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G. S. STEARNS ET AL
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INVENTORS
GERALD S. STEARNS
GORDON E. SMART

By
Gerald S. Stearns
METHOD AND APPARATUS FOR PROGRESSIVELY COMPRESSING THE END PORTION OF A WIRE TO FORM A NAIL

Gerald S. Stearns, Charleston, W. Va., and Gordon E. Smart, Cleveland, Ohio

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The present invention relates to a method and machine for continuously forming nails from multi-length wire, or from cut-to-length wires. In conjunction with Gordon E. Smart's Patent No. 2,702,937 granted March 1, 1955, we invented this as an entirely separate machine; however, it is best adapted to use with that patented process or a similar type production.

Nail machines of the past and present have been so manufactured that they depend on intermittent feeding of the wire through the straightening device into the nail forming part of the machine which consists of a stationary anvil, and a hammer as essential elementary parts. After the wire is in position in the anvil, and secured, the travel of the wire feeding into it is stopped momentarily until the hammer part has been applied in one stroke to the part of the wire in the anvil or mold thus forming the nail. After the nail is ejected another piece of wire travels into the anvil and the cycle is repeated. Some machines have two strands of wire feeding into the same machine, thus ejecting two nails at each revolution of the machine, which completes the cycle. The production of one of these machines amounts to less than a handful of six penny or eight penny sized nails in one minute. Moreover, due to conditions surrounding this type machine, lubricant materials adhere to the nails when they are formed, thus making a cleaning and tumbling operation necessary before the nails can be shipped to customers for consumer use.

With above facts in mind we disclose our invention, which consists of a machine built on the principle of moving anvils mounted in a unit such that the wire proper diametrical size, for eight penny nails for example, is fed continuously through the straightening and cutting device (any marketed straightening and cutting device may be used; however, a continuous type, such as illustrated and described in Patent No. 2,702,937, is best adapted to use with this nail machine), coming out in the form of cut-to-length wires, each one of which makes one nail. Our nail machine picks up all these pieces in a continuous flow and forms them into nails and deposits them in hoppers ready for consumer use.

One of the objects of our invention is to provide a nail forming machine which will make nails continuously without intermittent stops.

Another object of this invention is to eliminate the additional operation of cleaning and tumbling the nails after being formed.

Another object of this invention is to increase the production of a nail machine by 20 times or more.

Another object of this invention is to provide one machine, requiring only a few square feet of floor space, which will produce more nails than whole batteries of present day nail machines that require thousands of square feet of valuable floor space.

Another object of this invention is to provide one nail machine that will replace many nail machines, thus less capital investment and also less maintenance and power costs.

Another object of this invention is to provide a nail machine which can be used in conjunction with drawing and straightening and cutting equipment as an integral part, thus saving extra storage space, and extra labor in re-handling which is necessary when using the present conventional method and machines.

Another object of this invention is to provide a method and machine for making nails which gives the operator the ability to maintain quality control over each phase of making nails, from the time the rod or wire enters a sizing machine to draw it to the proper diametrical size, through the straightening operation, through the cutting to length operation, and through the forming operations to the nail ready for consumer use.

Other objects and a better understanding of this invention may be had by referring to the following description and claims, in conjunction with the accompanying drawings in which:

Figure 1 is an elevational view of the nail machine, and illustrates prior to the machine multi-length diametrically sized wire entering the straightening and cutting device (illustrated in phantom) and entering the feed hopper as cut-to-length wires, and conveyance for these wires prior to entering the nail machine as shown.

Figure 2 is top view of Figure 1.

Figure 3 is a top view of the segment of Figure 2 which illustrates in more detail how each piece of wire is progressively compressed farther into the anvil mold as it passes each stationary powered heading roll until the wire is completely formed into a nail.

Figure 4 is a front elevational view of the anvil mold insert 8.

Figure 5 is a top view of the anvil mold insert 8.

Figure 6 is a rear elevational view of the anvil mold insert 8.

In this invention, we are forming nails. These nails are formed from diametrically sized, cut-to-length pieces of wire. The diameter of the wires and their length are determined by the size of the nails to be made. Nails are referred to as 3d, 4d, etc; meaning 3 penny or 4 penny, each size or penny has a definite diameter size of shank and a definite over all length measurement. There are also classifications of nails such as “common,” “box,” “finish,” “flooring,” “lath,” “roofing,” designating size and shape of head, etc. In observing the figures 1 and 2 it is evident that our machine is so constructed that it will make any size and classification desired, simply by placing the proper sized anvil mold inserts 8 into the perimeter of the anvil mold wheel 20.

The simple steps in the operation of our machine can best be observed in Figure 2.

Proper diametrically sized cut-to-length wires 4 are fed into hopper 5, drop onto roll trough conveyer 6, feed vertically down through constant flow feeder and guide 7, drop into anvil mold inserts 8, remain in these molds until completely formed into nails by passing between heading rolls 12 and heading idler rolls 21, are kicked out by the ejecting device 17, into final feed hopper 16, and into nail hoppers or containers 18.

In more detail as observed in both Figure 1 and Figure 2 the proper diametrically sized multi-length wire 1 is fed through the straightening and cutting device 2 (shown in phantom) which takes out all of the camber and bends in the wire so that the ultimate product, nails, will be perfectly straight and cuts this wire in a way that it passes through the cutting head of that device 3 into exact cut-to-length wires 4 such that when they are formed into nails with heads and points, these nails will be the proper over all length, and deposits them into hopper 5. The next step in the operation as illustrated is the feeding of the wires onto the roll trough conveyer 6 which consists of two rolls (pipes) mounted in a suitable framework powered...
to turn in opposite directions outward slowly and the whole trough device tilted at a small degree down towards the machine so that the wire is between horizontal alignment and at the same time travel lengthwise to the constant flow feeder and guide 7 as the rolls turn.

The constant flow feeder 7 as illustrated is designed with two vertical halves, each half resembling the rubbering surface of an old fashioned wash-board, one of these halves being so mounted that it will have a very short up-and-down vibration motion and placed close enough to the other half to align the wires horizontally one top on the other with no wires side by side or clogging as they enter the guide which is the integral part of the feeder that positions these wires lengthwise horizontally and drops them one at a time in each anvil mold 8 as it passes under the guide. Both the trough 6 and feeder 7 are adjustable to accommodate any size wire for making different sized nails. However, any design and/or method of straightening and cutting multi-length wire and of getting these wires 4 over to and fed into the anvil mold inserts 8 may be used instead of 2—3—5—6 and 7 in our illustration and depends only on proper adjustment as they enter the anvil molds.

As already stated the anvil mold inserts 8 can be removed from the anvil mold wheel 20 and a different set of inserts placed in the wheel when the manufacturer wishes to make different sized nails. See Figures 4 and 5. Thus this nail machine can be easily changed to make different sized nails by making a simple adjustment to the constant flow feeder and guide 7 and replacing anvil mold inserts 8. The inserts 8 are all made with the outside shape and dimensions and lock in place in the anvil mold wheel 20. The clearance slots 30, length and size of air apertures 28 and 29, head recesses 26 and point molds 27 are the only parts of the inserts that are different and are what make it possible to make any sized nails in the same machine by merely installing properly sized and designed inserts 8 onto the anvil mold wheel 20.

From the time the wires 4 enter the anvil mold inserts 8 until they are removed by the ejecting device 17 there are two definite resultant actions. To explain these actions it is necessary to understand that the anvil mold wheel 20 supported in a proper framework mounting 23, with facing machine housing 14, revolves around the anvil mold wheel axle 24, in a clockwise direction as illustrated in Figure 1, power for this being provided by electric motor 15, said power being transmitted to anvil mold wheel 20 by V belts. It is also necessary to understand that the heading roll assembly 10 is stationary, and that the perimeter of the anvil mold wheel 20 passes through this assembly constantly.

Viewing Figure 3, the first action is accomplished as the piece of wire (taking just one piece of wire through its orbit in the machine) is pushed lengthwise longitudinally into the anvil mold insert 8 as it passes by the first powered roll 11 which is an insert roll. The second action is the complete forming of the piece of wire into a nail accomplished by a series of compression in succession, each compression actions in an axial direction of the wire further compressing the wire into the anvil mold insert 8 as it passes each of the powered heading rolls 12, the last roll completing the compressing action.

To more fully understand these two actions of insertion and complete formation Figures 2 and 3 best illustrate that the insert roll 11 and the succeeding heading rolls 12 all revolve in the same direction such that their perimeters are traveling the same direction as the perimeter of the anvil mold wheel 20 and slightly faster than the anvil mold wheel perimeter; but that these rolls are mounted in a suitable stationary housing 14 at a 90° angle to the anvil mold wheel 20. Figure 1 best illustrates that the power transmission to these rolls 11 and 12 is derived from a raised ring gear 9 mounted on the side of the anvil mold wheel 20 which in turn powers gears 25, 75 which turn the axles 22 to which the insert roll 11 and heading rolls 12 are keyed. This gear ratio is such that the perimeters will all of the insert rolls 11 travel slightly faster than the perimeter of the anvil mold wheel 20. The resulting action to the piece of wire as it successively passes the heading rolls 12 is that each one of the heading rolls forces the wire further into the anvil mold insert 8 forcing it to conform to the shape of that anvil mold insert in which the shape of the head and point of the proper size nail exists. This is accomplished by each successive heading roll 12 being mounted a little closer to the path of the anvil mold insert 8. Due to the fact that the heading roll perimeter is traveling slightly faster than the end of the wire with which it has to come into contact for compression, the forming of the head is accomplished evenly instead of being formed off center or mis-shaped. As illustrated in Figure 2, in order to give more stability to the anvil mold wheel a set of idler rolls 21 are mounted in a suitable housing 14 as an integral part of the stationary heading roll assembly, being housed in the same mounting with the powered rolls 11 and 12 such that a U- or clevis-shaped housing 15 of one idling roll 21 opposite each heading roll and are mounted at a 90° angle to the anvil mold wheel 20 but on the opposite side of the perimeter of that wheels from the powered rolls 11 and 12. The perimeter of each of the idler rolls 21 constantly rides against a machined surface on the side opposite the powered rolls 11 and 12 of the anvil mold wheel 20. Also a part of the stationary roll assembly is a hold-down shoe 13 Figures 1, 2, and 3, which extends in a curved form over the flat perimeter surface of the anvil mold wheel 20 and very close to it from the constant flow feeder guide so that the last heading roll to keep the pieces of wire from being thrown out of the anvil mold inserts 8 by forces of compression or the centrifugal action caused by the revolving of the anvil mold wheel 20. The last part of this stationary heading roll assembly is the ejecting device 17 which is so mounted that it catches under the head of the already formed nail as the anvil mold insert 8 carries it past, and being of a wedge shape design forces the nail out of the anvil mold insert 8 into a side mounted automatic feed hopper 16 which allows the nails to feed directly into nail kgs 18 or suitable shipping containers from which point the containers are moved away on a roll away conveyer 19. If very small nails are to be manufactured by using this nail machine, it is only necessary for the pieces of wire to come in contact with the insert roll 11 and the last heading roll 12. When larger nails are being formed more of the heading rolls 12 come into compression contact with the head-end of the piece of wire.

Although this invention has been described in its preferred form with a certain amount of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A method of making headed wire nails from proper diametrically sized cut-to-length wires comprising the steps of feeding wires individually into successive closed recesses in a holder, successively moving said wires longitudinally in said recesses to abut one end of each of said wires against the closed end of each of said recesses with the opposite end portions of said wires projecting from said recesses, moving the recesses in said holder past a plurality of cylindrical surfaces spaced progressively to the open ends of said recesses while rotating said cylindrical surfaces at a speed greater than and in the same direction of movement of the recesses to progressively and axially compress the projecting ends of said wires held in said recesses to form heads thereon and subsequently ejecting said headed wires from said recesses,
2,917,756

2. Apparatus for making headed wire nails from proper diametrically sized cut-to-length wires comprising means for feeding wires individually into successive closed end recesses in a holder, successively moving said wires longitudinally in said recesses to abut one end of each of said wires against the closed end of each of said recesses with the opposite end portions of said wires projecting from said recesses, means for moving the recesses in said holder past a plurality of cylindrical surfaces spaced progressively closer to the open ends of said recesses, means for simultaneously rotating said cylindrical surfaces at a speed greater than and in the same direction of movement of the recesses to progressively and axially compress the projecting ends of said wires held in said recesses to form heads thereon and means to subsequently eject the headed wires from said recesses.

3. The apparatus defined in claim 2 wherein each of the closed ends of the recesses defines a converging wall portion so as to provide a point on said one end of said wire simultaneously with forming the head on the said projecting end of said wire.

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