United States Patent

Smith

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[54] MECHANISM FOR CONTAINING A NAIL PACKAGE AND FEEDING SUCCESSIVE NAILS THEREFROM

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[21] Appl. No.: **125,772**

[52] **U.S. Cl.** **227/136**

[51] **Int. Cl.** **B25c 1/00**

[58] **Field of Search** 227/95, 135, 136

[56] **References Cited**

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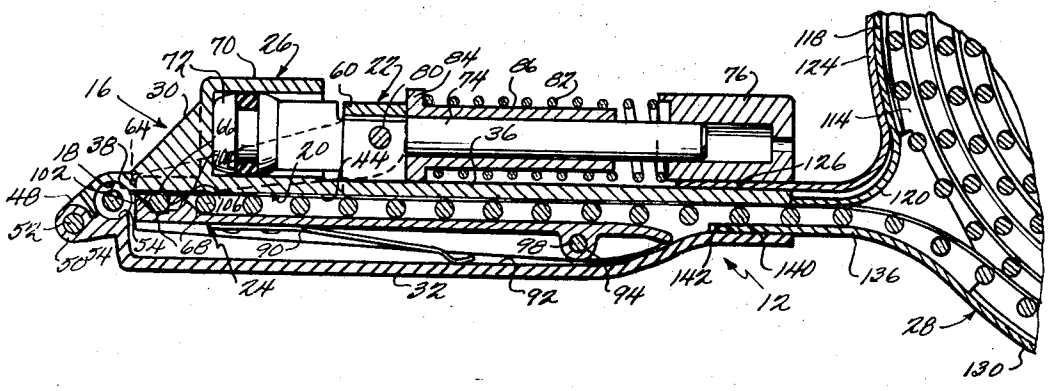
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[57] **ABSTRACT**

A mechanism for containing a fastener package and for feeding successive fasteners from the package into a position to be driven by a fastener driving element during the drive stroke thereof, the fastener package being in the form of a coil of circular headed nails flexibly interconnected in series with their shanks in spaced parallel relation, the mechanism including a nose piece assembly defining an elongated drive track receiving the fastener driving element therein during the operating cycle thereof, and a nail feeding track communicating laterally with the drive track, a ratchet type feeding mechanism for feeding successive nails within the nail feeding track into the drive track, and a magazine assembly for containing the coil of the fastener package, the feeding mechanism including a nail feeding pawl carried by an actuating member movable through a return stroke by a fluid pressure actuated piston and through a drive stroke by a spring assembly which also serves to bias the feeding pawl into its nail feeding position, and a pivoted spring pressed holding pawl provided with surfaces for substantially laterally closing the drive track at the position of communication with the nail feeding track substantially throughout the longitudinal extent thereof so as to prevent successive nails in the drive track from being canted into the nail feeding track during the driving movements thereof by the fastener driving element, the nose piece and magazine assemblies both being of two-part construction movable between an opened loading position and a closed releasably latched operative position, the magazine assembly including a non-adjustable container suitable to support nail packages of different nail sizes, there being provided nail head camming surfaces between the nose piece and magazine assemblies which insure movement of the nails from the container into the nail feeding track in proper nail head guided relation irrespective of the vertical position of the nail heads within the container due to the length of the nail shanks.

14 Claims, 7 Drawing Figures

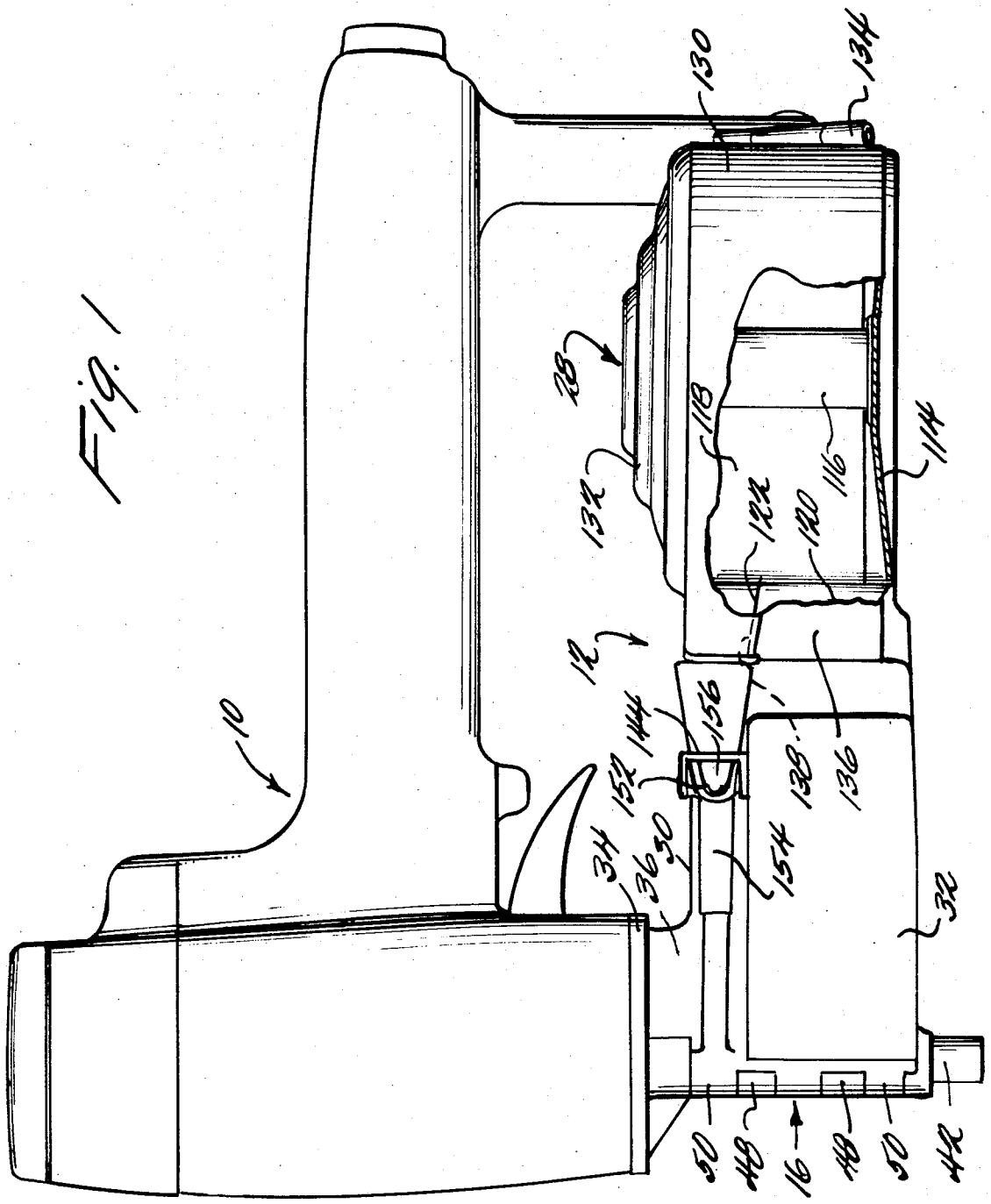


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Fig. 1



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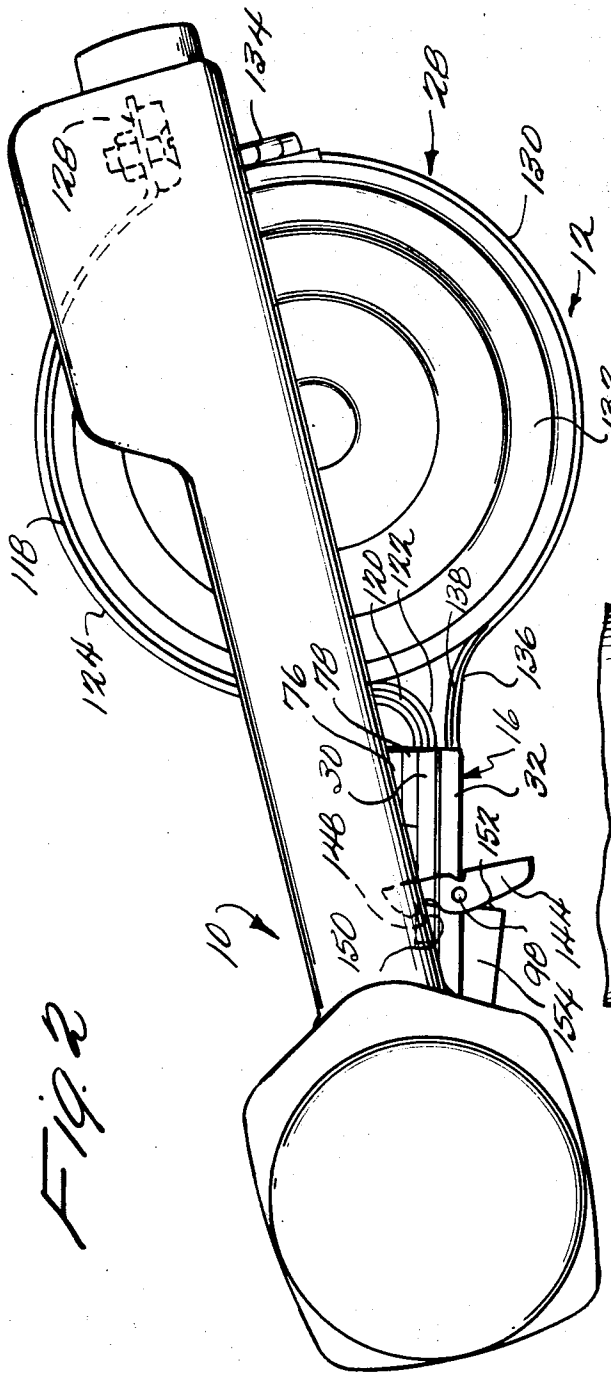


Fig. 2

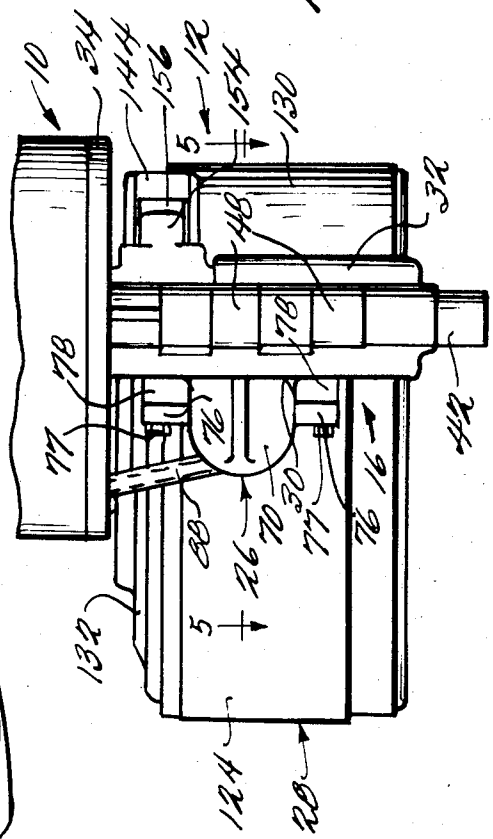


Fig. 3

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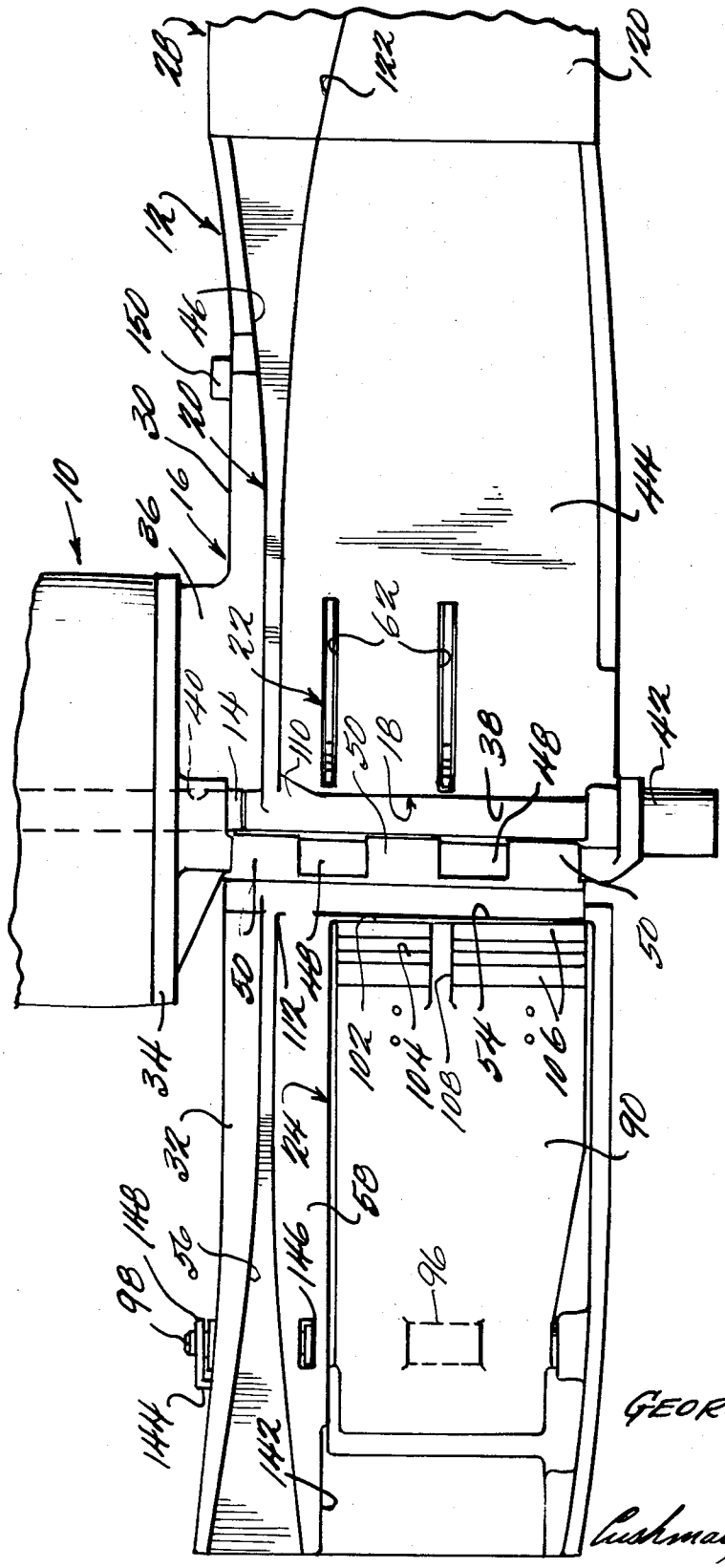


Fig. 4

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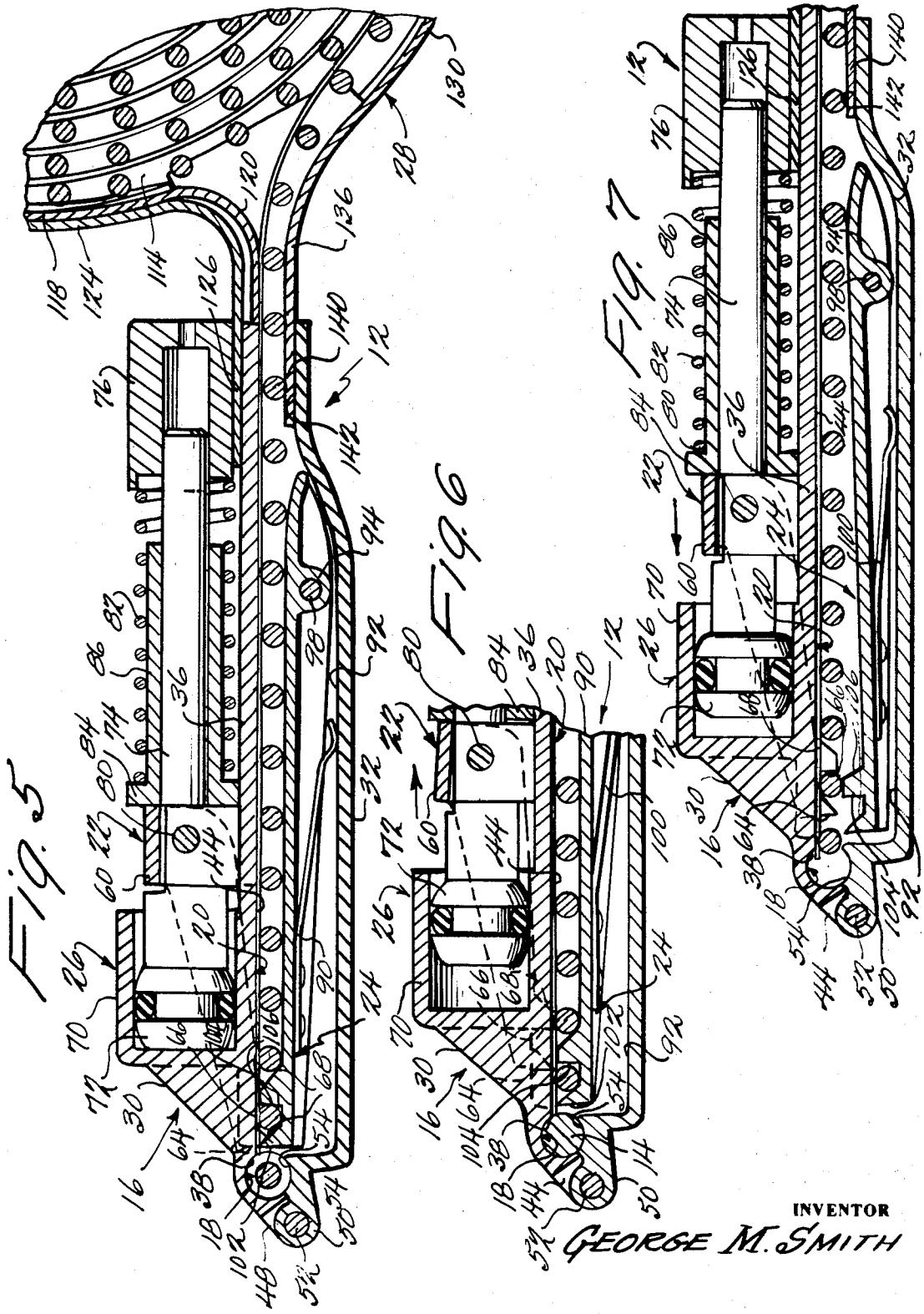


Fig. 5

Fig. 6

Fig. 7

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MECHANISM FOR CONTAINING A NAIL PACKAGE AND FEEDING SUCCESSIVE NAILS THEREFROM

This invention relates to fastener feeding mechanisms for fastener driving devices and more particularly to fastener feeding mechanisms for feeding fasteners from a fastener package in the form of a strip of circular headed nails interconnected in series with their shanks in spaced parallel relation.

Fastener packages of the type described above are known in the art. Such packages are advantageous in that by interconnecting the fasteners in series with their shanks in spaced parallel relation, all known types of circular headed fasteners can be packaged for driving by the device including common nails, screw thread nails and the like. The nails in packages of this type may be either relatively rigidly interconnected so that the final package is in stick form or they may be flexibly interconnected so that the final package is either in coil or folded form.

By providing for the flexible interconnection of the nails, a fairly large number of fasteners can be included within a single package by winding the fasteners into a coil. In this way, a relatively large number of fasteners can be conveniently handled within the fastener driving device, thus reducing the time required to reload the device.

A disadvantage of fastener packages of this type is that they generally require a relatively complex and expensive fastener feeding mechanism, (in comparison with conventional spring actuated pushers) since such mechanisms must be operable to engage the leading portion of the strip of nails and to simultaneously move the leading nail into the drive track and unwind a nail from the coil or fold formation.

Various feeding mechanisms of this type have been proposed which have received some degree of acceptance. For example, a turret type feeding mechanism is disclosed in commonly-assigned Maynard U.S. Pat. No. 3,259,292 dated July 5, 1966. A ratchet type feed mechanism is disclosed in commonly-assigned Boulay U.S. Pat. 3,281,046 dated Oct. 25, 1966. It will be understood that a ratchet type feeding mechanism can be manufactured at a cost less than a turret type feeding mechanism. One disadvantage of the ratchet type mechanisms heretofore proposed is the tendency for the nail within the drive track to move into the laterally communicating nail feeding track during the driving action, thus giving rise to the possibility of either jamming or damage to the device. This problem is not presented in the more costly turret type feeding mechanism.

Accordingly, it is an object of the present invention to provide a ratchet type feed mechanism for fastener packages of the type described having improved means for preventing movement of a nail within the drive track inwardly into the nail feeding track during the driving movement of the nail, thus substantially eliminating the disadvantages noted above.

Another object of the present invention is the provision of a ratchet type feed mechanism of the type described having an improved spring assembly for effecting movement of an actuating member carrying a nail feeding pawl through a drive stroke which spring assembly simultaneously serves to resiliently bias the nail feeding pawl into its nail feeding position.

Another object of the present invention is the provision of a mechanism for containing a fastener package in the form of a coil of circular headed nails fixedly interconnected in series with their shanks in spaced parallel relation, and for feeding successive nails from the package into a position to be driven by a fastener driving element during the drive stroke thereof, the mechanism being operable to accommodate a relatively wide range of different sized nail packages without the necessity of making any adjustments therefor.

Another object of the present invention is the provision of a fastener feeding mechanism for fastener packages of the type described which is of simple and sturdy construction, economical to manufacture and maintain and efficient in operation, both from a standpoint of loading and feeding of the fastener package.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings, wherein an illustrative embodiment is shown.

In the drawings:

FIG. **1** is a side elevational view of a fastener driving device, with parts broken away, embodying the principles of the present invention;

FIG. **2** is a top plan view of the device shown in FIG. **1**;

FIG. **3** is a front elevational view of the lower portion of the device including the fastener containing and feeding mechanism of the present invention;

FIG. **4** is a fragmentary side elevational view of the fastener feeding mechanism illustrating the same in its opened loading position;

FIG. **5** is an enlarged fragmentary sectional view taken along the line **5—5** of FIG. **3** showing the position of the parts in their normal inoperative position;

FIG. **6** is a view similar to FIG. **5** showing the position of the parts during the return stroke of the actuating means; and

FIG. **7** is a view similar to FIGS. **5** and **6** showing the position of the parts during the operative stroke of the actuating means.

Referring now more particularly to FIGS. **1–4** of the drawings, there is shown therein a fastener driving device, generally indicated at **10**, having a fastener containing and feeding mechanism, generally indicated at **12**, embodying the principles of the present invention. The device **10** includes the usual fastener driving element **14** which is moved through an operating cycle including a drive stroke and a return stroke preferably by a conventional pneumatic system (not shown). It will be understood that any type of pneumatic system may be utilized, as for example, the system disclosed in commonly-assigned application Ser. No. 843,665, filed July 22, 1969, for FLUID PRESSURE OPERATED FASTENER DRIVING DEVICE, now U.S. Pat. No. 3,572,572, issued Mar. 30, 1971. While pneumatic systems are preferred, other systems for effecting the cycle of operation of the fastener driving element may be utilized as, for example, electrical systems, hammer actuated systems, spring actuated systems and the like.

The fastener mechanism **12** of the present invention is useful in handling and feeding fastener packages in the form of a strip of circular headed nails interconnected in series with their shanks in spaced parallel

relation, either of the rigid stick form, although particularly suited for the flexible coil or folded form.

Fastener packages of the preferred type are well known in the art. One example of a fastener package of this type is disclosed in commonly-assigned Peterson U.S. Pat. 3,083,369 dated Apr. 2, 1963. Other examples of fastener packages of this type are disclosed in the following U.S. Pat. Nos.: 3,276,576; 3,338,396; 3,357,761; and 3,442,374. The Peterson patent, as well as patent 3,276,576, discloses fastener packages of both the rigid stick form as well as the flexible coil form. Other examples of rigid stick type packages are illustrated in the following U.S. Pat. Nos.: 3,212,632; 3,349,899; 3,358,822; 3,463,304; and 3,471,008.

The mechanism **12** includes a nosepiece assembly, generally indicated at **16**, defining an elongated drive track, generally indicated at **18**, for receiving the fastener driving element **14** during the operating cycle thereof and a nail feeding track, generally indicated at **20**, communicating at one end laterally with the drive track.

The nail feeding mechanism **12** also includes a nail feeding means, generally indicated at **22**, a nail holding means, generally indicated at **24**, cooperable with the nail feeding means **22** and an actuating means, generally indicated at **26**, movable through an operating cycle including a feeding stroke and a return stroke for effecting a movement of successive fasteners through the fastener feeding track and into the drive track. As shown, the mechanism **12** also includes a magazine assembly, generally indicated at **28**, disposed in communication with the other end of the nail feeding track for supporting the coil form of the package with the leading portion of the strip extending into and through the nail feeding track.

As best shown in FIG. **4**, the nosepiece assembly **16** includes a fixed part **30** and a movable part **32**. The fixed part is formed with an upper horizontally extending base portion **34** detachably rigidly connected to the housing of the fastener driving device **10** by any suitable means as, for example, bolts or the like (not shown).

The terms "upper" and "horizontally," as well as other terms such as "above," "below," "vertical," "forward," "rearward," as used hereinafter are to be construed in their relative sense. Thus, for convenience, the device **10** will be described in an orientation operable to drive fasteners downwardly into a horizontal workpiece, although it will be understood that the device is not limited to such application but can be used to drive fasteners into vertical workpieces or beneath horizontal workpieces, as well as workpieces of any other orientation.

Extending downwardly from the base portion **34** is a vertical wall portion **36** having a vertically extending surface **38** of concavely arcuate cross-sectional configuration formed in alignment with a circular opening **40** extending through the base portion **34**. The lower end of the surface **38** merges into the interior cylindrical surface of a lower sleeve portion **42** formed integrally on the fixed part **30** in depending relation thereon. The surface **38** as well as the surfaces forming the openings at each end thereof define a part of the drive track **18**. The wall portion **36** also includes a recessed central vertical surface **44** defining a complementary shank receiving portion of the nail feeding track **20**. The upper end of the surface **44** communicates with a generally horizontally extending surface **46** of concave U-shaped cross-sectional configuration, defining a complementary head receiving portion of the nail feeding track **20** which converges forwardly from its rearward end.

Formed on the end of the wall portion **36** adjacent the drive track defining surface **38** and extending outwardly therefrom is a pair of vertically spaced pivot lugs **48**. The movable part **32** is, as shown, in the form of a wall portion similar to the wall portion **36** having three vertically spaced complementary pivot lugs **50** formed on one end thereof. The lugs **48** and **50** as well as the base portion **34** are vertically apertured to receive a pivot pin **52** (FIGS. **5–7**) which serves to mount the movable part **32** for pivotal movement on the fixed part **30** between an opened access position, as shown in FIG. **4**, and a closed nail feeding position, as shown in FIGS. **1–3**.

As best shown in FIG. **4**, the movable part **32** is provided with a complementary drive track defining vertical surface **54** similar to the surface **38**. Also as before, the movable part **32** includes a horizontally extending surface **56** defining a forwardly converging complementary head receiving portion of the nail feeding track **20** and an adjacent recessed surface **58** defining a complementary shank engaging portion of the nail feeding track **20**.

The nail feeding means **22**, as shown, is preferably in the form of a U-shaped pawl member **60** formed with angularly extending leg portions guidingly received within a pair of horizontally extending openings **62** formed in the vertical wall portion **36** of the fixed part **30**. Each of the angularly extending leg portions of the pawl member **60** is provided with a pair of parallel leading and trailing nail feeding surfaces **64** and **66** facing in a direction toward the drive track and extending transversely across the nail feeding track. The trailing feeding surface **66** is operable to engage the trailing surface of the shank of the second nail disposed in the nail feeding track. The leading nail feeding surface is spaced longitudinally from the trailing surface a distance less than the spacing between the axis of adjacent nail shanks for a purpose hereinafter to be more fully described. Each angularly extended portion **60** also includes a pair of parallel pawl camming surfaces **68** which extend across the nail feeding track in an angular direction outwardly of the U-shaped pawl **60** and toward the drive track so as to engage a leading portion of the shanks of the nails disposed within the drive track.

As shown, the actuating means **26** is in the form of a cylinder **70** formed integrally on the outer side of the wall portion **36**. A piston **72** is slidably mounted within the cylinder **70** and has a piston actuating rod **74** formed thereon extending outwardly of the cylinder. The outer end portion of the actuating rod **74** is slidably received within a bearing block **76** detachably mounted, as by a pair of bolts **77** (FIG. **3**) extending through apertured flanges in the bearing block and threadedly engaged within a pair of vertically spaced horizontally elongated bosses **78** formed integrally on the outer surface of the wall portion **36** of the fixed part **30**. As best shown in FIGS. **5–7**, the U-shaped pawl

member **60** is disposed in embracing relation to a block portion formed on the actuating rod **74** intermediate its ends thereof and is pivotally connected thereto by a pivot pin **80** extending vertically through suitable apertures formed in the leg portions of the pawl member and the block portion of the actuating rod.

Suitable spring means is provided for resiliently biasing the pawl member **60** into a feeding position wherein the bight portion of the pawl member engages the block portion of the actuating rod **74** and the feeding surfaces **64** and **66** extend across the nail feeding track. While the spring means may take any desired form, the arrangement shown in the drawings is preferred since a single spring means is utilized to perform the dual purpose of resiliently biasing the pawl member into its feeding position and of effecting movement of the actuating rod through its drive stroke. In the embodiment shown, the spring means is in the form of a helical compression spring **82** mounted in surrounding relation to the actuating rod **74** with its rearward end engaging the bearing block **76** and its forward end engaging the rearward surface of an annular flange **84** formed on the forward end of a sleeve element **86**. As shown, the sleeve element **86** is slidably mounted on the actuating rod **74** within the spring **82** and the forward surface of the flange **84** engages the rearward surface of the bight portion of the pawl member **60** to effect the resilient bias of the latter into its feeding position. In this way, the spring **82** not only serves to maintain the pawl member **60** in its feeding position but at the same time applies a resiliently biasing force on the actuating rod **74** tending to move the piston **72** into the forward end of the cylinder member **70**. The actuating rod is moved through its return against the action of the spring **82** by air under pressure from the pneumatic system of the device. As best shown in FIG. **3**, the fixed part **30** of the nosepiece assembly **16** is formed with an integral portion **88** extending between the forward upper portion of the cylinder member and the base portion **34** adjacent the periphery thereof. The portion **88** is provided with a passage extending therethrough which communicates at its lower end with the feed end of the cylinder and at its upper end with the pneumatic system of the device **10** at a location therein which provides for a change in pressure from atmospheric to reservoir during the cycle of operation of the pneumatic system. A preferred example is to communicate the passage with the upper end of the drive chamber of the device.

During the return stroke of the actuating rod **74**, the pawl member **60** cooperates with the holding means **24** which, as shown, is preferable in the form of a plate-like holding pawl member **90** disposed within a recess **92** formed in the central portion of the movable part **32**. Formed in the rearward end portion of the pawl member **90** is a pair of vertically spaced vertically apertured bosses or lugs **94** defining an opening therebetween for receiving a cooperating vertically apertured lug **96** formed on the adjacent interior surface of the movable part **32**. A pivot pin **98** extends through the apertured bosses **94** and **96** and serves to pivotally mount the holding pawl member **90** on the movable part **32** of the nose piece assembly **16** for movement about a vertical axis disposed in spaced parallel relation to the axis of the drive track **18**. The holding pawl member **90** is resiliently biased into a nail holding position by suitable spring means which, as shown, is preferably in the form of a spring strap **100** fixed at its forward end to the outer surface of the holding pawl member **90** and having its rearward end disposed in engagement with the inner surface of the movable part **32**.

The forward end of the holding pawl member **90** is formed with a drive track closing surface **102** disposed, when the pawl member is in its nail holding position, transversely across the nail feeding track within the area of lateral communication between the nail feeding track and the drive track. The holding pawl member **90** also includes a nail holding surface **104** parallel with the surface **102** and spaced therefrom in a direction away from the drive track a distance less than the distance between the axes of adjacent nail shanks. In addition, the holding pawl member **90** includes a pair of cam surfaces **106** which extend across the nail feeding track in an angular direction outwardly of the pawl member and toward the nail track so as to be engaged by a leading portion of the shanks of the nails disposed within the nail feeding track.

As best shown in FIG. **4**, the drive track closing surface **102** extends vertically substantially throughout the longitudinal extent of the portion of the drive track which communicates laterally with the nail feeding track. As shown, the nail holding surface **104** is of like vertical extent as well as the associated camming surfaces **106**. The upper end of the holding pawl member **90** is preferably disposed at a level just below the upper leg of the feeding pawl member **60**. In order to accommodate the physical presence of the lower leg of the feeding pawl member **60**, a slot **108** is formed in the adjacent portion of the holding pawl member **90**. Also, with reference to FIG. **4**, it will be noted that both the fixed part **30** and the movable part **32** are provided with nail head camming surfaces **110** and **112** respectively disposed at the juncture between the head guiding surfaces **46** and **56** and the drive track defining surfaces **38** and **54** respectively.

Referring now more particularly to FIGS. **1–3** the magazine assembly **28** includes a bottom wall **114** which is of circular configuration in plan providing an upper nail point engaging and supporting surface of shallow frustoconical form. The central portion of the bottom wall **114** has a spindle **116** rigidly secured thereto which extends upwardly therefrom so as to engage within the core of the coiled nail package. Rigidly secured to one side peripheral edge of the bottom wall **114** is a fixed arcuate side wall **118** one end of which is bent outwardly, as indicated at **120**, so that its interior surface is in alignment with the surface **44** of the fixed part **30** of the nose piece assembly. The outwardly bent portion **120** includes an upwardly facing forwardly and upwardly inclined ledge **122** which is in alignment with the lower end of the rearwardly diverging head receiving surface **46** of the fixed part **30**.

The bottom wall **114**, spindle **116** and arcuate side wall **118** constitute a fixed part of the magazine assembly **28**. Any suitable means may be provided for fixedly attaching the fixed magazine part on the device and, as shown, such means takes the form of an arcuate mounting bracket **124** rigidly secured, as by welding or the like, to the exterior periphery of the arcuate side wall **118** and having a pair of outwardly extending at-

taching flanges **126** and **128** formed on the ends thereof. The flange **126** is fixedly connected with the fixed part **30** of the nose piece assembly as by engagement between the adjacent outer surface of the fixed part and the bearing **76** as best shown in FIGS. **5** and **7**. The opposite attaching flange **128** is rigidly secured to the housing of the device as best shown in dotted lines in FIG. **2**.

The magazine assembly **28** also includes a movable part consisting essentially of a complementary arcuate side wall **130** and a top wall **132** of generally frustoconical configuration fixedly secured along a portion of its periphery with the upper edge of the arcuate side wall **130**. The fixed and movable parts of the magazine assembly are interconnected by an inclined hinge assembly **134** connected to adjacent ends of the arcuate side walls **118** and **130** so as to permit pivotal movement of the side wall **130** and top wall **132** between a closed nail containing position and an open access position wherein the side wall **130** extends upwardly and outwardly of the bottom wall **114** and side wall **118**.

The free end of the side wall **130** is bent outwardly, as indicated at **136**, in a manner similar to the outwardly bent end portion **120** of the side wall **118**. Also as before, the outwardly bent portion **136** is provided with an upwardly inclined ledge **138** disposed in alignment with the lower edge of the head receiving surface **56** when the movable magazine part is in its closed position. The outwardly bent portion **136** includes an extension or tongue portion **140** of a lesser vertical extent adapted to engage within a shallow recess **142** formed in the interior rear end portion of the movable part **32** when the movable magazine part is in its closed position, as best shown in FIGS. **4**, **5** and **7**.

It will be readily apparent that access both to the nail feeding track **20** and the interior of the magazine assembly **28** is obtained when the movable parts of the nose piece and magazine assemblies are disposed in their opened position. After a coil package of nails is loaded therein the side wall **130** is first moved into its closed position and then the movable part **32** of the nose piece assembly is moved into its closed position. Due to the overlapping arrangement of the tongue portion **140** within the recess **142**, a single releasable latch means may be provided for retaining both of the movable parts in their closed positions. As shown, a preferred embodiment of such a latch means includes a generally U-shaped latch element **144**, the legs of which are disposed horizontally and include apertures for receiving an upper extension of the pivot pin **98**. As best shown in FIG. **4**, the movable nose piece part **32** is provided with an appropriate opening **146** for receiving the lower leg of the latch element **144** and the upper leg is disposed above the upper surface of the movable part **32**.

As best shown in FIG. **2**, the upper leg also includes a hook-like extension, indicated at **148**, adapted to engage a cooperating lug **150** formed on the upper surface of the fixed part **30**. The latch element **144** is resiliently biased into a latching position by any suitable means. As shown, this means takes the form of a coil spring **152** disposed within a hollow horizontally elongated boss **154** formed on the outer surface of the movable part **32**. As best shown in FIGS. **1–3**, the rearward end of the spring **152** extends outwardly of the hollow boss **154** and engages a tab **156** bent inwardly from the bight portion of the latch element, the tab element also serving as a stop surface limiting the biased pivotal movement of the latch element in a counterclockwise direction, as viewed in FIG. **2**, by engagement with the adjacent surface of the movable part **32**. It will be noted that the hook-like extension **148** includes the usual forwardly extending cam surface adapted to engage the locking lug **150** as the movable part **32** is pivoted toward its closed position. The latch element is thus automatically moved out of its latching position against the action of the spring **152** as the movable part approaches its closed position, the hook-like extension **148** moving into locked engagement with the lug **150** when the movable part reaches its fully closed position, as best shown in FIG. **2**.

The manner in which the mechanism **12** of the present invention is loaded with a nail package is believed to be apparent from the description set forth above. Briefly, in the loading of a nail package, the operator must first release the latch element **144** and move the movable part **32** of the nose piece assembly into its open position and then move the movable part of the magazine assembly into its open position. The coil nail package is then slipped over the spindle **116** (the spindle entering the open core of the coil) and the leading portion of the strip is pulled outwardly from the coil. As best shown in FIG. **4**, with the movable part **32** disposed in its opened loading position, the complementary drive track surface **38** and nail feeding track surfaces **44** and **46** of the fixed part **30** are fully opened laterally permitting the operator to conveniently position the leading portion of the fastener package in proper feeding relation therein with the leading nail in engagement with the drive track surface **38** and the shanks and heads of the remaining nails in engagement with the surfaces **44** and **46** respectively.

Next, the operator pivots the movable part of the magazine assembly into its closed position and then the movable part **32** of the nose piece assembly into its closed position, the latch element **144** serving to automatically retain the movable parts in their closed position as aforesaid. It will be noted that when the movable part **32** is in its closed position the surface **54** cooperates with the surface **38** to define the central portion of the drive track **18**, the surface **56** cooperates with the surface **46** to define the head receiving portion of the nail feeding track and the surface **58** cooperates with the surface **44** to define the shank portion of the nail feeding track, the inner surface of the holding pawl member **90** also cooperating in this regard.

With the device thus properly loaded it will be noted that the nail feeding parts are initially disposed in the position shown in FIG. **3** prior to actuation. When the device is actuated, air under pressure is communicated with drive cylinder to effect movement of the drive piston and the fastener drive element **14** connected therewith through its drive stroke. The air pressure which serves to drive the drive piston is likewise communicated through the portion **88** of the nose piece assembly **16** with the cylinder **70** thus simultaneously commencing the return stroke of the actuating rod **74** against the action of spring **82**. During the return stroke of the actuating rod **74**, the cam surfaces **68** of the

feeding pawl **60** engage the leading shank surfaces of the two leading nails within the nail feeding track. The nail holding surface **104** of the holding pawl **90** in engagement with the trailing shank surface of the leading nail within the nail feeding track prevents movement of the nails within the nail feeding track in a direction away from the drive track, thus causing the feed pawl to be pivoted out of its feeding position against the action of spring **82**. It is important to note that prior to the initial return stroke movement of the feeding pawl, the leading feed surface **64** thereof is positioned in the area of the juncture between the nail feeding track and the drive track and is not disposed within the drive track. With this relationship there is no possibility presented of head interference with the nail feeding pawl in the event of a lag in the initiation of the return stroke of the nail feeding pawl.

When the actuating rod **74** reaches the end of its return stroke, cam surfaces **68** will move out of engagement of the shanks of the leading nails in the nail feeding track permitting the spring **82** to effect pivotal movement of the feeding pawl back into its feeding position wherein the feeding surface **66** extends across the nail feeding track in a position to engage the trailing surface of the second nail of the fastener package.

A significant functional advantage of the present invention is achieved during the driving of the leading nail through the drive track **18** during the drive stroke of the fastener driving element **14**. It will be noted that the initial driving movement of the leading nail will cause the carrier wires of the nail package to fracture by virtue of the relative longitudinal movement between the leading nail and the next adjacent nail which is held in a stationary position by the engagement of its head within the head portion of the nail feeding track. During this initial movement of the leading nail, the carrier wires of the nail package tend to cause the shank of the leading nail to move into the shank portion of the nail feeding track prior to fracture. Such movement, however, is prevented by the surface **102** of the holding pawl **90** which substantially laterally closes the drive track at its position of lateral communication with the nail feeding track. In this way, the feeding mechanism of the present invention insures that the nail within the drive track will be properly driven outwardly thereof into the workpiece.

At the end of the drive stroke, the operator deactuates the device so as to effect the return stroke of the fastener driving element **14**. Deactuation serves to exhaust the drive cylinder to atmosphere. The exhausting of the drive cylinder simultaneously serves to exhaust the cylinder **70** thus permitting the spring **82** to commence the feeding stroke of the actuating rod **74**. The feeding pawl **60** is thus moved by the actuating rod **74** under the action of the spring **82**, in a direction toward the drive track, the feeding surface **66** engaging the second nail within the nail feeding track. The engagement and movement of the second nail by the feeding pawl will effect movement of the leading nail in the nail feeding track by virtue of the carrier wires interconnecting the two nails. However, because of the presence of the fastener driving element **14** within the drive track **18**, the head of the leading nail can not move within the drive track until the fastener driving element is withdrawn from the adjacent portion of the drive track. As the fastener driving element is withdrawn, the feeding movement of the feeding pawl member **60** is completed, the compressive strength of the carrier wires between the leading nail and the second nail being such as to insure movement of the leading nail fully into the drive track.

It will be noted that during the feeding movement of the pawl **60**, the leading shank surfaces of the leading two nails will be moved into engagement with the cam surfaces **106** of the holding pawl **90**, thus pivoting the holding pawl out of its nail holding position against the action of the spring **100**. As the second nail reaches a position corresponding with a position of the leading nail fully within the drive track at the end of the feeding movement of the pawl **60**, spring **100** is operable to move the holding pawl **90** back into its nail holding position wherein the surface **102** substantially laterally closes the drive track and the holding surface **104** extends across the nail feeding track in a position to engage the trailing shank surface of the leading nail within the nail feeding track.

The particular construction of the feed pawl and its manner of operation whereby the feeding action is accomplished by engagement of the second nail within the nail feeding track is disclosed and claimed in commonly-assigned application Ser. No. 125,726 filed herewith, in the name of Edward I. Fisher and entitled NAIL FEED MECHANISM, to which reference may be made for a more detailed understanding of the operational advantages thereof. It will be understood that while an arrangement of this type is preferred, other feeding pawl constructions may be utilized in conjunction with the ratchet type feeding mechanism of the present invention and that the magazine assembly of the present invention would have applicability to other types of feeding mechanisms.

The magazine assembly **28** of the present invention is particularly advantageous in that it has the capability of accommodating nail packages in a wide variety of shank length sizes as, for example, inches. 1 ⅜ inches to 2 inches. In this regard, it will be noted that the magazine assembly **28** is operable to support the coil formation of the nail package with the nail points engaging the upwardly facing frustoconical surface of the bottom wall **114**. Since the nail coil is supported by engagement of the nail points with the bottom wall **114**, the heads of the nails will be disposed at different vertical positions within the magazine assembly, depending upon the length of the shank. For the smaller sizes, the surfaces of the ledges **122** and **138** as well as the upwardly facing inclined surfaces **46** and **56** function to engage beneath the surface of the heads and cam the nails upwardly into proper vertical alignment to be engaged by the pawl members at the leading portion of the nail feeding track.

Nail packages embodying nails of generally large length will move into the drive track during operation such that the upper surface of their edges are engaged by the downwardly facing inclined surfaces **46** and **56** so as to be cammed into proper vertical position at the forward end of the drive track. It will also be noted that the vertical extent of the surface **102** of the holding pawl is sufficient to insure engagement not only of the larger size shanks but of the smaller size shanks as well.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing preferred specific embodiment has been shown and described for the purpose of illustrating the functional and structural principles of this invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

I claim:

1. In a fastener driving apparatus including a fastener driving element movable through a cycle of operation including a drive stroke and a return stroke,

an improved mechanism for feeding successive fasteners from a fastener package into a position to be driven by said fastener driving element during the drive stroke thereof, the fastener package being in the form of a strip of circular headed nails interconnected in series with their shanks in spaced parallel relation,

said mechanism comprising a nose piece assembly defining an elongated drive track receiving said fastener driving element therein during the operating cycle thereof and a nail feeding track communicating laterally with said drive track,

an actuating member carried by said nose piece assembly for movement through an operating cycle including an operative stroke in a direction along the extent of said nail feeding track toward said drive track and a return stroke,

nail feeding means operatively connected with said actuating member for movement through operative and return strokes therewith and mounted for movement relative to said actuating member for resiliently biased lateral movement into a nail feeding position extending across said nail feeding track,

said nail feeding means having first surface means operable during successive operative strokes of said actuating member with said nail feeding means in said feeding position to engage successive nails of a fastener package along the trailing shank surfaces thereof and to successively move the leading nails of the package into said drive track,

nail holding means pivotally mounted on said nose piece assembly for movement about an axis generally parallel with said drive track,

spring means resiliently biasing said nail holding means into a nail holding position and permitting movement of said nail holding means out of said nail holding position,

said nail holding means including first surface means operable when said nail holding means is disposed in said nail holding position to be engaged by the shanks of successive nails within said nail feeding track during the feeding movement thereof so as to move said nail holding means out of said nail holding position and permit said spring means to move said nail holding means back into said nail holding position at the end of each successive nail feeding movement,

said nail holding means including second surface means operable when said nail holding means is disposed in said nail holding position for substantially laterally closing said drive track at the position of communication with said nail feeding track substantially throughout the longitudinal extent thereof so as to prevent successive nails in said drive track from being canted into said nail feeding track during the driving movements thereof by said fastener driving element,

said nail holding means including third surface means spaced from said second surface means in a direction outwardly of said drive track a distance less than the spacing between the axis of adjacent nail shanks for engaging the trailing shank surfaces of successive nails in said nail feeding track during successive return strokes of said actuating member so as to prevent movement thereof in a direction away from said drive track,

said nail feeding means including second surface means operable when said nail feeding means is disposed in said nail feeding position to be engaged by the shanks of successive nails within said nail feeding track during successive return strokes of said actuating member so as to move said nail feeding means out of said feeding position and permit the same to be biased back into said nail feeding position at the end of each successive return stroke of said actuating member.

2. A mechanism as defined in claim 1 wherein said actuating member comprises a piston rod having a piston on one end thereof, a cylinder carried by said nose piece assembly slidably sealingly receiving said piston, a bearing block carried by said nose piece assembly in horizontally spaced relation to said cylinder for slidably supporting the opposite end of said piston rod, a coil spring surrounding said piston rod and having one end operatively engaged with said bearing block, said nail feeding means comprising a pawl member pivotally mounted on said piston rod between said piston and the opposite end of said coil spring, and means operatively connecting the opposite end of said coil spring with said pawl member so as to simultaneously and independently resiliently bias said pawl member into said feeding position and said piston rod into a position corresponding to the end of said drive stroke.

3. A mechanism as defined in claim 1 wherein said nose piece assembly comprises a fixed part having surface means defining a laterally open portion of said drive track and said nail feeding track and a movable part pivotally connected to said fixed part for movement about an axis parallel with and forwardly adjacent said drive track between a closed feeding position and an opened loading position, said movable part having surface means disposed in spaced relation with said fixed part surface means when said movable part is disposed in said opened loading position so as to permit movement of the leading end portion of a fastener package into said open track portion and track defining cooperating relation with said fixed part surface means when said movable part is disposed in said closed feeding position so as to support the leading portion of said fastener package for feeding movement along said nail feeding track in a direction toward said drive track.

4. A mechanism as defined in claim 3 including a container assembly for receiving and supporting a trailing portion of the fastener package disposed in a coil

formation, said container assembly including a fixed part rigidly secured to the fixed part of said nose piece assembly and a movable part pivotally connected to said fixed container part for movement between a closed fastener containing position and an opened loading position and a single latch means for releasably securing both of said movable parts in their closed positions.

5. A mechanism as defined in claim 4 wherein said fixed container part includes a generally frustoconical bottom wall having a spindle extending upwardly from the central portion thereof for engagement within a central core of the coil formation with the points of the nails of the coil supported on said bottom wall, and an arcuate side wall fixed to a peripheral portion of said bottom wall, said fixed side wall having an end portion extending outwardly of the arcuate extent thereof into alignment with the nail feeding track defining surface means of said fixed nose piece part, said movable part including a generally frustoconical top wall and an arcuate side wall fixed to a peripheral portion thereof, said movable side wall having an end portion extending outwardly of the arcuate extent thereof into alignment with the nail feeding track defining surface means of said movable nose piece part when said movable parts are disposed in their closed positions,

the nail feeding track defining surface means of said fixed and movable nose piece parts including vertically spaced upper and lower surfaces for engaging the upper and lower surfaces of the heads of the nails during their movement through said nail feeding track, said upper and lower surfaces sloping downwardly and upwardly from the rearward ends thereof in forwardly converging relation, each of said side wall end portions having a ledge formed therein in alignment with the rearward end of the associated lower surface.

6. A mechanism as defined in claim 3 wherein said fixed and movable parts include vertically extending wall portions each having spaced complementary pivot lugs formed integrally on an end thereof adjacent said drive track and a pivot pin extending through said pivot lugs.

7. A mechanism as defined in claim 6 wherein said movable part wall portion is provided with a central recess and wherein said nail holding means comprises a plate member disposed within said recess.

8. In a fastener driving apparatus including a fastener driving element movable through a cycle of operation including a drive stroke and a return stroke,

an improved mechanism for feeding successive fasteners from a fastener package into a position to be driven by said fastener driving element during the drive stroke thereof, the fastener package being in the form of a strip of circular headed nails interconnected in series with their shanks in spaced parallel relation,

said mechanism comprising a nose piece assembly defining an elongated drive track receiving said fastener driving element therein during the operating cycle thereof and a nail feeding track communicating laterally with said drive track,

an actuating member carried by said nose piece assembly for movement through an operating cycle including an operative stroke in a direction along the extent of said nail feeding track toward said drive track and a return stroke,

nail feeding means operatively connected with said actuating member for movement through operative and return strokes therewith and mounted for movement relative to said actuating member for lateral movement into a nail feeding position extending across said nail feeding track,

said nail feeding means having first surface means operable during successive operative strokes of said actuating member with said nail feeding means in said feeding position to engage successive nails of a fastener package along the trailing shank surfaces thereof and to successively move the leading nails of the package into said drive track,

nail holding means pivotally mounted on said nose piece assembly for movement about an axis generally parallel with said drive track,

spring means resiliently biasing said nail holding means into a nail holding position and permitting movement of said nail holding means out of said nail holding position,

said nail holding means including first surface means operable when said nail holding means is disposed in said nail holding position to be engaged by the shanks of successive nails within said nail feeding track during the feeding movement thereof so as to move said nail holding means out of said nail holding position and permit said spring means to move said nail holding means back into said nail holding position at the end of each successive nail feeding movement,

said nail holding means including second surface means operable when said nail holding means is disposed in said nail holding position for engaging the trailing shank surfaces of successive nails in said nail feeding track during successive return strokes of said actuating member so as to prevent movement thereof in a direction away from said drive track,

said nail feeding means including second surface means operable when said nail feeding means is disposed in said nail feeding position to be engaged by the shanks of successive nails within said nail feeding track during successive return strokes of said actuating member so as to move said nail feeding means out of said feeding position and permit the same to be biased back into said nail feeding position at the end of each successive return stroke of said actuating member,

said actuating member comprising a piston rod having a piston on one end thereof,

a cylinder carried by said nose piece assembly slidably sealingly receiving said piston,

a bearing block carried by said nose piece assembly in horizontally spaced relation to said cylinder for slidably supporting the opposite end of said piston rod,

a coil spring surrounding said piston rod and having one end operatively engaged with said bearing block,

said nail feeding means comprising a pawl member pivotally mounted on said piston rod between said piston and the opposite end of said coil spring,

and means operatively connecting the opposite end of said coil spring with said pawl member so as to simultaneously and independently resiliently bias said pawl member into said feeding position and said piston rod into a position corresponding to the end of said drive stroke.

9. A mechanism as defined in claim 8 wherein said last-mentioned means comprises a sleeve slidably mounted on said piston rod within said coil spring, said sleeve having a radially outwardly extending annular flange on the forward end thereof, the rearward surface of said flange engaging the opposite end of said coil spring, the forward surface of said flange engaging said pawl member.

10. A mechanism as defined in claim 9 wherein said pawl member is of U-shaped configuration pivotally mounted on said piston rod with the bight portion thereof extending longitudinally along the periphery of said rod and the legs thereof embracing said piston rod.

11. In a fastener driving device including a fastener driving element movable through a cycle of operation including a drive stroke and a return stroke,

an improved mechanism for containing a fastener package in the form of a strip of circular headed nails interconnected in series with their shanks in spaced parallel relation and disposed in a coil formation and for feeding successive nails from the package into a position to be driven by said fastener driving element during the drive stroke thereof,

said mechanism including a magazine assembly for receiving and supporting the fastener package disposed in said coil formation,

a nose piece assembly defining an elongated drive track receiving said fastener driving element therein during the operating cycle thereof and a nail feeding track communicating laterally with said drive track for receiving and supporting a leading portion of the fastener package in the form of a strip extending from the coil formation and supported within said magazine assembly,

said nose piece assembly including a fixed part having surface means defining an open portion of said drive track and said nail feeding track and a movable part pivotally connected to said fixed part for movement between a closed feeding position and an opened loading position,

said movable part having surface means disposed in spaced relation with said fixed part surface means when said movable part is disposed in said opened loading position so as to permit movement of the leading end portion of a fastener package into said open track portion and in track defining cooperating relation with said fixed part surface means when said movable part is disposed in said closed feeding position so as to support the leading portion of said fastener package for feeding movement along said nail feeding track in a direction toward said drive track,

said magazine assembly including a fixed part rigidly secured to the fixed part of said nose piece assembly and a movable part pivotally connected to said fixed container part for movement between a closed fastener containing position and an opened loading position,

latch means for releasably securing both of said movable parts in their closed positions,

said fixed magazine part including a generally frustoconical bottom wall having a spindle extending upwardly from the central portion thereof for engagement within a central core of the coil formation with the points of the nails of the coil supported on said bottom wall, and an arcuate side wall fixed to a peripheral portion of said bottom wall and extending upwardly therefrom,

said fixed side wall having end portion extending outwardly of the arcuate extent thereof into alignment with the nail feeding track defining surface means of said fixed nose piece part,

said movable magazine part including a generally frustoconical top wall and an arcuate side wall fixed to a peripheral portion thereof,

said movable side wall having an end portion extending outwardly of the arcuate extent thereof into alignment with the nail feeding track defining surface means of said movable nose piece part when said movable parts are disposed in their closed positions,

the nail feeding track defining surface means of said fixed and movable nose piece parts including vertically spaced upper and lower surfaces for engaging the upper and lower surfaces of the heads of the nails during their movement through said nail feeding track,

said upper and lower surfaces sloping downwardly and upwardly from the rearward ends thereof in forwardly converging relation,

each of said side wall end portions having a ledge formed therein in alignment with the rearward end of the associated lower surface,

and means adjacent said nail feeding track for feeding successive nails into said drive track to be driven outwardly thereof by said fastener driving element during the drive stroke thereof.

12. A mechanism as defined in claim 11 wherein nail feeding means comprises

an actuating member carried by said nose piece assembly for movement through an operating cycle including an operative stroke in a direction along the extent of said nail feeding track toward said drive track and a return stroke,

nail feeding means operatively connected with said actuating member for movement through operative and return strokes therewith and mounted for movement relative to said actuating member for resiliently biased lateral movement into a nail feeding position extending across said nail feeding track,

said nail feeding means having first surface means operable during successive operative strokes of said actuating member with said nail feeding means in said feeding position to engage successive second nails of a fastener package along the trailing shank surface thereof and to successively move the leading nails of the package into said drive track,

nail holding means mounted on said nose piece assembly for resiliently biased movement toward a nail holding position,

said nail holding means including first surface means operable when said nail holding means is disposed in said nail holding position to be engaged by the shanks of successive nails within said nail feeding track during the feeding movement thereof so as to move said nail holding means out of said nail holding position and permit said nail holding means to be resiliently biased back into said nail holding position at the end of each successive nail feeding movement,

said nail holding means including second surface means operable when said nail holding means is disposed in said nail holding position for substantially laterally closing said drive track at the position of communication with said nail feeding track so as to prevent successive nails in said drive track from being canted into said nail feeding track during the driving movements thereof by said fastener driving element,

said nail holding means including third surface means spaced from said second surface means in a direction outwardly of said drive track a distance less than the spacing between the axes of adjacent nail shanks for engaging the trailing shank surfaces of successive nails in said nail feeding track during successive return strokes of said actuating member so as to prevent movement thereof in a direction away from said drive track,

said nail feeding means including second surface means operable when said nail feeding means is disposed in said nail feeding position to be engaged by the shanks of successive nails within said nail feeding track during successive return strokes of said actuating member so as to move said nail feeding means out of said feeding position and permit the same to be resiliently biased back into said nail feeding position at the end of each successive return stroke of said actuating member.

13. A mechanism as defined in claim 12 wherein said actuating member comprises a piston rod having a piston on one end thereof, a cylinder carried by said nose piece assembly slidably sealingly receiving said piston, a bearing block carried by said nose piece assembly in horizontally spaced relation to said cylinder for slidably supporting the opposite end of said piston rod, a coil spring surrounding said piston rod and having one end operatively engaged with said bearing block, said nail feeding means comprising a pawl member pivotally mounted on said piston rod between said piston and the opposite end of said coil spring, and means operatively connecting the opposite end of said coil spring with said pawl member so as to simultaneously and independently resiliently bias said pawl member into said feeding position and said piston rod into a position corresponding to the end of said drive stroke.

14. A mechanism as defined in claim 13 wherein said last-mentioned means comprises a sleeve slidably mounted on said piston rod within said coil spring, said sleeve having a radially outwardly extending annular flange on the forward end thereof, the rearward surface of said flange engaging the opposite end of said coil spring, the forward surface of said flange engaging said pawl member.

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