United States Patent [19]

Maestri

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[45] **March 13, 1973**

[54] TOOL FOR DRIVING AND SETTING HEADLESS NAILS OR METAL TACKS

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[21] Appl. No.: **127,634**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 856,001, Sept. 8, 1969, abandoned.

[30] **Foreign Application Priority Data**

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Feb. 20, 1969 Italy.....13102 A/69

[52] **U.S. Cl.**.....**227/109**
[51] **Int. Cl.**.....**B27f 7/14**
[58] **Field of Search**.....227/109

[56] **References Cited**

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Primary Examiner—Granville Y. Custer, Jr.
Attorney—Browdy & Neimark

[57] **ABSTRACT**

An improved tool for driving and setting headless nails or metal tacks is disclosed, comprising a driving device which is associated with a novel magazine essentially consisting of a casing closed by a slidable member, both defining therein a passage for housing and guiding a plurality of headless nails which are elastically pushed into a T-contoured ejection passage where they are driven by a ribbed and pointed ejector connected to the driving device. Moveable parts inside the magazine can partially take up or fill the passage for housing and guiding headless nails of different lengths.

10 Claims, 26 Drawing Figures

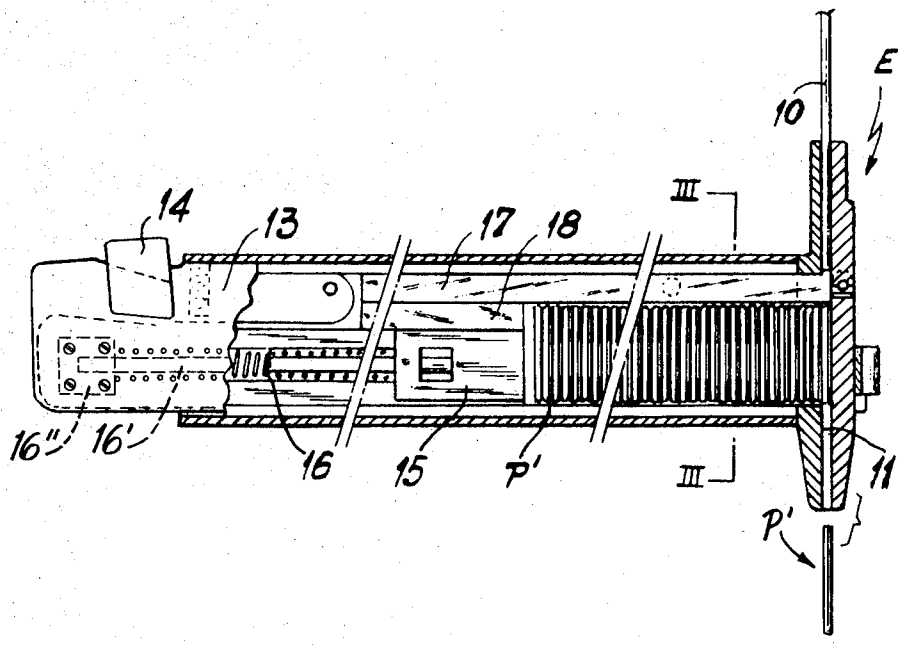


Fig. 1

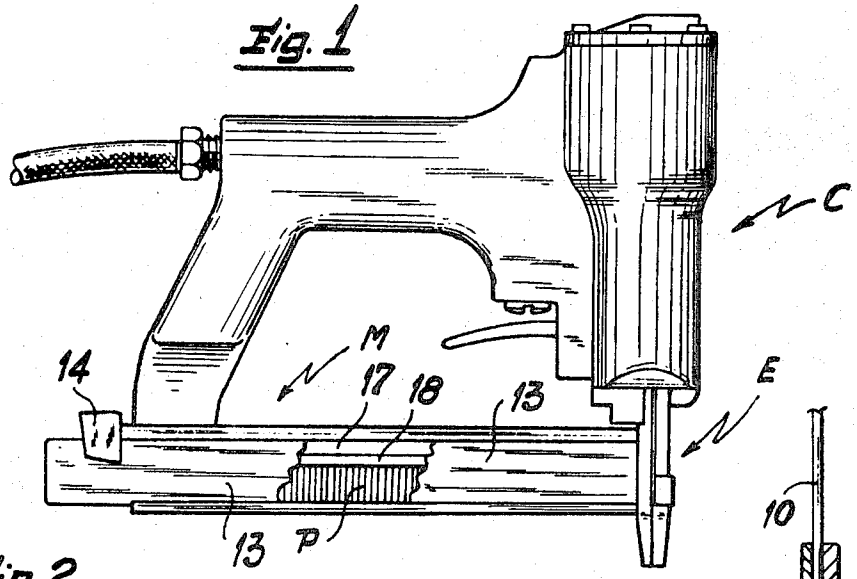


Fig. 2

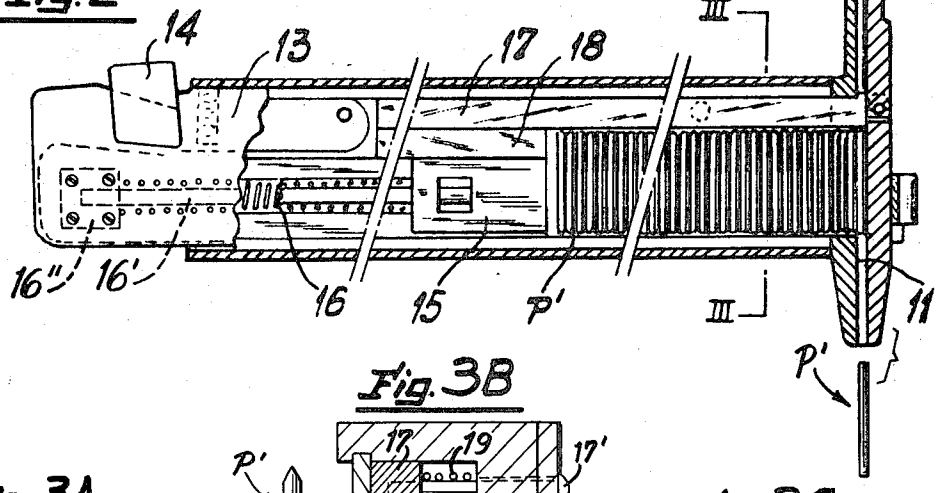


Fig. 3A

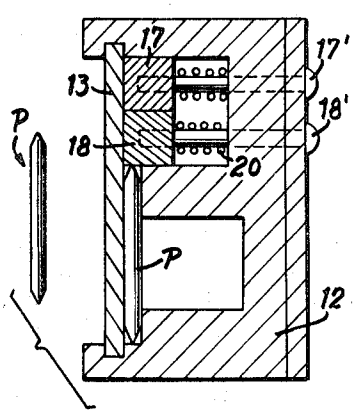


Fig. 3B

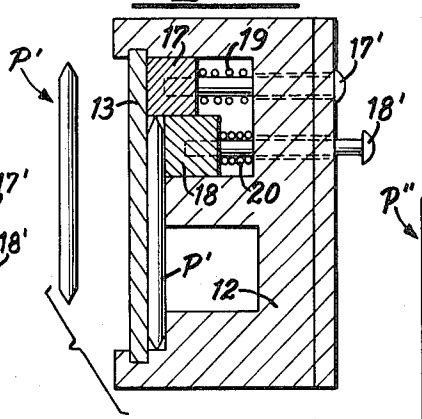
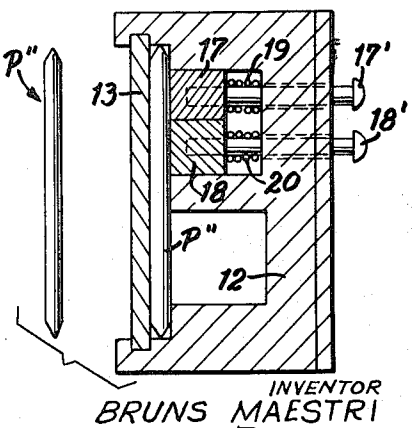


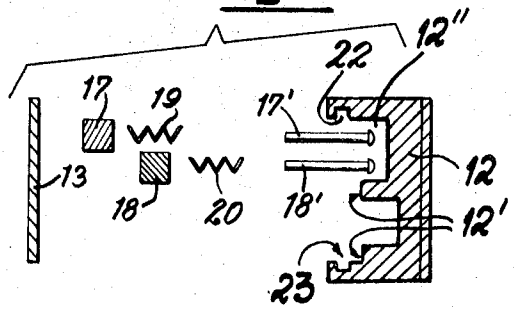
Fig. 3C



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Fig. 4



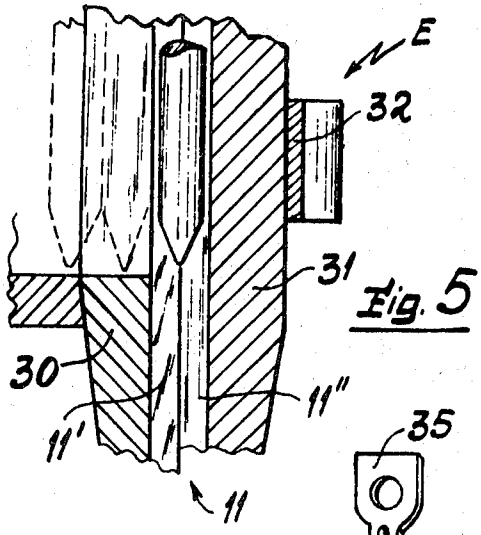


Fig. 5

Fig. 6

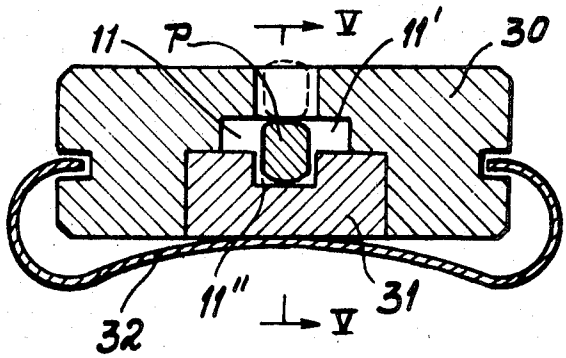
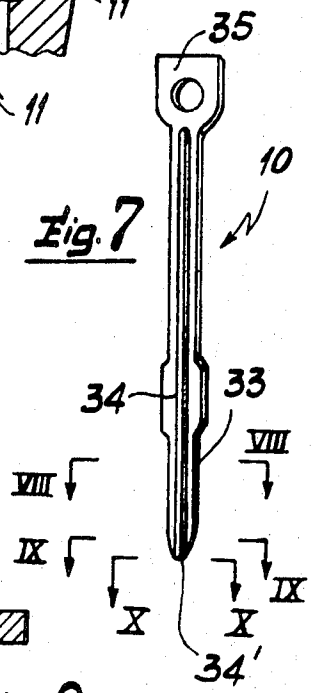


Fig. 7



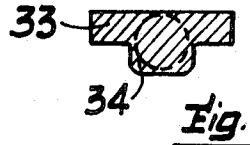


Fig. 8

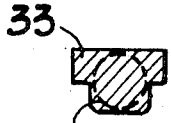


Fig. 9

Fig. 10



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Fig 11A

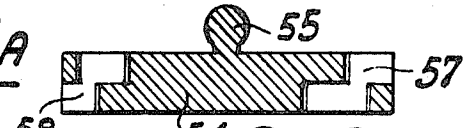


Fig 11B

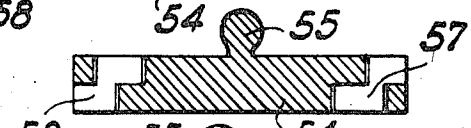


Fig 11C

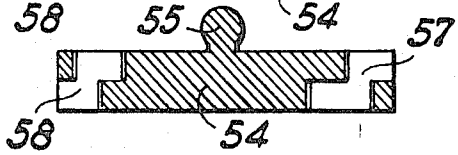


Fig 11

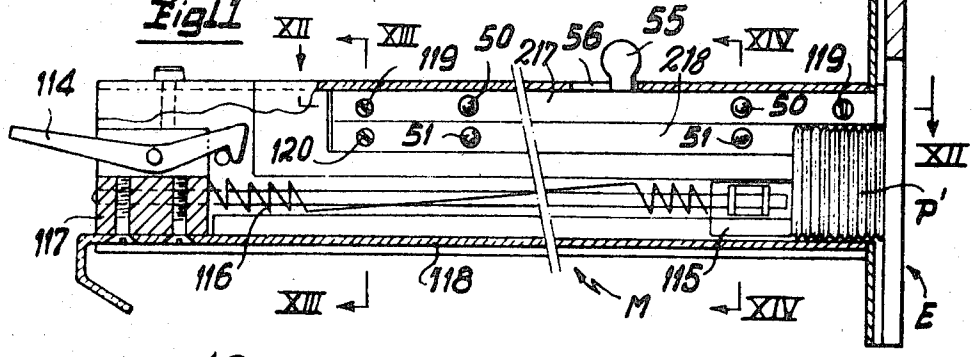
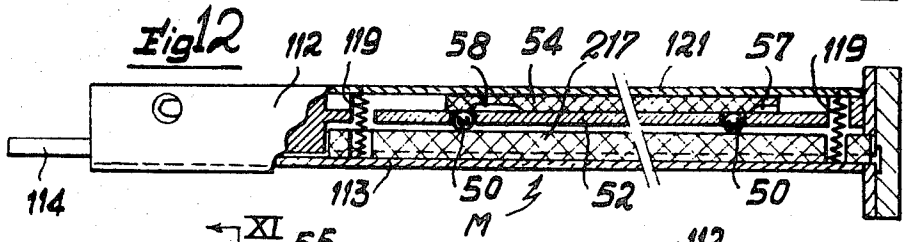


Fig 12



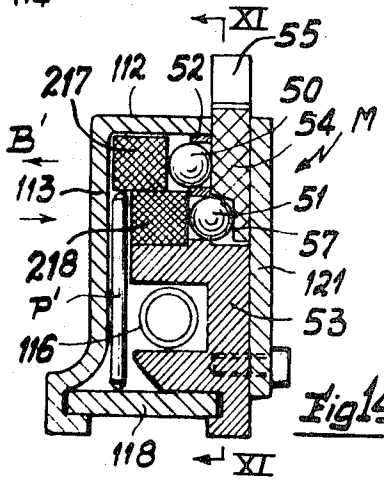


Fig 14

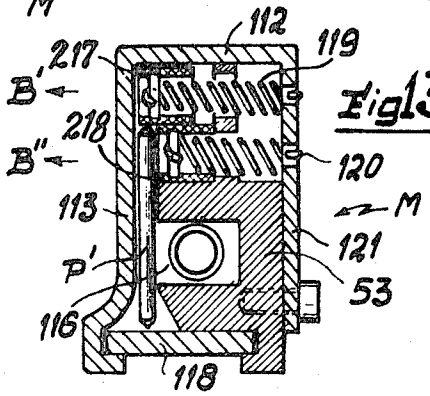


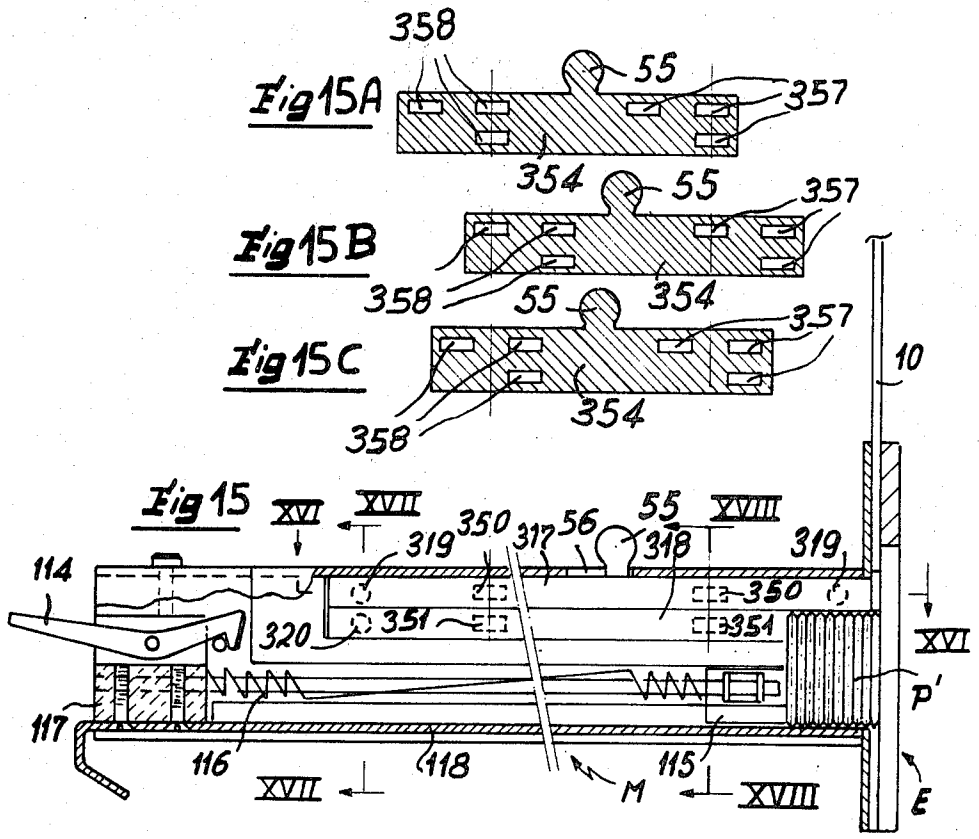
Fig 13

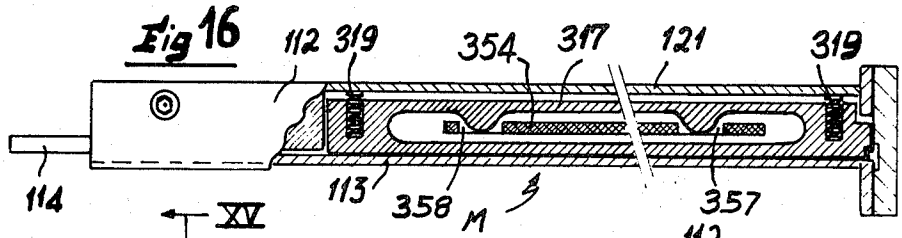
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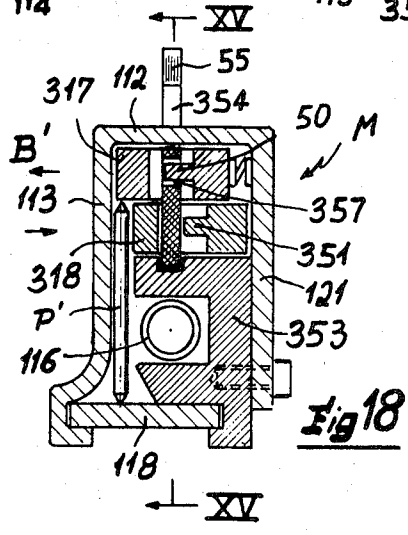
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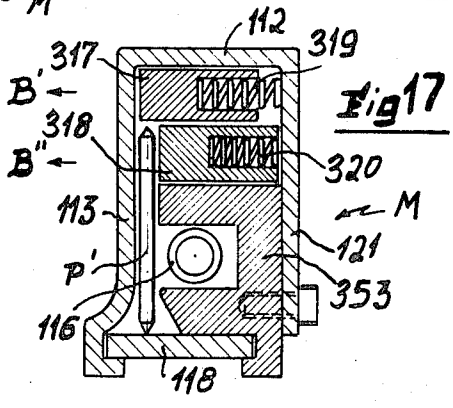
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TOOL FOR DRIVING AND SETTING HEADLESS NAILS OR METAL TACKS

This application is a continuation-in-part of prior application Ser. No. 856,011 filed Sept. 8, 1969, now abandoned.

This invention relates to tools or equipment, and in particularly tools or equipment of the type to be held in the hand and worked manually, electrically, or preferably by pneumatic means, for driving nails and the like. More particularly, this invention relates to improvements made to equipment or tools of the above type so that headless nails or tacks may be driven and set.

Mechanically operated equipment and tools for applying in quick succession clips, staples, or nails provided with a large or at least shaped head, are well known in the prior art and are suitable for many uses. Said kind of staples and nails, capable of being driven and set by such known means, are always visible on the outside of the structures into which they are set. In fact, the broad head of the nail or the bridging part of the staple, which serves as a head common to the two shanks of the staple itself, can be seen at the surface of the piece or part of wood or the like into which the shanks have been set.

This superficial evidence, as well as other technical considerations, prevent the use of said known mechanical means of driving in many fields and in many operations in which mechanical nail driving would be most profitable. An example of such fields, not exploited at the present time, is in the application of profiles, mouldings, frames and the like in wood, plastics, or the like. Said application requires the fixing to be made, in addition to a possible glueing operation, with metal tacks or with nails, generally very fine nails completely headless, which are to be totally inserted in the part to which they are applied, preferably burying their top end to a depth for example of about one millimeter, so that on finishing said nails or tacks are practically invisible.

The nail driving devices of the prior art are not suitable for this sort of work for two main reasons. One reason is that said tacks or headless nails, having neither bridging part nor broad head, cannot be housed, moved forward and guided in magazines provided with a guide passage shaped as a nail head by means of which the headed nails can be aligned and supported. The second reason is that the ejector or driver of the tool, which must have a transverse section corresponding to that of the elements to be ejected and driven, would be reduced to a fine rod or practically to a wire when those elements are headless nails, obviously unable to stand the load due to the energetic action necessary at the moment of driving in the nail.

SUMMARY OF THE INVENTION

It is therefore a main object of this invention to provide improved devices adapted to overcome the above-mentioned and other limitations by way of solving the technical problems involved.

It is another object of this invention to provide improved tools adapted to be used for driving and setting headless nails or tacks. It is still another object of this invention to provide improved devices in which headless tacks or nails of different lengths duly established and standardized can be rationally housed, driven and set.

It is a further object of this invention to provide a device of the type and for the aforementioned uses or similar uses, further improved so that it can be used for a very long time even under imperfect cleaning and lubricating conditions.

One of the characteristics of an embodiment of the present invention is the provision of a magazine for placing in a longitudinally moveable position, a plurality or "load" of headless nails or tacks, laid on the same plane and driven by a suitable member duly sprung towards the ejection position in such a way that each single nail or tack is successively ejected by the driving device duly operated mechanically or pneumatically. A vertically extended horizontal passage is formed within this magazine in order to provide a coordinated and guided movement of the headless nails. Part of one side of said magazine is comprised of one or more moveable members duly designed to occupy a corresponding space in the passage in order to lodge and guide tacks shorter than the maximum height of said passage. For this purpose, each of said moveable parts is pushed by springs towards the opposite side of the magazine.

In another preferred embodiment of the present invention, particularly suitable for a prolonged use under imperfect conditions of cleaning and oiling, the improvement consists essentially in associating with said moveable members suitable mechanical means of which the moveable members are selectively advanced into the position wherein they occupy part of the passage for the headless nails. Said moveable members can be rigidly locked in said position eliminating at the same time any lateral load when the moveable members must be drawn back to allow the use of longer headless nails or tacks. Preferably, said moveable members are combined with springs to push them back to the backward position, contrasting with the said mechanical means of advancing or transverse movement.

Said mechanical means may be of different types and include also the presence and use of replaceable parts. Preferably, said mechanical means include a moveable component within the magazine which can, on command, take on several positions in which none or one or more of said moveable parts will be in the advanced position or rigidly blocked in their operating position.

These and other more specific characteristics of the present invention, together with the main advantages deriving from same will become evident from the following detailed description of preferred embodiments thereof shown in the attached drawings in which:

FIG. 1 shows a side view of a pneumatic nailer improved according to the present invention;

FIG. 2 shows a side view, partially broken away and with an opened side, of the housing, feed and ejection unit of the improved tool of FIG. 1;

FIGS. 3A, 3B and 3C show sectional views of said unit taken along the line III-III in FIG. 2, in its different positions according to the length of the nail to be driven;

FIG. 4 shows an exploded view of the same unit;

FIG. 5 shows on a very enlarged scale part of the ejection unit, sectioned along the plane indicated by V-V in FIG. 6;

FIG. 6 shows a transverse section of the same detail as in FIG. 5;

FIG. 7 shows a greatly enlarged view of the ejector;

FIGS. 8, 9 and 10 show, on the same scale as FIGS. 5 and 6, transverse sections of said ejector taken along the lines VIII—VIII, IX—IX and X—X respectively in FIG. 7;

FIG. 11 shows, essentially in the same conditions illustrated in FIG. 2, the magazine of a tool improved according to a further embodiment designed for selective use of tacks or headless nails of three different lengths;

FIGS. 11A, 11B and 11C show the mechanical means operable by the worker, used for the selective advance of the moveable parts, said mechanical means are shown in a sectional view taken along the line XI—XI in FIG. 14, and in its three different possible positions with reference to FIG. 11;

FIG. 12 shows a broken top view of the magazine partially sectioned along the line XII—XII of FIG. 11;

FIGS. 13 and 14 show the magazine in greater detail and in a transverse section taken along lines XIII-XIII and XIV-XIV respectively of FIG. 11; and

FIG. 15 shows, essentially in the same conditions illustrated in FIGS. 2-11 the magazine of a tool improved according to a further embodiment of the present invention;

FIG. 15 A, 15 B and 15 C show the mechanical means operable by the worker, used for the selective advance of the moveable parts, said mechanical means are shown in a sectional view taken along lines XV—XV in FIG. 18 and in its three different possible positions with reference to FIG. 15:

FIG. 16 shows a broken top view of the magazine partially sectional along line XVI—XVI of FIG. 15;

FIGS. 17 and 18 show the magazine in greater detail and in a transverse section taken along lines XVII—XVII and XVIII—XVIII of FIG. 15.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With particular reference to FIG. 1, an improved tool according to the invention includes a driving mechanism C, for example a pneumatic portable one, adapted to operate with the necessary reciprocating movement, an ejector or driver contained within an ejecting and driving unit E and a magazine M, for housing and feeding of the headless nails or tacks to be driven. The overall unit C will not be described or shown in detail because it does not constitute a characteristic of the present invention; it can be easily produced in any well known way by those skilled in the art.

According to a characteristic of the improvement, the magazine M is adapted to contain, guide and move forward tacks or headless nails P of different lengths, for example nails P, P' and P'' consisting of pieces of wire duly pointed at the ends and having a length of for example 14mm, 19mm and 24mm respectively. It would be well to note here that the nails P, P' and P'' are connected together into a strip, rather than being individual nails, for ease of handling, and by any familiar method of being joined. These lengths, however, are not in any way limiting so long as they are chosen and maintained with sufficient dimensional tolerance. The headless nails of different lengths can be indifferently inserted into the magazine M where they are moved forward by the ejector or driver 10 within an ejection or drive passage 11 provided for in the ejection unit E.

Referring now to FIGS. 2 to 4, the magazine M is essentially comprised of an E-shaped casing 12 having inside protruding parts provided with opposed grooves 22 and 23 (FIG. 4) for the smooth housing of a sliding cover member 13 which forms one of the sides of the nail housing space. The cover member 13 can be drawn back, following removal of a catch 14, for the opening of the magazine and for a temporary withdrawal of a pusher member 15, operated by a spring 16, which serves for pushing the plurality of nails towards and into the ejection passage 11. When cover 13 is removed, pusher 15 is held in retracted position because it is rigidly connected to the cover 13 through a shaft 16' of the spring 16 which has one end attached to the terminal part of the cover 13 by any suitable means as shown at 16.

The tacks are guided along a narrow vertical passage of variable height as described hereinbelow, one side of which is formed by the aforesaid cover member 13. The opposite side at the lower half is formed by the same E-shaped casing 12 particularly by both its parts 12' (FIG. 4). The upper half of the E-shaped casing 12 has a recess 12'' into which are lodged the prismatic bars 17 and 18; these are elastically pushed against the opposite slidable cover 13 by compression springs 19 and 20 respectively (FIG. 3A, 3B and 4). Springs 19 and 20 are very limited in strength, and are held in place by means of bolts 17' and 18' (FIGS. 2, 3A, 3B and 3C). One or both said bars are drawn back into the recess 12'', as it can be seen in FIGS. 3B and 3C, when a series of tacks P' (FIG. 2 and 3B) of P'' (FIG. 3C) having an intermediate length or the maximum length allowed by the size of the magazine M are inserted into the housing space. Said tacks are guided both on their sides and vertically as their ends lightly touch the bottom and top limit of their housing, said top limit being provided for by bar 17 for tacks P' of intermediate length, and by bar 18 for tacks P of shorter length as can be seen in FIGS. 3B and 3A respectively.

The headless nails or tacks are subsequently moved along the ejection passage 11 which, as can be seen from FIGS. 5 and 6, is shaped as a "T" with the broad transverse portion 11' and the groove 11''. These portions of the passage are preferably formed in opposite members 30 and 31 the second of which is suitably moveable, at least in its lower part, for the accessibility to the passage along which the tacks move. A proper fastener, for example an elastic clip 32, will keep said two members in a working position.

The groove 11'' longitudinally embraces part of the tacks P, which extend into said groove, sufficiently to ensure a guide for the straightness of their movement during their ejection.

The broader portion 11' serves to hold the correspondingly broader part 33 of the ejector 10, which has a corresponding "T" shape and practically consists of a flat piece having a longitudinal rib 34. This form of the ejector ensures a maximum of rigidity and resistance to stress along its whole length. The upper end 35 (FIG. 7) of the ejector is shaped in such a way as to permit a proper connection with the piston of the pneu-

matic mechanism or whichever means is used to move the ejector.

Moreover, the broader part **33** of the ejector gradually gets narrower in proximity of its lower end so that the ejector terminates with a point **34'** (FIG. **7** and **10**) which completely embraces the section of the headless nail and can penetrate slightly into the surface into which the nail is being driven, so as to effect the required setting without leaving the slightest trace.

The embodiment illustrated in FIGS. **1** to **10**, although assuring a very satisfactory operation under normal conditions, may give rise to some difficulties when used for an exceptionally long time and/or under imperfect cleaning and oiling conditions. Said difficulties, mainly due to presence of compression springs **19** and **20**, are overcome by the embodiment illustrated in FIGS. **11** to **14** where said compression springs are replaced by return springs.

Referring now to FIG. **11**, there is shown the magazine M, in which also a plurality of headless nails of different lengths can be lodged, in particular three different lengths. In the figure, the magazine M shown is loaded with tacks P' of medium length, which are subsequently pushed to the ejection position where they are subjected to the action of the ejector **10** contained in ejection unit E. The movement towards said position is ensured by a pusher member **115** pushed by a spring **116** which is supported on a block **117** connected to a slidable bottom part **118** positioned in the lower part of the casing **112** of the magazine M. The opening of the housing space of the magazine may be carried out, after disengagement of the latching device **114**, by removing the bottom part **118**. The loading of the magazine is thus effected from the lower side, said condition not being of primary importance insofar as said magazine may be loaded by other equivalent means.

According to this embodiment of the present invention, the moveable members **217** and **218** consist of longitudinal prismatic bars which are adapted to occupy the upper part of the housing space when pressed against the side part **113** of the casing **112**, in a similar way as bars **17** and **18** in the embodiment illustrated in FIGS. **1** to **10**. In this case, however, the bars **217** and **218** are connected to return springs and, in particular, pairs of return springs **119** and **120** respectively, attached to the opposite side **121** of the casing **112** of the magazine, causing the respective prismatic bars to draw back and thus make free the respective upper part of the space housing the nails. Consequently, in this embodiment, without any intervention of other mechanical means, the magazine would be ready to receive longer nails occupying the whole space available in the magazine.

The mechanical means used in this embodiment to move the bars **217** and/or **218** selectively in the direction B' or B'' respectively (FIG. **13**), contrasting with the action of the return springs **119** and **120** respectively, consist in pairs of balls **50** and **51** respectively. Said balls are housed in holes in a wall **52** integral with the internal body **53** of the magazine in a way that they can move transversely. The balls are urged against a plate **54** acting as a cam on said balls. The cam plate **54** is longitudinally slidable along the casing **112** over the body **53** of the magazine and has an handgrip such as a lug **55** slidable along the slot **56** in the upper part of the casing **112**.

The cam-plate **54** has lengthwise profiled recesses **57** and **58** through part of its thickness, said recesses having a depth less than the radius of balls **50** and **51**. The shape and function of said recesses are particularly comprehensible with reference to FIGS. **11A**, **11B** and **11C**, in which said plate **54** is shown in its three possible operating positions defined with respect to the pairs of balls **50** and **51** of FIG. **11**. The mere forward and rearward manual movement of plate **54** will move balls **50** and **51** out of the recesses **57** and **58** because the depth of said recesses is less than the radius of the balls so that the edge of each recess can push the ball into the correspondent hole in wall **52**.

In the position shown in FIG. **11A**, the balls **51** acting on the lower bar **218**, cannot slip into said recesses, therefore the bar **218** remains pushed ahead in its position protruding into the housing space. Into said space, therefore, can be inserted only those nails or tacks having the shortest length provided for the use of the tool. In the position shown in FIG. **11B**, corresponding to that shown in FIGS. **12**, **13** and **14**, the balls **51** can be drawn back as they are situated in front of the recesses **57–58** whereas balls **50** keep the upper bar **217** in its forward position thus preparing the housing for the insertion and guiding of nails P' of intermediate length. In the position shown in FIG. **11C** the recesses **57–58** are situated in the back of all the balls **50** and **51** thus allowing both bars **217** and **218** to be urged backwards by the respective springs **119** and **120** thus preparing the housing space for the insertion and guiding of the nails having the maximal height allowed by the vertical dimensions of the housing of the magazine.

From the aforegoing and with reference to FIGS. **11** to **14** it may be easily understood how the second embodiment overcomes the aforementioned difficulties due to the presence of compression springs. In fact, for example, under the condition shown in FIG. **14**, the bar **218** exercises no side pressure on the nails P' as it is kept in its withdrawn position by the respective return springs **120** (FIG. **13**). Even should the return springs weaken or were no longer operational after a very prolonged use of the tool, the bar may be pulled back in consequence of the insertion of the nails into the housing space. The bars are moved forward by the operator and sufficient force can be exercised on them to overcome any eventual blocking or jamming. Said force is equally transmitted along the bars at spaced points, corresponding to the positions of the pairs of balls **50** and **51**. The positioning of the bars is therefore uniform throughout the whole useful length of the housing space for the nails.

However, in view of the fact that the improved device has been described and illustrated for exemplification purposes without any limitation, it is obvious that said device may be embodied with many other different equivalent solutions without exceeding the scope of the invention itself.

For example, a possible modification, which would be particularly useful in order to prevent the insertion of deformed nails between the bars **217–218** and the said part **113** of the casing **112**, may be the inversion of the operational direction of the springs **119–120**. In said case, the cam-plate **54** would drawback the bars

217–218 instead of push them forward and the springs 119–120 would push the bars 217–218 instead of drawing them back.

With the inversion of the operational direction of the springs 119 it is possible to eliminate the pairs of balls 50, 51 and to simplify the form of the cam-plate 54. As illustrated in the drawings (FIG. 16–18) the bars 317 and 318 have each an internal cavity lodging the cam-plate 354 which can be moved back and forth inside said cavities. Each cavity is provided with a pair of protrusions placed at a predetermined horizontal distance. At the same predetermined horizontal distance there are pairs of rectangular holes 357 and 358 in the cam-plate 354 (FIG. 15 A–C). Said pairs of holes are disposed along two or more superimposed lines according to the number of bars. In this case the bars are two (317 and 318) so that the pairs of holes should be also two, but in the FIG. 15 A–C there is an additional pair of holes, in the upper line, for constructive purposes only.

The embodiment of FIGS. 1–10 operates as follows: After having released the catch 14, the sliding flat cover 13 is drawn back, thus withdrawing the shaft 16, the pusher 15, and the spring 16. The strip of nails is now placed into the magazine with the points on the bottom side of the passage. If the nails are of sufficient length, the strip of nails must be forced against the spring bars 17 and 18 (or bar 18 alone) with the fingers of one hand while the sliding cover 13 together with the shaft 16', pusher 15 and spring 16 are slided forward by the other hand until the catch 14 sticks in its lock. At this time, the nails are forced by pusher 15 against front member 31 and the first nail is in position for ejection by the ejector 10.

The embodiments of FIGS. 11–14 and 15–18 both have the same operational steps. After having placed the lug 55 of the cam plate in the position corresponding to the height of the nails to be loaded, the magazine is inverted, the spring-operated lever 114 is released and the sliding cover 118 together with pusher 115, its shaft and spring 116 are drawn back. The nails, preferably connected in a strip, are now dropped vertically into the passage of the housing. When the sliding cover 118 and its appendages are slided forward until the lever 114 catches the lock, the nails are urged against the ejection unit E, thus permitting the driving operation.

What is claimed is:

1. A tool for driving headless nails and tacks comprising

driving means;

a magazine associated with said driving means and having an open side;

an elongated flat member slidably closing the open side of said magazine;

a horizontal passage for housing the nails, defined by the internal faces of said magazine and of said elongated member;

a spring operated thrust member for urging the nails along the passage toward one end of the magazine;

an ejection passage joining the one end of the magazine, for receiving the nails urged from the magazine by the thrust member;

an ejector driven by the driving means, said ejector being slidably mounted in the ejection passage to drive the nails as they are fed from said magazine;

a longitudinal bar located in said magazine, said bar being moveable within said magazine to restrict the vertical size of said passage so that said passage can accommodate nails of varying lengths; and

adjusting means for urging said bar into a predetermined position within said magazine.

2. A tool as defined in claim 1, wherein at least two longitudinal bars are provided within said magazine, adjusting means being provided for each bar.

3. A tool as defined in claim 2, wherein said adjusting means comprises:

two spaced pluralities of balls, each plurality being in permanent contact with each of the bars;

a cam-plate having a spaced pair of stepped recesses therein to lodge said balls, said recesses having a depth less than the radius of said balls;

means for adjusting the horizontal position of said cam-plate so that said recesses may be brought into or out of alignment with either one or both or none of the pluralities of balls; and

spring means for urging said bars toward said balls.

4. A tool in accordance with claim 3 wherein said magazine further includes a longitudinal slot along the upper portion thereof and wherein said means for adjusting the position of said cam-plate comprises a handgrip on the upper portion of said cam-plate, said handgrip passing through said slot.

5. The tool of claim 1, wherein said ejection passage has a T-shaped contour and said ejector has a T-shaped cross section, the lower portion of the ejector being chamfered to terminate in a point having a transverse dimension slightly exceeding the diameter of the headless nails to be driven.

6. The tool of claim 1, wherein the elongated flat member closing the open side of the magazine is slidably attached at one side of said magazine and is held in closing position by a catch means.

7. The tool of claim 6, wherein the open side of said magazine is at the bottom thereof and said catch means is a latching device.

8. A tool in accordance with claim 1 wherein said adjusting means comprises:

spring means for urging said bar in the direction of said flat member such that said bar engages the nails when long nails are used and said bar engages said flat member when short nails are used effectively varying the vertical size of said passage.

9. A tool in accordance with claim 1 wherein:

said bar is provided with a longitudinally extending horizontal cavity therein and a plurality of protrusions within said cavity; and

said adjusting means includes a cam-plate within said cavity, a plurality of spaced recesses in said cam-plate to lodge said protrusions, means for adjusting the horizontal position of said cam-plate so that said recesses may be brought into or out of alignment with said protrusions, and spring means for urging said protrusions toward said recesses.

10. A tool in accordance with claim 9 wherein said magazine further includes a longitudinal slot along the upper portion thereof and wherein said means for adjusting the position of said cam-plate comprises a handgrip on the upper portion of said cam-plate, said handgrip passing through said slot.

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