differential piston unit for sealing the cylinder for the lower large diameter piston from the cylinder for the upper small diameter piston and it further has an upwardly facing annular valve seat of smaller diameter than the annular valve seat at the upper end of the cylinder sleeve and located adjacent thereto and radially spaced inwardly therefrom. A valve sleeve is reciprocatingly carried by the cylinder member and it has a downwardly facing annular valve ring engageable with the upwardly facing annular valve seats of the cylinder sleeve and the cylinder member and also has an annular piston shoulder subject to the air under pressure in the housing. The cylinder member includes passageways for venting to atmosphere the upwardly facing annular valve seat thereof and the cylinder thereof above the upper small diameter piston of the differential piston unit. The housing has passageways for venting to atmosphere the cylinder of the cylinder sleeve below the lower large diameter piston of the differential piston unit. The cylinder member also has passageways for continuously supplying air under pressure from the hollow housing to the cylinder thereof below the upper small diameter piston of the differential piston unit.

Means including control valve means, when in one condition, supply air under pressure from the housing below the annular piston flange of the cylinder sleeve for moving the same upwardly to cause the annular valve seat thereof to engage the annular valve ring of the valve sleeve and to move the valve sleeve upwardly to disengage the annular valve ring thereof from the annular valve seat of the cylinder member for sealing the cylinder of the cylinder sleeve above the lower large diameter piston of the differential piston unit from the air under pressure in the housing and for venting the same to atmosphere. As a result, the air under pressure in the cylinder of the cylinder member below the upper small diameter piston of the differential piston unit moves the same upwardly to retract the nail-driving blade.

The aforementioned means including said control valve means is also operative, when in another condition, for venting to atmosphere air from below the annular piston flange of the cylinder sleeve for allowing the air under pressure in the housing acting on the annular piston shoulder of the valve sleeve and the annular piston shoulder of the cylinder sleeve to move the same downwardly. This causes the annular valve ring of the valve sleeve to engage the annular valve seat of the cylinder member and to disengage the annular valve seat of the cylinder sleeve from the annular valve ring of the valve sleeve for sealing the cylinder of the cylinder sleeve above the lower large diameter piston of the differential piston unit from the atmosphere and for supplying air under pressure thereto from the housing. As a result, the air under pressure in the cylinder of the cylinder sleeve above the large diameter piston of the differential piston unit overcomes the force of the air under pressure in the cylinder member below the small diameter piston of the differential piston unit and moves the same downwardly to advance the nail-driving blade.

The aforesaid control valve means includes a first valve having a normal position and movable to a second position when the nailing machine is placed against an object to be nailed, and a second valve having a normal position and movable to a second position when a control trigger is manually depressed. The arrangement is such that air from below the piston flange of the cylinder sleeve is vented to atmosphere to move the cylinder sleeve downwardly and advance the nail-driving blade only when both valves are moved to their second positions. These first and second valves are located in bores in a valve housing arranged in the machine housing and the bores and passages associated with the valves are sealed against leakage.

The hollow housing has an upper portion of large transverse dimensions which is supplied with the air under pressure, a lower cylindrical portion of small transverse dimension which slidable mounts the lower part of the cylinder sleeve, and an intermediate portion of intermediate transverse dimension which forms a cylinder for receiving the annular piston flange of the cylinder sleeve. This annular piston flange has packing for slidably sealing the same to the intermediate portion of the housing. The housing carries upper and lower packings slidably receiving the cylinder sleeve for sealing the upper portion of the housing from the cylinder forming intermediate portion of the housing and for sealing the cylinder forming intermediate portion of the housing from the lower portion of the housing. The upper small diameter piston and the lower large diameter piston of the differential piston unit have packing for slidably sealing the same in the cylinder of the cylinder member and in the cylinder of the cylinder sleeve. These packings are preferably V-type packings.

The housing includes a foot plate secured thereto below the cylinder sleeve and the lower large diameter piston of the differential piston unit through which the reciprocatable blade extends. An annular rubber bumper is carried by the foot plate around the reciprocatable blade to be engaged by the lower large diameter piston of the differential piston unit when the latter is moved downwardly. The foot plate is provided with vent passages about the annular rubber bumper for directing the air, which is vented to atmosphere from below the differential piston unit when the latter is reciprocated, about the annular rubber bumper for cooling the same. A nail guide plate is carried by the foot plate for guiding the reciprocatable blade and a nail to be driven thereby, and a magazine is carried by the foot plate for feeding nails to the nail guide plate.

The upper end of the reciprocatable nail-driving blade is T-shaped, and the means for securing the blade to the lower end of the differential piston unit includes a two-part separable holder secured to the lower end of the differential piston unit and encompassing the upper end of the blade. The holder has shoulders engageable by the undersides of the T-shaped portion of said blade, and a backup plate within the holder is engageable b the top side of the T-shaped portion of the blade when the differential piston unit advances the blade for driving nails.

Further objects of this invention reside in the details of construction of the pneumatically operated nailing machine and in the cooperative relationships between the component parts thereof.

Other objects and advantages of this invention will become apparent to those skilled in the art upon reference to the accompanying specification, claims and drawings in which:

FIG. 1 is a side elevational view of a preferred form of the pneumatically operated nailing machine of this invention;

FIG. 2 is a partial front elevational view of the nailing machine looking from the left of FIG. 1;

FIG. 3 is a rear elevational view of the nailing machine looking from the right of FIG. 1;

FIG. 4 is an enlarged vertical sectional view through the nailing machine taken substantially along the line 4—4 of FIG. 3 and showing the differential piston unit in its upper position;

FIG. 5 is an enlarged sectional view of the upper portion of FIG. 4 illustrating the upper small diameter piston of the differential piston unit;

FIG. 6 is a horizontal sectional view through the two part holder for the nail driving blade taken substantially along the line 6—6 of FIG. 4;

FIG. 7 is an elevational view of one of the parts of the blade holder of FIG. 6 and taken substantially along the line 7—7 of FIG. 6;

FIG. 8 is an exploded perspective view of the nail driving blade and its holder by which it is secured to the differential piston unit;

FIG. 9 is a vertical sectional view similar to FIG. 4 and taken substantially along the line 4—4 of FIG. 3 but illustrating the differential piston unit in its down position;

FIG. 10 is a horizontal sectional view of the stationary valve disc and taken substantially along the line 10—10 of FIG. 9;

FIG. 11 is an enlarged and exploded partial sectional view of the valve sleeve and its valve ring showing the manner of securing the valve ring to the valve sleeve;

FIG. 12 is a sectional view similar to FIG. 11 but showing the valve ring secured in place on the valve sleeve;

FIG. 13 is a side elevational view of the two part cylinder member utilized in the nailing machine;

FIG. 14 is a horizontal sectional view through the two part cylinder member taken substantially along the line 14—14 of FIG. 13;

FIG. 15 is a bottom view of the two part cylinder member looking from the bottom of FIG. 13;

FIG. 16 is a partial side elevational view of the inner part of the two part cylinder member;

FIG. 17 is a horizontal sectional view through the nailing machine taken substantially along the line 17—17 of FIG. 4;

FIG. 18 is a vertical sectional view through the nailing machine taken substantially along the line 18—18 of FIGS. 4 and 17;

FIG. 19 is an enlarged sectional view through the control valve means illustrating the valves thereof in their normal positions; and

FIG. 20 is a sectional view similar to FIG. 19 but showing the valves thereof in their second positions.

Referring first to FIGS. 1 to 4 and 9, a preferred form of the pneumatically operated nailing machine of this invention is generally designated at 10. It includes a hollow housing 11 having a handle portion 12 provided with a cavity 13 to which air under pressure is supplied by a fitting 14. The upper portion of the motor part of the hollow housing 11 has a cavity 15 of large transverse dimensions which communicates with the cavity 13 of the handle portion 12 for being supplied with air under pressure. The hollow housing 11 also has an intermediate cavity portion 16 of intermediate transverse dimension which forms a cylinder portion for the piston flange of the cylinder sleeve. The hollow housing 11 also has a lower internal cylindrical portion 17 of small transverse dimension which slidably mounts the lower part of the cylinder sleeve. The hollow housing 11 may be formed of any suitable material, such as, die cast aluminum, or the like.

A cylinder sleeve 20 is reciprocatably received in the hollow housing 11 and has its lower portion slidably mounted in the lower cylindrical portion 17 of the hollow housing 11. The cylinder sleeve 20 is provided with an internal cylinder 21 for the reciprocatable differential piston unit. At its upper end the cylinder sleeve 20 is provided with an upwardly facing annular valve seat 23 and an annular piston shoulder 22 of small area therearound, this annular piston shoulder 22 being subject to the air under pressure in the hollow housing 11. Intermediate its ends the cylinder sleeve 20 is provided with an annular piston flange 30 which in turn is provided with a packing 31. The cylinder sleeve 20 may be formed of any suitable material and, preferably, it is molded from a suitable rigid synthetic plastic material. The packing 31 is preferably a cup-shaped packing which is preferably formed from a suitable resilient synthetic rubber or rubberlike plastic material, such as, buna rubbers, particularly buna N rubber, or the like, it being held in place in a groove in the cylinder sleeve 20 and being backed by the annular piston flange 30. The annular piston flange 30 and its packing 31 operate in the intermediate cylinder portion 16 of the hollow housing 11, the packing 31 forming an airtight seal.

The upper portion 15 of the hollow housing 11 is sealed from the intermediate portion 16 thereof by sealing means which include a seal 24 secured to a backing ring 25. The seal 24 is preferably V-shaped and may be formed of a suitable resilient synthetic rubber of rubber like plastic material which is molded to the backing ring 25. The seal 24, 25 rests against a shoulder in the hollow housing 11 and, in addition to friction, it is also held in place by the air pressure in the hollow housing 11. Thus, the upper side of the piston flange 30 is not affected by air under pressure in the upper portion 15 of the hollow housing 11. The bottom of the intermediate portion 16 of the hollow housing 11 is sealed by packing 26 which preferably is a V-shaped packing which is received in a suitable groove in the housing. This V-shaped packing 26 is preferably formed from a suitable resilient synthetic rubber or rubberlike plastic material. The bottom of the cylinder sleeve 20 is also provided with an O ring 27 for further sealing the cylinder sleeve 20 with respect to the lower portion 17 of the hollow housing 11. A lubricant fitting 28 is provided in the hollow housing between the sealing means 24 and the piston flange 30 for lubricating the intermediate cylinder portion 16 receiving the piston flange 30. Likewise, a lubricant fitting 29 is carried by the housing 11 between the sealing means 26 and the O ring 27 for lubricating the lower small diameter portion 17 of the hollow housing 11. It will be noted that these lubricating fittings 28 and 29 are not subject to air under pressure. These fittings 28 and 29 and/or vent openings (not shown) vent to atmosphere the spaces between the sealing means 24 and the piston flange 30 and between the sealing means 26 and the O ring 27.

As shown more clearly in FIGS. 4, 9 and 13 to 16, the nailing machine also includes a two-part cylinder member, the inner part having a bottom portion 32 and a top portion 33 which is provided with an internal cylinder 34. The bottom portion 32 is provided with an internal shoulder 35 and is also circumferentially provided with a plurality of half-round slots 36 which communicate with an upper annular shoulder 37. The outer part 39 of the cylinder member has a plurality of circumferentially arranged half-round slots 40 on the inside thereof, these slots 40 communicating at their bottoms with radially extending notches 41. When the inner and outer parts of the cylinder member are assembled together, the circumferentially spaced slots 36 and 40 therein form vertically extending circular passages communicating the slots 41 at the bottom of the outer part 39 with the annular shoulder 37 on the inner part 32. Near its upper end the outer part 39 of the cylinder member is provided with an annular groove 42 and this annular groove 42 is communicated to the inside cylinder 34 of the cylinder part 33 by aligned passages 43 and 44, the passage 43 being in the part 39 and the passage 44 being in the part 32. The juncture between the inner and outer parts 32 and 39 about the passages 43 and 44 is sealed by an O ring 45. The parts 32, 33 and 39 may be made of any suitable material but, preferably, they are molded from a suitable rigid synthetic plastic material.

Engaging the bottom of the inner and outer parts of the cylinder member **32, 39** is a valve disc **47** having an upwardly facing annular valve seat **48**, the valve seat **48** being adjacent to and radially inwardly from the upwardly facing annular valve seat **23** of the cylinder sleeve **20**. Screws **49** extending through suitable holes in the valve disc **47** and through certain of the passages **36, 40** in the cylinder member are threaded into a cover **50** for securing the valve disc **47** and the two-part cylinder member **32, 39** to the cover **50**. The cover **50** is provided with a hole **51** which communicates with the shoulder **37**, the passages **36, 40** and the slots **41** of the cylinder member above the upwardly facing annular valve seat **48** of the valve disc **47**. In this way, the upwardly facing annular valve seat **48** is vented to atmosphere. The upper end of the outer portion **39** of the cylinder member is provided with a seal ring **52** for sealing the same against the cover **50**. The radial passage **43, 44** operates to supply air under pressure from the hollow housing **11** to the cylinder **34** in the cylinder member. The cover **50** is secured to the hollow housing **11** by means of screws **53** and an O ring **54** forms a seal between the hollow housing **11** and the cover **50**. The cover **50** may be formed of any suitable material, such as, die cast aluminum, or the like, and the valve disc **47** may be formed from a suitable metal, such as, steel, or the like.

A valve sleeve **56** is reciprocatingly mounted on the outer portion **39** of the cylinder member and O-rings **57** form seals therebetween. The valve sleeve **56** is provided with an annular piston shoulder **58** which is subject to the air under pressure in the hollow housing **11**. The valve sleeve **56** may be formed of any suitable material but preferably it is molded from a suitable rigid synthetic plastic material. The valve sleeve **56** is provided with an annular slot **59** which receives a downwardly facing valve ring **60**. The valve ring **60** is preferably formed from a suitable resilient synthetic rubber or rubberlike plastic material and, as shown more clearly in FIG. **11**, it has annular ribs **61** therearound. A vent passage **62** communicates with the annular groove **59** so that when the valve ring **60** is forced into the annular groove **59**, air trapped in the annular groove **59** will be vented to atmosphere. Thus, the valve ring **60** may be completely inserted in the annular groove **59** without the trapping of any air. After the valve ring **60** is so inserted in the annular groove **59**, a plug **63** is inserted in the vent passage **62** so as to close the same, as shown in FIG. **12**. As a result, the valve ring **60** in addition to being held in place in the annular groove **59** by friction it is also held in place by vacuum. The upper end of the valve sleeve **56** is provided with slots **64** which operate to throttle the supply of air to the cylinder **34** as the valve sleeve **56** is raised from the position shown in FIG. **9** to the position shown in FIG. **4**.

The differential piston unit designated at **67** has a lower large diameter piston **68** arranged within the cylinder **21** of the cylinder sleeve **20** and an upper small diameter piston **69** arranged in the cylinder **34** of the cylinder member **33** and a piston rod **70** connecting the pistons **68** and **69** together. The small diameter piston **69** is provided with a packing **71** which is held in place by a washer **72** when a screw **73** secures the piston **69** to the piston rod **70**. The piston rod **70** is in the form of a tube and is provided with screw threads at its upper end for receiving the screw **73**. The packing **71** is preferably a V-shaped packing made of a suitable resilient synthetic rubber or rubberlike plastic material and it operates to form a seal between the piston **69** and the cylinder **34**. The piston **69** may be formed of any suitable material and preferably it is molded from a suitable rigid synthetic plastic material.

The lower large diameter piston **68** is preferably formed from metal, such as, steel, or the like, and it is provided with a packing **75** which is preferably cup-shaped and which is preferably molded from a suitable resilient synthetic rubber or rubberlike plastic material. The packing **75** is snapped into a groove in the piston **68** for holding the same in place on the piston **68**. The bottom of the piston **68** is provided with an annular shoulder **76** which receives and captures a two part holder **77**, the details of which are shown more clearly in FIGS. **6** to **8**. The holder is provided with a central cavity having internal flats **78** for receiving the head **79** of a screw **81**, the head **79** having flats **80** mating with the flats **78** in the holder **77**. The screw **81** extends through a hole in the piston **68** and screw threadedly receives a nut **82** for securing the holder **77**, piston **68** and screw **81** together. The screw **81** also has a reduced threaded portion **83** which is threaded into the piston rod **70** for securing the piston **68** to the piston rod **70**. The two-part holder is preferably made of metal and formed by investment casting or the like.

A sealing means is provided for sealing the piston rod **70** and, hence, sealing the cylinder **34** of the cylinder member **33** below the piston **69** from the cylinder **21** of the cylinder sleeve **20** above the piston **68**. This sealing means includes a cup-shaped member **86** which abuts against the shoulder **35** in the inner part **32** of the cylinder member and is held in place by the valve disc **47** which engages a shoulder on the cup-shaped member **86**. The cup-shaped member **86** is sealed in the inner part **32** of the cylinder member by an O-ring **87**. A gland **88** caries a pair of O-rings **89** which engage the piston rod **70** of the differential piston unit and also the cup-shaped member **86**, the gland **88** being held in place by a snapring **91** snapped into a groove **90** in the cup-shaped member **86**. The cup-shaped member **86** and the gland **88** are preferably molded from a suitable rigid synthetic plastic material. The O-rings **89** in addition to sealing the piston rod **70** also form a seal between the cup-shaped member **86** and the gland **88**.

The nail-driving blade **94**, as shown more particularly in FIG. **8**, extends through slots **96** in the two-part holder **77** and it is provided with a T-shaped portion **95** at its upper end. The bottom sides of the T-shaped portion **95** engage shoulders **97** in the holder **77** so that when the holder **77** is moved upwardly, the blade **94** is retracted therewith. A backup plate **98** is arranged between the top side of the T-shaped portion **95** of the blade and the head **79** of the screw **81**, the backup plate **98** having flats mating with the flats **78** in the holder. Thus, as the differential piston unit **67** is moved downwardly, the backup plate **98** in the holder **77** engages the top of the T-shaped portion **95** of the blade **94** for advancing the blade **94**. Preferably, the blade **94** and the backup plate are formed of metal, such as, steel stampings, or the like.

A handle cover **100** encompasses the upper inner portion **33** of the cylinder member and it is secured to the cover **50** by means of screws **101**. The handle cover **100** is provided with radial slots **102** for venting the top of the cylinder **34** of the cylinder member above the upper small diameter piston **69** and for completing the vent passage from above the upwardly facing annular valve seat **48**. The handle cover **100** is preferably provided with a lubricant fitting **103** for supplying lubricant to the cylinder **34** of the cylinder member **33**. It is also here noted that the lubricant fitting **103** is not subject to air under pressure. The handle cover **100** is useful in manipulating the nailing machine as it is being used. The handle cover may be made of any suitable material but preferably it is made from a suitable rigid synthetic plastic material.

A foot plate **105** is secured by screws **106** to the bottom of the hollow housing **11** below the lower cylinder portion **17** thereof and, hence, below the differential piston unit **67**. The foot plate **105** carries an annular resilient rubber bumper **107** about the nail-driving blade **94**, the rubber bumper **107** being secured in place by a ring **108** having a plurality of outwardly extending fingers which are clamped between the foot plate **105** and a ring **109** in the housing. The foot plate **105** is provided with a plurality of circumferentially arranged slots **110** which in addition to the central opening in the foot plate provide air passages for venting air to atmosphere from beneath the large diameter piston **68** of the differential piston unit. Thus, as the differential piston unit **67** is reciprocated, air is directed around the annular rubber bumper **107** as well as through the center thereof so as to provide maximum cooling of the rubber bumper **107** to dissipate heat therefrom which is generated by the lower large diameter piston **68** engaging the rubber bumper **107** as the nailing blade **94** is advanced.

The foot plate **105** also has a pair of depending flanges **112** and flanges **113** extending laterally therefrom. A magazine **114** extends between the flanges **112** and has flanges **115** engaging the flanges **113** for securing the magazine to the foot plate. The magazine **114** also has a bracket portion **115'** which is secured to an extension **116** from the handle portion **12** of the housing **11** for providing further support for the magazine **114**. The magazine **114** is channel shaped for receiving and guiding a strip of nails inserted therein, the heads of the nails extending over a guiding edge **117** on one of the legs of the magazine. When a strip of nails, adhesively secured together, is inserted in the magazine, it is maintained therein by a guide flange **118** arranged above the heads of the nails. A handle **119** is provided for manually manipulating a feed device **120** which is urged forwardly by a spring **121** and a locking arrangement **122** is provided for locking the feed device **120** in its retracted position as shown in FIG. **1**. When nails are inserted in the magazine **114** and the locking device **122** released, the spring **121** operates through the feed device **120** for advancing the nails between the legs **112** of the foot plate **105**.

A nail guide plate **125** and a blade guide plate **126** are secured to the flanges **113** of the foot plate **105** by means of screws and nuts **127**, these same screws and nuts **127** securing the flanges **115** of the magazine **114** in place. The nail guide plate has an opening therein corresponding to the shape of the nails to be driven and this opening operates accurately to guide the nails as they are advanced into the blade guide plate **126** below the blade **94**. The blade guide plate **126** has a channel **128** therein for guiding the blade **94** as it is advanced and retracted by the differential piston unit **67**. When the blade **94** is retracted the end nail of a strip of nails is fed into the channel **128** in the blade guide plate **126** and when the blade **94** is advanced, it drives the nail into the object to be nailed.

The blade guide plate **126** also has a pair of channels **129** which slidably receive a pair of pins **130** normally project below the nail and blade guide plates **125** and **126**. These pins **130** are provided with shoulders which underlie fingers **131** on a lever **132** which is pivoted at **133** to the foot plate **105**. The pins **130** and the lever **132** are normally in the down position as illustrated in FIGS. **1** to **4**. However, when the foot plate of the nailing machine is placed against an object to be nailed, the pins **130** are pushed upwardly to cause the pivoted lever **132** to swing upwardly to the position illustrated in FIG. **9**.

Below the handle portion **12** the housing **11** is provided with a boss **136** which has a downwardly facing cylindrical chamber **137**. As shown more clearly in FIGS. **17** and **18**, this boss **136** is provided with a drilled passage **138** extending from the internal cavity **15** of the hollow housing **11** and which is closed at its bottom end by a plug **140**. Another drilled passage **139** communicating with the passage **138** enters into the cylindrical chamber **137**, the other end of the passage **139** being closed by a plug **141**. The passages **138, 139** supply air under pressure into the cylindrical chamber **137** from the cavity **15** of the hollow housing **11**. The boss **136** also has a vertical drilled passage **141** extending from the intermediate cylindrical cavity **16** in the housing member **11** below the piston flange **30** of the cylinder sleeve **20**, this passage **141** being closed at its bottom end by a plug **143**. A drilled passage **142** connects the passage **141** to the interior of the cylindrical chamber **137** at a point below the point where the passage **139** communicates with the cylindrical chamber **137**. Thus, the passages **141, 142** connect the intermediate cylindrical portion **16** of the hollow housing **11** below the piston flange **30** of the cylinder sleeve **20** with the cylindrical chamber **137**.

A control valve assembly, as shown more clearly in FIGS. **19** and **20**, is arranged within the cylindrical chamber **137**, it including a valve housing **146** having a closure disc **147** secured thereto by screws or the like, not shown. The valve housing **146** and closure disc **147** may be formed of any suitable material but preferably they are molded from a suitable rigid synthetic plastic material. The control valve housing is provided with an external annular groove **148** which communicates with the passage **139, 138** leading from the cavity **15** in the hollow housing **11** so that air under pressure is supplied to this annular groove **148**. The exterior of the valve housing **146** is also provided with an annular groove **149** which communicates with the passage **142, 141** so that this annular groove **149** is in communication with the intermediate cylindrical cavity **16** in the hollow housing **11**. These annular grooves **148** and **149** are sealed in the cylindrical chamber **137** by O rings **150, 151** and **152**.

The control valve housing **146** is provided with a first bore therethrough including an upper large diameter bore **154**, an intermediate diameter bore **155** and a lower smaller diameter bore **156**. Holes **157** and **158** in the control valve housing **146** and the closure disc **147** communicate with the lower smaller bore **156**. The upper bore **154** is sealed with respect to the cylindrical chamber **137** by an O-ring **159** and the holes **157** and **158** are sealed by an O ring **160**. A hole **162** communicates the upper large diameter bore **154** with the annular groove **148** and a hole **163** communicates the intermediate diameter bore **155** with the annular groove **149**. A shoulder **164** forming a valve seat is arranged between the intermediate diameter bore **155** and the smaller diameter bore **156**.

Arranged within the intermediate diameter bore **155** of the valve housing **146** is a valve **165** which has a valve stem **166** extending downwardly through the small diameter bore **156**, the holes **157** and **158** and a hole in the foot plate **105** to a point below the foot plate **105** so as to be engageable by the pivoted lever **132**. The O-ring **160** which seals the holes **157** and **158** also seals the valve stem **166**. A compression spring **167** within the large diameter bore **154** resiliently urges the valve **165** downwardly. The valve **165** is provided with a central bore **168** which is connected by a plurality of radial passages **169** to an annular groove **170** in the exterior of the valve **165**. This annular groove **170** is in communication with the passage **163** in the valve housing **146** when the valve **165** is in its normal down position as illustrated in FIG. **19**. An O-ring **171** seals the valve **169** in the intermediate bore **155** between the passages **162** and **163**. The bottom annular portion of the valve **169** is provided with an O-ring **172** which is held in place by friction and suction in an annular groove in the valve and which seats against the annular shoulder **164** when the valve is in its normal lowered position as illustrated in FIG. **19**.

The valve housing **146** is also provided with a second bore therethrough, the second bore including an upper small diameter bore **175**, a lower large diameter bore **176** and an intermediate conical portion **177**. A passage **178** connects the lower small diameter bore **156** of the first bore to the lower large diameter bore **176** of the second bore. The large diameter bore **176** is sealed by an O-ring **179** arranged between the valve housing **146** and the closure disc **147**. A second valve **180** is located in the lower large diameter bore **176** and it has a conical surface adapted to engage the conical surface **177** between the bores **175** and **176**. A compression spring **181** resiliently urges the valve **180** into engagement with its conical seat **177**. A fluted stem **182** extends upwardly through the small diameter bore **175** and a hole in the boss **136**. A trigger **184** is pivoted at **185** to the handle portion **12** of the nailing machine is operable to move the valve **180** downwardly against the action of the spring **181** when it is depressed, as illustrated in FIG. **20**. The valve **165** and its downwardly depending stem **166** and the upwardly extending fluted stem **182** are preferably molded from a suitable rigid synthetic plastic material, while the valve **180** is preferably molded from a suitable resilient synthetic rubber or rubberlike plastic material, such as, for example, buna rubber or the like.

When the valve **169** is in its normal bottom position, as illustrated in FIG. **19**, air under pressure from the cavity **15** in the housing **11** is delivered through the passages **138, 139**, annular groove **137**, passages **162, 168** and **169**, annular groove **170**, passage **163**, annular groove **149** and passages **142** and **141** to the intermediate cylindrical chamber **16** in the housing **11** below the piston flange **30** on the cylinder sleeve **20**. As a result, the cylinder sleeve **20** is in its raised position as illus-

trated in FIG. 4 and the differential piston unit 67 is also in its raised position. In this latter connection the annular upwardly facing valve seat 23 is engaging the valve ring 60 and the valve ring 60 is disengaged from the stationary upwardly facing valve seat 48. With these valve means in these positions as illustrated in FIG. 4, the supply of air pressure in the upper cavity 15 of the housing 11 is sealed from above the lower large diameter piston 68 by the annular valve seat 23 engaging the valve ring 60. Air above the large diameter piston 68 is vented to atmosphere around the upwardly facing annular valve seat 48 through the radial slots 41, passages 40, 36, annular groove 37, hole 51 in the cover plate 50 and passages 102 in the handle cover 100. Air under pressure from the cavity 15 of the housing 11 is transmitted below the upper small diameter piston 69 through slots 64 in the valve sleeve 56, annular groove 42 and passages 43 and 44 into the cylinder 34 of the upper cylinder member 33. Thus, the differential piston is held in its raised position as illustrated in FIG. 4.

When the foot plate of the nailing machine is placed against an object to be nailed, the pins 130 pivot the lever 132 upwardly about its pivot 133 as illustrated in FIGS. 9 and 20. This pivoting of the lever 132 raises the valve 169 through its valve stem 166 to its second or upper position against the action of the spring 167 as illustrated in FIGS. 9 and 20. When this occurs, the annular groove 170 of the valve 165 is moved upwardly out of registry with the passage 163 so as to interrupt the supply of air under pressure from the upper cavity 16 of the housing 11 to below the piston flange 30 of the cylinder sleeve 20. The passage 163 and, hence, the intermediate cylinder 16 below the piston flange 22 of the cylinder sleeve 20 is connected through the intermediate diameter bore 155, small diameter bore 156 and passage 178 to the large diameter bore 176 for the second valve. However, since the second valve 180 is engaging its seat 177 the intermediate cylinder 16 below the piston flange 30 of the cylinder sleeve 20 is not vented to atmosphere and the cylinder sleeve 20, valve sleeve 56 and the differential piston 67 remain in their upper positions as illustrated in FIG. 4.

However, when the trigger 184 is depressed, the fluted stem 182 presses the valve 180 downwardly against the action of the spring 181 to connect the large diameter bore 176 past the valve 180 and through the fluted stem 182 to atmosphere. As a result, when the valves 165 and 180 are both in their second positions as illustrated in FIGS. 9 and 20, the intermediate cylinder 16 of the housing 11 below the piston flange 30 is vented to atmosphere through passages 141, 142 annular groove 149, passage 163, intermediate diameter bore 155, small diameter bore 156, passage 178, large diameter bore 176, small diameter bore 175 and fluted stem 182. As a result, air under pressure in the cavity 15 of the housing 11 acts upon the piston shoulder 58 of the valve sleeve 56 to move the valve sleeve 56 and the cylinder sleeve 20 downwardly for causing the valve ring 60 to engage the upwardly facing annular valve seat 48 to interrupt the venting to atmosphere of the cylinder 21 above the lower large diameter piston 68 of the differential piston unit 67. Also, when this occurs, air under pressure in the cavity 15 of the housing 11 acts on the piston shoulder 22 of the cylinder sleeve 20 to move it downwardly to the position shown in FIG. 9. When this occurs, air under pressure from the cavity 15 in the housing 11 is supplied over the annular valve seat 23 to the cylinder 21 above the large diameter piston 68 to drive the differential piston 68 downwardly against the action of the air under pressure below the upper small diameter piston 69 of the differential piston unit. The downward movement of the differential piston unit 67 advances the nailing blade 94 to drive the nail into the object to be nailed.

When the foot plate is thereafter removed from the work to be nailed and the trigger 184 is released, the first and second valves 165 and 180 are returned by their respective springs 167 and 181 to the positions shown in FIGS. 4 and 19 and the differential piston unit 67 is moved to its raised position in the manner previously described above. When the differential piston unit 67 is so raised, another nail is advanced from the magazine 114 through the contoured aperture in the nail guide plate 125 below the nail-driving blade 94 to condition the nailing machine for its next cycle of operation.

The valving means including the upwardly facing annular valve seats 23 and 48 on the cylinder sleeve 20 and the cylinder member 32, 39 and the downwardly facing annular valve ring 60 on the valve sleeve 56 provide for rapid control for large volumes of air, air above the lower large diameter piston 68 being rapidly vented to atmosphere and air under pressure being rapidly supplied to the upper side of the lower large diameter piston 68. Furthermore, since the valve seat 23 engages the valve ring 60 before the valve ring 60 disengages the valve seat 48 and since the valve ring 60 engages the valve seat 48 before the valve seat 23 disengages the valve ring 60, positive valving action is assured and there is no escape of air under pressure to the atmosphere. As a result, maximum nailing forces with minimum expenditure of air are assured.

The control valve means including the control valves 165 and 180 in the valve housing 146 provide a simple and accurate control for the movement of the cylinder sleeve 20 and the valve sleeve 56 so that the nailing machine is operated in a safe and foolproof manner. The disclosed means including the holder 77 for securing the nail-driving blade 94 to the differential piston unit 67 provides a hard driving connection for the nail-driving blade but, yet, permits relative movement between the blade and the holder so that there is no binding of the blade as it is retracted and advanced in its groove 128 formed in the guide plate 126 carried by the foot plate 105.

By molding from suitable rigid synthetic plastic materials, such as, for example, "NORYL 731-701" or the like, the various parts as described above may be accurately manufactured and machining of the parts is maintained at a minimum. Also, the various parts of the nailing machine may be readily and easily assembled with minimum man hours required. As a result, the nailing machine of this invention may be inexpensively manufactured.

While for purposes of illustration, one preferred form of this invention has been disclosed, other forms of this invention may become apparent to those skilled in the art and, therefore, this invention is to be limited only by the scope of the appended claims.

I claim:

1. A pneumatically operated nailing machine comprising a reciprocatable blade for driving nails when advanced, a reciprocatable differential piston unit having a lower large diameter piston and an upper small diameter piston connected by a piston rod, means securing the blade to the differential piston unit to be advanced and retracted thereby, a reciprocatable cylinder sleeve having a cylinder reciprocatingly receiving the lower large diameter piston of the differential piston unit, a cylinder member having a cylinder reciprocatingly receiving the upper small diameter piston of the differential piston unit, sealing means for the piston rod of the differential piston unit for sealing the cylinder for the lower large diameter piston from the cylinder for the upper small diameter piston, valving means including an annular upwardly facing valve seat on the cylinder sleeve, a stationary annular upwardly facing valve seat adjacent the valve seat on the cylinder sleeve, and a reciprocatable valve sleeve having a downwardly facing annular valve ring adapted to engage the stationary upwardly facing valve seat and to be engaged by the upwardly facing valve seat on the cylinder sleeve, means including passageways for supplying air under pressure beneath the upper small diameter piston and for venting to atmosphere air above the lower large diameter piston to drive the differential piston unit upwardly and retract the blade when the cylinder sleeve is moved upwardly to engage its annular upwardly facing valve seat with the annular downwardly facing valve ring of the valve sleeve and to disengage the annular downwardly facing valve ring of the valve sleeve from the stationary annular upwardly facing valve seat, and for interrupting the venting of air to atmosphere from

above the large diameter piston and for supplying air under pressure above the large diameter piston to drive the differential piston downwardly and advance the blade when the cylinder sleeve is moved downwardly to engage the annular downwardly facing valve ring of the valve sleeve with the stationary annular upwardly facing valve seat and to disengage the annular upwardly facing valve sleeve of the cylinder sleeve from the annular downwardly facing valve ring of the valve sleeve, and means including control valve means for selectively moving said cylinder sleeve and valve sleeve upwardly and downwardly.

2. A nailing machine as defined in claim 1 wherein said means including control valve means includes a first valve having a normal position and movable to a second position when the nailing machine is placed against an object to be nailed and a second valve having a normal position and movable to a second position when a control trigger is manually depressed, the arrangement being such that the cylinder sleeve is moved downwardly to advance the blade only when both valves are moved to their second positions.

3. A nailing machine as defined in claim 1 wherein said means for selectively moving said cylinder sleeve upwardly and downwardly also includes a piston flange on said cylinder sleeve, and said control valve means selectively supplies air under pressure to and vents air from said piston flange for moving said cylinder sleeve upwardly and downwardly, respectively.

4. A nailing machine as defined in claim 3 wherein said means including control valve means includes a first valve having a normal position and movable to a second position when the nailing machine is placed against an object to be nailed and a second valve having a normal position and movable to a second position when a control trigger is manually depressed, the arrangement being such that air from said piston flange is vented to atmosphere to move the cylinder sleeve downwardly and advance the blade when both valves are moved to their second positions.

5. A nailing machine as defined in claim 1 including a foot plate below the cylinder sleeve and the lower large diameter piston of the differential piston unit and through which the reciprocatable blade extends, an annular rubber bumper carried by the foot plate around the reciprocatable blade to be engaged by the lower large diameter piston of the differential piston unit when the latter is moved downwardly, and vent passages in the foot plate about the annular rubber bumper for directing air from below the differential piston unit, when the latter is moved downwardly, about the annular rubber bumper for cooling the same.

6. A nailing machine as defined in claim 1 including a foot plate below the cylinder sleeve and the lower large diameter piston of the differential piston unit and through which the reciprocatable blade extends, a nail guide plate carried by the foot plate for guiding the reciprocatable blade and a nail to be driven thereby, and a magazine carried by the foot plate for feeding nails to the nail guide plate.

7. A nailing machine as defined in claim 1 wherein the upper end of said reciprocatable blade is T-shaped and said means for securing the blade to the lower end of the differential piston unit includes a two-part separable holder secured to the lower end of the differential piston unit and encompassing the upper end of said blade, said holder having shoulders engageable by the under sides of the T-shaped portion of said blade, a backup plate within the holder is engageable by the top side of the T-shaped portion of said blade.

8. A pneumatically operated nailing machine comprising a hollow housing supplied with air under pressure, a reciprocatable blade extending through the bottom of the housing for driving nails when advanced, a reciprocatable differential piston unit in the housing having a lower large diameter piston and an upper small diameter piston connected by a piston rod, means securing the blade to the lower end of the differential piston unit to be advanced and retracted thereby, a cylinder sleeve reciprocatably mounted in the housing and having a cylinder reciprocatingly receiving the lower large diameter piston of the differential piston unit, said cylinder sleeve having at its upper end an upwardly facing annular valve seat and an annular piston shoulder of small area therearound subject to the air under pressure in the housing and having intermediate its ends an annular piston flange of large area therearound, a cylinder member in the housing having a cylinder reciprocatingly receiving the upper small diameter piston of the differential piston unit, said cylinder member having sealing means for the piston rod of the differential piston unit for sealing the cylinder for the lower large diameter piston from the cylinder for the upper small diameter piston and having an upwardly facing annular valve seat of smaller diameter than the annular valve seat at the upper end of the cylinder sleeve and located adjacent thereto and radially spaced inwardly therefrom, a valve sleeve reciprocatingly carried by the cylinder member and having a downwardly facing annular valve ring engageable with said upwardly facing annular valve seats of said cylinder sleeve and cylinder member and having an annular piston shoulder subject to the air under pressure in the housing, said cylinder member including passageways for venting to atmosphere the upwardly facing annular valve seat thereof and the cylinder thereof above the upper small diameter piston of the differential piston unit, said housing having passageways for venting to atmosphere the cylinder of the cylinder sleeve below the lower large diameter piston of the differential piston unit, said cylinder member having passageways for supplying air under pressure from the hollow housing to the cylinder thereof below the upper small diameter piston of the differential piston unit, means including control valve means in one condition for supplying air under pressure from the housing below the annular piston flange of the cylinder sleeve for moving the same upwardly to cause the annular valve seat thereof to engage the annular valve ring of the valve sleeve and to move the valve sleeve upwardly to disengage the annular valve ring thereof from the annular valve seat of the cylinder member for sealing the cylinder of the cylinder sleeve above the lower large diameter piston of the differential piston unit from the air under pressure in the housing and for venting the same to atmosphere, whereby the air under pressure in the cylinder of the cylinder member below the upper small diameter piston of the differential piston unit moves the same upwardly to retract the nail-driving blade, said means including said control valve means also being operative in another condition for venting to atmosphere air from below the annular piston flange of the cylinder sleeve for allowing the air under pressure in the housing acting on the annular piston shoulder of the valve sleeve and the annular piston shoulder of the cylinder sleeve to move the same downwardly, to cause the annular valve ring of the valve sleeve to engage the annular valve seat of the cylinder member and to disengage the annular valve seat of the cylinder sleeve from the annular valve ring of the valve sleeve for sealing the cylinder of the cylinder sleeve above the lower large diameter piston of the differential piston unit from the atmosphere and supplying air under pressure thereto from the housing, whereby the air under pressure in the cylinder of the cylinder sleeve above the large diameter piston of the differential piston unit overcomes the force of the air under pressure in the cylinder of the cylinder member below the small diameter piston of the differential piston unit and moves the same downwardly to advance the nail-driving blade.

9. A nailing machine as defined in claim 8 wherein said hollow housing has an upper portion of large transverse dimensions which is supplied with the air under pressure, a lower cylindrical portion of small transverse dimension which slidably mounts the lower part of the cylinder sleeve, and an intermediate portion of intermediate transverse dimension which forms a cylinder for receiving the annular piston flange of the cylinder sleeve, said annular piston flange has packing for slidably sealing the same to said intermediate portion of the housing, and said housing carries upper and lower packings slidably receiving the cylinder sleeve for sealing the

upper portion of the housing from the cylinder forming intermediate portion of the housing and for sealing the cylinder forming intermediate portion of the housing from the lower portion of the housing.

10. A nailing machine as defined in claim 8 wherein said upper small diameter piston and said lower large diameter piston of the differential piston unit have packing for slidably sealing the same in the cylinder of the cylinder member and in the cylinder of the cylinder sleeve.

11. A nailing machine as defined in claim 9 wherein said upper small diameter piston and said lower large diameter piston of the differential piston unit have packing for slidably sealing the same in the cylinder of the cylinder member.

12. A nailing machine as defined in claim 9 wherein said packings are V-type packings.

13. A nailing machine as defined in claim 10 wherein said packings are V-type packings.

14. A nailing machine as defined in claim 9 including a lubricant fitting in the intermediate portion of the housing below the upper packing and above the annular piston flange packing, and a lubricant fitting in the lower portion of the housing below the lower packing, said fittings being free from air under pressure.

15. A nailing machine as defined in claim 8 wherein said hollow housing includes a top cover secured to the remainder of the housing, said cylinder member is secured to the underside of said cover within the housing, and said cylinder of said cylinder member extends above the housing and the cover.

16. A nailing machine as defined in claim 15 wherein said housing includes a hollow handle cover secured to said cover about the cylinder of said cylinder member, and said hollow handle cover has passageways for venting to atmosphere the passageways in the cylinder member which vent the upwardly facing valve seat thereof and the cylinder thereof above the upper small diameter piston of the differential piston unit.

17. A nailing machine as defined in claim 16 wherein said hollow handle cover includes a lubricating fitting above the upper small diameter piston of the differential piston unit, said fitting being free from air under pressure.

18. A nailing machine as defined in claim 8 wherein said housing includes a foot plate below the cylinder sleeve and the lower large diameter piston of the differential piston unit and through which the reciprocatable blade extends, an annular rubber bumper is carried by the foot plate around the reciprocatable blade to be engaged by the lower large diameter piston of the differential piston unit when the latter is moved downwardly, the foot plate is provided with vent passages about the annular rubber bumper for directing the air, which is vented to atmosphere from below the differential piston unit when the latter is moved downwardly, about the annular rubber bumper for cooling the same.

19. A nailing machine as defined in claim 8 wherein said housing includes a foot plate below the cylinder sleeve and the lower large diameter piston of the differential piston unit and through which the reciprocatable blade extends, a nail guide plate is carried by the foot plate for guiding the reciprocatable blade and a nail to be driven thereby, and a magazine is carried by the foot plate for feeding nails to the nail guide plate.

20. A nailing machine as defined in claim 8 wherein the upper end of said reciprocatable blade is T-shaped and said means for securing the blade to the lower end of the differential piston unit includes a two-part separable holder secured to the lower end of the differential piston unit and encompassing the upper end of said blade, said holder having shoulders engageable by the under sides of the T-shaped portion of said blade, a backup plate within the holder is engageable by the top side of the T-shaped portion of said blade.

21. A nailing machine as defined in claim 8 wherein said means including control valve means includes a first valve having a normal position and movable to a second position when the nailing machine is placed against an object to be nailed and a second valve having a normal position and movable to a second position when a control trigger is manually depressed, the arrangement being such that air from below the piston flange of the cylinder sleeve is vented to atmosphere to move the cylinder sleeve downwardly and advance the nail-driving blade when both valves are moved to their second positions.

22. A nailing machine as defined in claim 1 wherein said valve sleeve has an annular groove with a vent passage extending from the bottom of the groove, said downwardly facing annular valve ring is resilient and has annular ridges on the sides thereof, said resilient annular valve ring is forced into said annular groove with the air behind said ring being vented through the vent passage, and a plug is inserted in the vent passage to close the same whereby the resilient annular ring is secured in the annular groove by vacuum as well as by its resiliency.

23. A nailing machine as defined in claim 8 wherein said valve sleeve has an annular groove with a vent passage extending from the bottom of the groove, said downwardly facing annular valve ring is resilient and has annular ridges on the sides thereof, said resilient annular valve ring is forced into said annular groove with the air behind said ring being vented through the vent passage, and a plug is inserted in the vent passage to close the same whereby the resilient annular ring is secured in the annular groove by vacuum as well as by its resiliency.

24. A nailing machine as defined in claim 8 wherein said cylinder member is a two-part telescopically arranged member, the inner part includes the cylinder for the upper small diameter piston of the differential piston unit and carries the sealing means for the piston rod of the differential piston unit, the outer part slidably carries the valve sleeve, and the inner part and the outer part have mating longitudinal grooves forming the passageways for venting to atmosphere the upwardly facing annular valve seat of the cylinder member.

25. A nailing machine as defined in claim 24 wherein said inner part and outer part of said cylinder member have registered holes forming the passageways for supplying air under pressure from the hollow housing to the cylinder below the upper small diameter of the differential piston unit.

26. A nailing machine as defined in claim 1 wherein said cylinder sleeve, cylinder member and valve sleeve are molded from a suitable rigid synthetic plastic material.

27. A nailing machine as defined in claim 8 wherein said cylinder sleeve, cylinder member and valve sleeve are molded from a suitable rigid synthetic plastic material.

28. A nailing machine as defined in claim 24 wherein the inner and outer parts of the cylinder member are molded from a suitable synthetic plastic material.

29. A nailing machine as defined in claim 2 wherein said means including said control valve means includes a valve housing having first and second bores reciprocatingly receiving said first and second valves, respectively, a passage connecting the first valve to a source of air under pressure, a passage connecting the first valve to the cylinder sleeve, a passage connecting the first valve to the second valve, and a passage connecting the second valve to atmosphere.

30. A nailing machine as defined in claim 4 wherein said means including said control valve means includes a valve housing having first and second bores reciprocatingly receiving said first and second valves, respectively, a passage connecting the first valve to a source of air under pressure, a passage connecting the first valve to the piston flange on said cylinder sleeve, a passage connecting the first valve to the second valve, and a passage connecting the second valve to atmosphere.

31. A nailing machine as defined in claim 8 wherein said means including said control valve means includes a valve housing having first and second bores reciprocatingly receiving said first and second valves, respectively, a passage connecting the first valve to a source of air under pressure, a passage connecting the first valve to the piston flange on said cylinder sleeve, a passage connecting the first valve to the second valve, and a passage connecting the second valve to atmosphere.

32. A pneumatically operated nailing machine including, a housing, a reciprocatable blade for driving nails when advanced, a reciprocatable air-operated piston unit in the housing connected to the blade for retracting and advancing the blade as the piston unit is raised and lowered, and means including control valve means for controlling the raising and lowering of the piston unit, the improvement wherein said means including said control valve means comprises a valve housing in the nailing machine housing having first and second bores, a first valve in the first bore having a normal position and movable to a second position when the nailing machine is placed against an object to be nailed, a second valve in the second bore having a normal position and movable to a second position when a control trigger is manually depressed, said valve housing having a first passage connecting the first valve to a source of air under pressure, a second passage connecting the first valve to the air-operated piston unit, a third passage connecting the first valve to the second valve, and a fourth passage connecting the second valve to atmosphere, the arrangement being such that the air-operated piston unit is moved downwardly to advance the nail-driving blade only when both valves are moved to their second positions.

33. A nailing machine as defined in claim 32 wherein said valve housing has sealing means for sealing said first and second bores therein and said first and second passages.

34. A nailing machine as defined in claim 32 wherein said valve housing is molded from a suitable rigid synthetic plastic material.

35. A nailing machine as defined in claim 32 wherein said first valve is molded from a suitable rigid synthetic plastic material.

36. A nailing machine as defined in claim 32 wherein said second valve is molded from a suitable resilient synthetic rubber or rubberlike plastic material.

37. A pneumatically operated nailing machine including a reciprocatable blade for driving nails when advanced, a reciprocatable air-operated piston unit, and means securing the blade to the piston unit to be advanced and retracted thereby, the improvement wherein the upper end of said reciprocatable blade is T-shaped, and said means for securing the blade to the piston unit includes a two-part separable holder secured to the piston unit and encompassing the upper end of said blade, said holder having shoulders engageable by the undersides of the T-shaped portion of said blade, a backup plate within the holder is engageable by the top side of the T-shaped portion of said blade when the piston unit advances the blade for driving nails.