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Mohr et al.

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[54] FASTENER SORTING APPARATUS

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[52] **U.S. Cl.** **209/73**, 209/82, 209/88, 209/111.7

[51] **Int. Cl.**.....**B07c 5/10**

[58] **Field of Search**.....209/82, 73, 111.7, 88

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[57] **ABSTRACT**

A sorting apparatus for detecting improperly-shaped fasteners, for example, nails, screws or the like, within a row of properly shaped fasteners and segregating and then expelling these improper fasteners from the proper fasteners.

19 Claims, 5 Drawing Figures

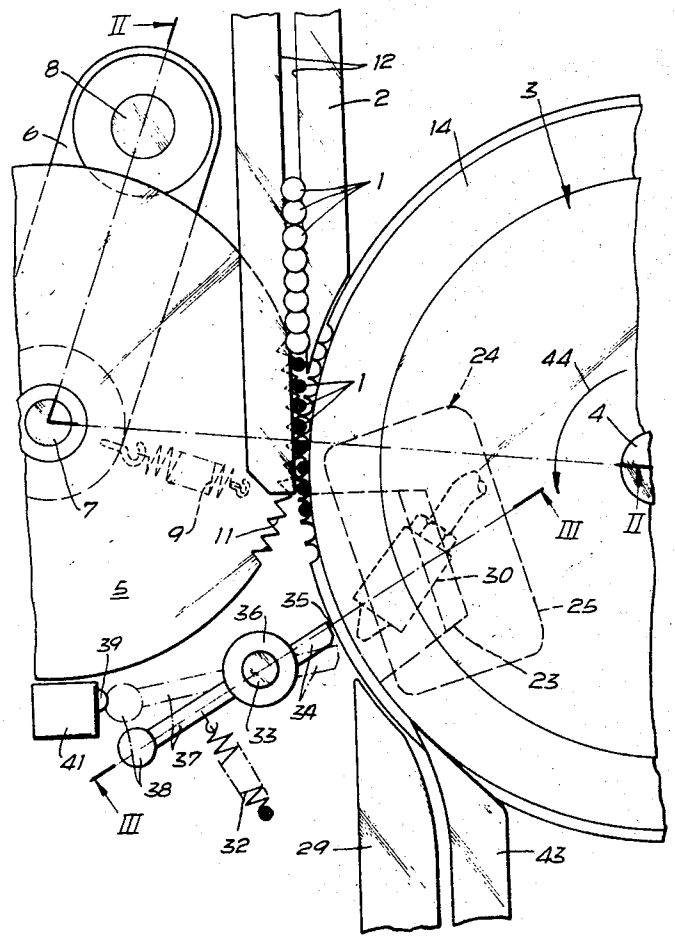
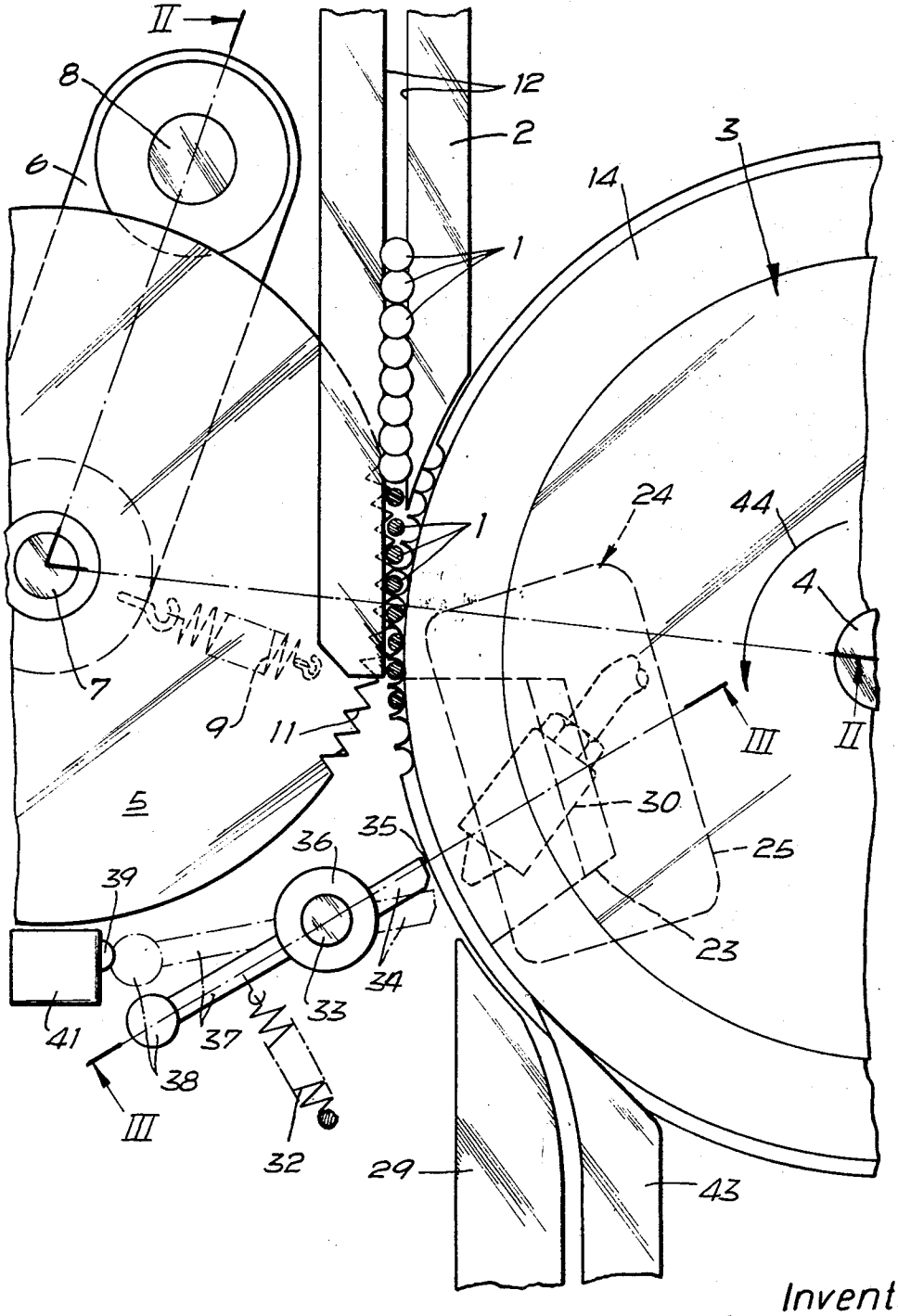


Fig. 1



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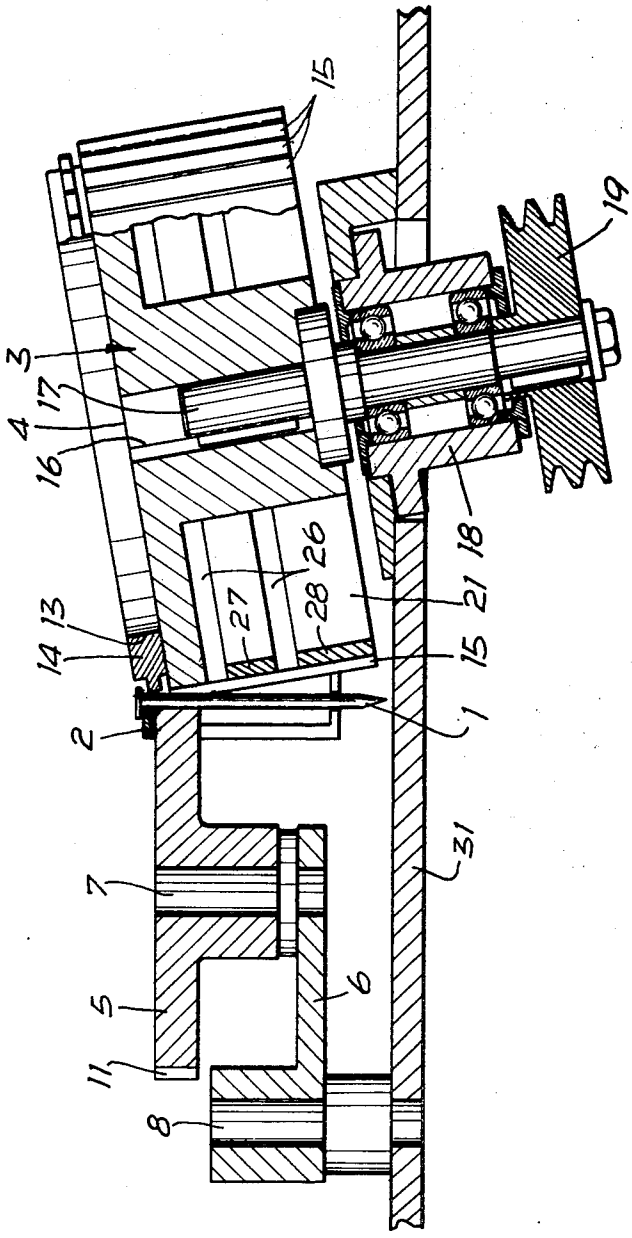


Fig. 2

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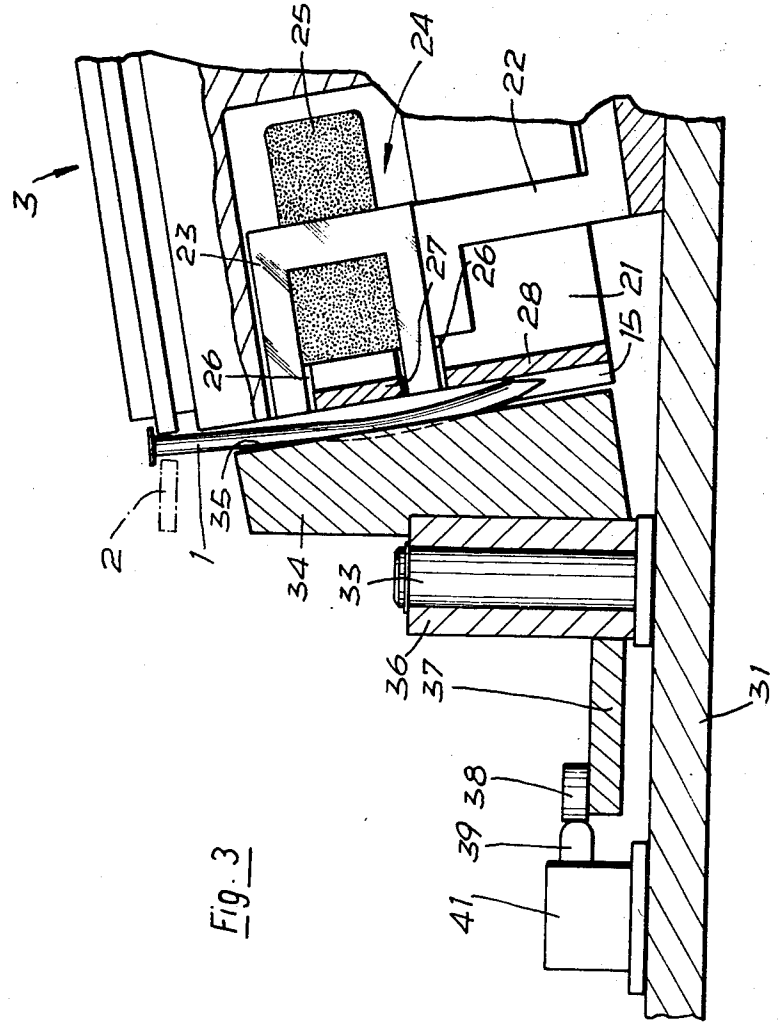


Fig. 3

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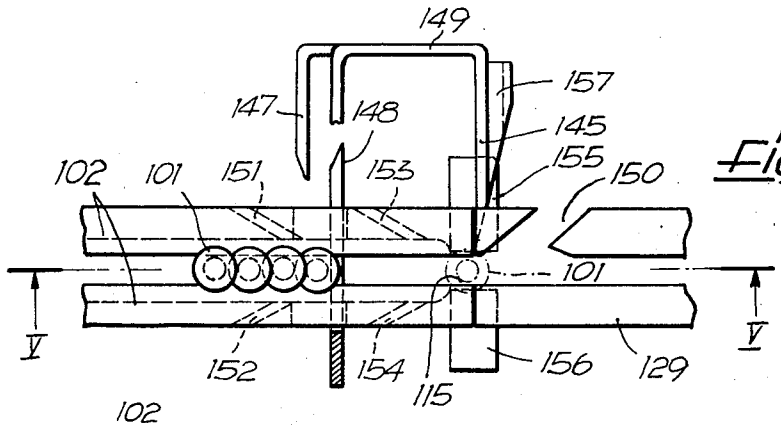


Fig.4.

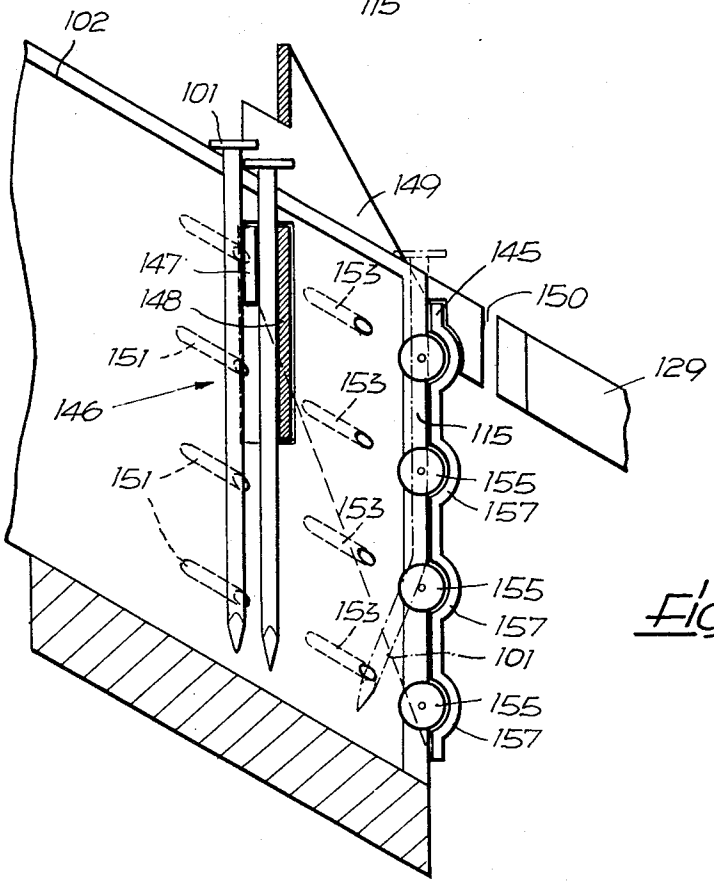


Fig.5.

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FASTENER SORTING APPARATUS

The present invention relates to a sorting apparatus for segregating improperly-shaped fasteners such as nails, bolts, rivets or the like from those of a proper shape while these fasteners are conveyed in a row parallel to each other along a conveyor.

It is an object of the present invention to provide such a sorting apparatus in which the operations of detecting improperly-shaped fasteners within a row of properly-shaped fasteners and of ejecting them from this row may be carried out at the highest possible speed.

One feature of the invention for attaining this object consists in the provision of a gauging device in which each individual fastener is checked for its accuracy and from which the properly-shaped fasteners are then further conveyed, while those fasteners which are found to be of an improper size or shape are ejected. Another feature of the invention consists in providing this gauging device in a substantially straight alignment with the conveyor along which the fasteners are fed to this device. If desirable, the properly-shaped fasteners may be further conveyed from the gauging device in substantially the same general direction in which all of the fasteners are fed to the gauging device, whereas the improper fasteners after being detected are ejected in a different direction.

Another object of the invention consists in providing such a sorting apparatus with a gauging device which is capable of detecting and reacting upon a variety of irregularities of the fasteners checked, which may consist, for example, of undesirable curvatures of the shanks of these fasteners regardless of the directions in which they might be bent, or if improper thicknesses or lengths of the fasteners.

For attaining this last object, the invention provides a gauging device which comprises one or more gauging pockets which are substantially in alignment with the end of the feed conveyor or may even be disposed within the feed conveyor. This gauging pocket which is adapted to receive one fastener at a time from the feed conveyor and has a length substantially equal to the length of the fasteners is limited by wall surfaces at two opposite sides and also at a third side. An important feature of the invention consists in designing at least one of these wall surfaces defining the gauging pocket so as to be movable relative to the feed conveyor and in providing at least one gauging device which is actuated by any part of an improperly-shaped fastener which projects from the fourth side of the gauging pocket and then, in turn, actuates an ejecting device for ejecting such a fastener from the gauging pocket.

The advantages of the sorting apparatus according to the invention may be briefly described as follows:

Since the entry to the gauging pocket is in substantially straight alignment with the feed conveyor or this pocket may be even disposed within this conveyor each fastener will pass from this conveyor directly into the gauging pocket which may be effected at a considerable speed. Since the gauging pocket has a length substantially equal to the length of the fastener, it permits any irregularities to be detected which might be present on any part of the length of the fastener. Since the gauging pocket is limited not only on two opposite sides but also on its third side, it permits curvatures in the

shank of a fastener to be detected which may extend in any direction from the normal axis of the fastener. The fastener may then either not be able at all to fit into the gauging pocket or if it is able to pass into this pocket, the bent part thereof will project from the open fourth side of the pocket. By designing at least one of the walls of the pocket so as to be movable relative to the feed conveyor, any fastener after being tested in the gauging pocket may leave the latter in substantially the same direction in which it has been fed to the pocket. By providing at least one gauging device which is actuated when determining that a fastener in the gauging pocket does not have the proper shape or size, this gauging device will actuate an ejecting device immediately after this fastener leaves the gauging pocket so as to eject this improper fastener in a direction different from the feeding direction for being collected in a suitable container. The present invention therefore permits all of the fasteners to be fed in a straight direction to the gauging pocket and all proper fasteners to be moved out and away from this pocket in substantially the same direction in which they have entered, while the gauging pocket in cooperation with the ejecting device will function substantially like a switch rail which deflects an improper fastener in a direction different from the general feeding direction.

The gauging device according to the invention may be operated mechanically or it may consist of an optical device or a pneumatic device which carries out the gauging operation by means of one or more light beams or by one or more blasts of air. This gauging device may engage with parts of a fastener projecting from the fourth side of the gauging pocket and/or it may scan the fastener within the pocket. In the latter case, the gauging device indicates that the fastener in the pocket has the proper size and shape when this fastener fills out the gauging pocket completely, which is possible only if the fastener, for example, a nail, is straight and of the proper dimensions. If, however, the fastener is bent, or too thick or too thin or even too short, it will not fill out the gauging pocket completely and the gauging device will then indicate the presence of an improper fastener which will then be thrown out of the pocket by the ejecting device. While the mechanical gauging device is especially suitable for testing the area immediately adjacent to the gauging pocket, the pneumatic or optical gauging device is especially suitable for testing a fastener which is located within the gauging pocket.

According to one preferred embodiment of the invention, the fastener sorting apparatus comprises a continuously revolving element which may consist of a chain, wheel or the like and the outer peripheral surface of which is provided with a toothed rim containing parallel, outwardly open grooves which are adapted to form a large series of gauging pockets which are adapted to receive the fasteners from the end of a feed rail. These gauging pockets are operatively associated with a gauging device which has a length equal to that of the fasteners and is located immediately adjacent to the outer opening of each of the grooves traveling past the gauging device during the rotation of the toothed rim. If any of the fasteners in the grooves has a part projecting from the groove, this part will engage upon the gauging device and thereby move the same, for example, by pivoting it against the action of a spring. This

movement will immediately actuate the ejecting device which will expel the improper fastener from its groove. A fastener sorting apparatus of this type of construction is capable of operating continuously.

According to another preferred embodiment of the invention, the gauging pocket is provided in a part of the slotted feed rail in the form of a slot which is in alignment with the guide slot of the feed rail and has a depth as seen in the feeding direction which is substantially equal to the diameter of the shanks of the fasteners, for example, nails. This apparatus is further provided with a stop member which is adapted to reciprocate from a position in which it closes the front end of the slot forming the gauging pocket to a position in which the front end of this slot is open. When this stop member is in its closing position, the gauging pocket which is formed by this slot is limited in three directions, namely by the two opposite side walls of the slot and the stop member at the front end of the slot. The gauging pocket in the form of the mentioned slot when forwardly closed by the stop member may have a depth substantially equal to the corresponding dimension of the fastener and a length substantially equal to the length of the fastener. It may, however, also be made of a considerably greater depth if a gauging device, for example, in the form of a photoelectric or pneumatic device, is provided which determines whether or not the fastener in the slot when engaging upon the stop member has the required width, as seen in the feeding direction. Due to the reciprocation of the stop member from its closing position to its retracted position, this apparatus according to the invention operates intermittently.

The features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying diagrammatically simplified drawings, in which

FIG. 1 shows a top view of a mechanism according to a first embodiment of the invention;

FIGS. 2 and 3 show cross sections which are taken along the lines II — II and III — III of FIG. 1, respectively;

FIG. 4 shows a top view of a mechanism according to a second embodiment of the invention; while

FIG. 5 shows a cross section which is taken along the line V — V of FIG. 4.

Referring first to the feed mechanism as illustrated in FIGS. 1 to 3, this mechanism is adapted to feed nails 1 to a collator, not shown, which connects the nails 1 in a row parallel to each other to form a nail strip, for example, by gluing. The feed mechanism comprises a longitudinally slotted, downwardly inclined rail 2 which is adapted to feed the nails by gravity and terminates into the gap between a grooved wheel 3, which is mounted so as to be rotatable about an axis 4, and a serrated wheel 5 which is mounted so as to be rotatable about an axis 7 at one end of a lever 6. The other end of this lever 6 is mounted so as to be pivotable about an axis 8. The end of the lever 6, carrying the serrated wheel 5 is connected to a coil spring 9 which tends to pull the serrated wheel 5 toward the periphery of the grooved wheel 3. Wheel 5 is provided with teeth 11 which are spaced from each other at a distance which substantially corresponds to the distance between the axes of the shanks of the adjacent nails 1 which are supplied in a row by the feed rail 2. In this particular embodiment of the invention, the nails 1 are suspended by their heads on the edges of a slot 12 between the two parts of the downwardly inclined feed rail 2 so that the longitudinal axes of the nail shanks extend in vertical directions. The axis of rotation 7 of the serrated wheel 5 and the pivotal axis 8 of lever 6 therefore also extend parallel to the longitudinal axes of the nails 1 and thus in vertical directions. The thickness of the serrated wheel 5 only amounts to a fraction of the length of the nails 1, and this wheel 5 is mounted on the lever 6 so as to engage with the shanks of nails 1 directly underneath the rail 2 and therefore only with the ends of the nails underneath their heads.

The grooved wheel 3 forms a substantially cylindrical element the axis of which coincides with the axis of rotations of this wheel 3. The outer edge of the upper plane surface of wheel 3 is provided with an outwardly open annular recess 13 in which a serrated ring 14 is mounted the teeth of which are spaced from each other at a distance which substantially corresponds to the distance between the longitudinal axes of the adjacent nails in rail 2. The length of the cylinder forming the grooved wheel 3 and thus the thickness of this wheel corresponds substantially to the length of the nails 1. The cylindrical outer surface of wheel 3 is provided with axially extending grooves 15 which serve as gauging recesses forming parts of gauging pockets. Grooves 15 therefore have a width and depth substantially corresponding to the diameter of the shanks of the nails 1 so that, if the shank of a nail 1 which is inserted into one of the grooves 15 has any irregularity, for example, by being bent or having a portion of a greater than the normal thickness, this irregular part of the nail shank will project from the open side of groove 15.

The grooved wheel 3 has a central bore 16 in which one end of a shaft 17 is secured which is rotatably mounted in a ball bearing 18 which is disposed at an oblique angle. The other end of shaft 17 which projects downwardly from the ball bearing 18 carries a pulley 19 which may be connected by one or a pair of belts to a drive unit. Due to the inclined position of the bearing 18, the axis of rotation 4 of the grooved wheel 3 extends at an angle of approximately 10° to a perpendicular plane. Bearing 18 is mounted in such a position that the teeth of the serrated ring 14 which are adjacent to the rail 2 are located exactly opposite to the rail 2 and therefore project underneath the heads of the nails 1. The pitch of the grooves 15 corresponds to the pitch of the teeth of the serrated ring 14 so that a shank of a nail 1 engaging between two adjacent teeth of ring 14 also engages at the same time into the upper end of a groove 15 underneath these teeth.

The grooved wheel 3 is provided with an annular chamber 21 which is open at its lower end into which a Z-shaped stationary bracket 22 engages, as shown in FIG. 3, the upper end of which carries within the chamber 21 the U-shaped core 23 of an electromagnet 24 the coil 25 of which is wound around the central web of this U-shaped core 23. The free ends of the arms of the U-shaped core 23 project through annular slots 26 to the bottom of the grooves 15, and the wall portions 27 and 28 of chamber 21 which form the bottom of grooves 15 are supported by the side walls of these

grooves. As may be seen especially in FIG. 1, the arms of core 23 have substantially trapezoidal lateral sides, and the longer sides of the trapeze which form the outer edges of the arms of core 23 are curved in accordance with the curvature of the periphery of the grooved wheel 3 and extend from the end of the rail 2 to a delivery rail 29. When the electromagnet 24 is energized by an electric current flowing through the coil 25, the nails 1 which are fed by the rail 2 and are gripped by the teeth of the serrated ring 14 will at the end of rail 2 be drawn magnetically into the associated grooves 15 and will normally be held therein until they reach the delivery rail 29. Also, since the axis of rotation of the grooved wheel 3 is obliquely inclined, a nail which might be hanging obliquely in the rail 2 will at first engage into the upper end of the associated groove 15 and will then be straightened out by being fully drawn into this groove by the action of the magnet 24. Therefore all nails 1 which are supplied will be drawn by the electromagnet 24 into the grooves 15, provided they fit into these grooves.

In the area between the end of the feed rail 2 and the beginning of the delivery rail 29 a nozzle 30 is provided, while between the end of feed rail 2 and the nozzle 30 the base plate 31 which carries the bearing 18 for the grooved wheel 3 and the pivot pin 8 of the lever 6 also carries a gauging wing 34 which is mounted so as to be pivotable about the axis of a bearing pin 33 against the action of a tension spring 32. The outer edge 35 of this wing 34 extends substantially along the length of the adjacent groove 15 in wheel 3 and directly adjacent to the open side of this groove and serves for gauging or scanning the area at and adjacent to this open side of groove 15. Wing 34 is secured to a tube 36 which is rotatably mounted on the bearing pin 33 and carries diametrically opposite to wing 34 an arm 37 the free end of which carries a roller 38 which is rotatably mounted thereon. When wing 34 is pivoted by engaging with a projecting part of a fastener in a groove 12, the roller 38 will engage upon an actuating pin 39 of an electric or pneumatic switch 41 which is adapted to control an electric or pneumatic circuit, not shown, by means of which the nozzle 30 will be connected to a source of compressed air. The gauging edge 35 of wing 34 and the switch 41 are arranged in such positions relative to each other that, even if a nail which is located within a groove 15 of the rotating wheel 3 projects only slightly from this groove, this projecting part of the nail will engage against the wing 34 and pivot the latter in the clockwise direction, as seen in FIG. 1, whereby the roller 38 will engage upon the pin 39 and actuate the switch 41.

Nozzle 30 is mounted in such a position that, when it is connected to a source of compressed air, a blast of air will be ejected from this nozzle and hit upon an inaccurate nail in the adjacent groove 15 and will blow the latter out of this groove and away from the wheel 3 so that it will not enter the delivery rail 29.

Directly behind the nozzle 30, as seen in the direction of rotation of the grooved wheel 3, a wedge 43 is provided which forms the front end of one side of the delivery rail 29 and is adapted to remove the nails 1 from the grooved wheel 3 by engaging into the gap between the teeth of the serrated ring 14 and the grooves 15 of the grooved wheel 3.

During the operation of the mechanism, the grooved wheel 3 which is driven by drive means, not shown, rotates in the direction of the arrow 44 as shown in FIG. 1. The nails 1 which are supplied by the rail 2 are then taken along by the teeth of the serrated ring 14 and at the same time also by the teeth of the serrated wheel 5. Since wheel 5 is pivotably mounted, it may yield for a short time against the action of spring 9 if the nails are not accurately held in rail 2 in their prescribed positions relative to the teeth of this wheel. By partly engaging into the upper end of grooves 15 of wheel 3, the nails 1 will then be shifted into alignment with these grooves within the gap between the grooved wheel 3 and the serrated wheel 5. After passing through this gap, the nails 1 will be further held in the tooth gaps of the serrated ring 14 by the end of rail 2 until they will pass at this end of rail 2 into the area in which they will be magnetically attracted by the electromagnet 24 and will be drawn from their perpendicular position to the inclined position in which they engage fully into the respective grooves 15. If such a nail has the proper shape, it will then be disposed entirely in the respective groove 15 so that during the further rotation of wheel 3 it will travel past the gauging wing 34 without touching the same and will then pass to the wedge 43 which removes it from the groove 15 and slides it into the slot in the delivery rail 24. If the nail has, however, an improper shape and is, for example, bent as shown in FIG. 3 so as to project partly from the groove 15, the projecting part of this nail 1 will engage with the gauging wing 34 and thereby pivot the latter against the force of spring 32 in the clockwise direction, as seen in FIG. 1, so that roller 38 will then actuate the switch 39. By the actuation of switch 39, the nozzle 30 will be connected to the source of compressed air and will blow a blast of air against the improperly-shaped nail which has been discovered by the gauging wing 34 and will thereby eject this nail from the respective groove 15. Consequently, the delivery rail 29 will feed only properly-shaped nails 1 to the collator.

In the apparatus according to the invention as illustrated in FIGS. 1 to 3, it is also possible to provide a permanent magnet in place of the electromagnet 24. Furthermore, in place of providing an electromagnet 24 in a fixed position, it is also possible to provide permanent magnets in the grooved wheel 3 adjacent to each groove 15. In place of the serrated wheel 5, it is also possible to provide a wheel brush the bristles of which then engage between the nails 1 which are supplied by the feed rail 2.

In order to insure that the apparatus according to FIGS. 1 to 3 will always function properly, all parts, with the exception of the arms of the core 23 of magnet 24, which are adjacent to the nails should be made of a material which cannot be magnetized, for example, of a non-magnetizable metal or a suitable plastic.

FIGS. 4 and 5 illustrate another embodiment of the invention, in which the feed rail 102 along which the nails 101 are fed to the apparatus terminates directly into the gauging area which is provided in the form of a slot 115 in rail 102. This slot 115 has a width which substantially corresponds to the diameter of the nails 101, and at its front end it is adapted to be limited by a slide plate 145 which serves as a stop member and extends in a vertical direction along the entire length of

slot **115** and is movable back and forth horizontally in the direction of its plane from an operative position in which it covers the front end of slot **115** to a retracted position in which it is withdrawn from slot **115**.

At the rear of slot **115**, as seen in the feeding direction of the nails **101**, a segregating device **146** is provided which insures that only a single nail will be moved at one time from this point to the slot **115**. This segregating device **146** comprises two flat control strips **147** and **148** which alternately engage into the path of travel of the nails **101** in rail **102**. As illustrated in FIG. **4**, the two control strips **147** and **148** together with the slide plate **145** form a substantially U-shaped bracket **149** which may be reciprocated in the horizontal direction by suitable driving means, not shown. In FIG. **4** bracket **149** is shown in its retracted position in which slide plate **145** is withdrawn from the gauging slot **115** so that the nail which is located within this slot may be further conveyed either to the collator or be ejected through an ejection slot. The second control strip **148** is located at the same time in its locking position, while the first control strip **147** is withdrawn from its locking position. If bracket **149** is moved from this position to its operative position, i.e., downwardly as seen in FIG. **4**, at first the slide plate **145** will be moved to this operative position in which it closes the end of slot **115**. During the further movement of bracket **149**, the first control strip **147** will move to its locking position and will thereby separate the nail **10** which engages upon the second strip **148** from the row of nails following it from the rear. As soon as this occurs near the end of the movement of bracket **149**, the second strip **148** will be moved away from its locking position so that the nail **101** which has been separated from the other nails by the control strip **147** can be conveyed into the slot **115**.

For feeding the nails **101** from the segregating device **146** into the slot **115** and from the latter either into a delivery rail **129** or into an ejecting slot **150**, inclined nozzles **151**, **152**, **153** and **154** are provided at both sides of the path of travel of the nails **101**. These nozzles are connected to sources of compressed air, not shown, and are operated in accordance with the reciprocating movements of bracket **149** so that, when the control strip **148** releases the nail which has been separated from the other nails by the control strip **147**, blasts of air will be blown simultaneously through the nozzles **151** and **152** against this nail so as to move it into the slot **115**. As soon as this nail has entered the slot **115**, a gauging device will be actuated which will be subsequently described. If the nail is of the required accuracy, this gauging device will connect the nozzles **153** to a source of compressed air, for example, by means of a control valve. Since these nozzles **153** are inclined in the direction toward the delivery rail **129**, the nail will then be blown out of slot **115** into the delivery rail when the slide plate **145** has been retracted from the end of slot **115** and thus from the further straight path of travel of the nail. If, however, the gauging device determines that the nail in slot **115** does not have the required size or shape, nozzles **154** will be connected to the source of compressed air so that, since these nozzles are inclined in the direction toward the lateral ejecting slot **150**, this nail when released by the slide plate **145** will be blown out of this ejecting slot **150**.

The gauging device which is provided in this embodiment of the invention consists of a photoelectric gauging device which comprises light sources **155** and photoelectric elements **156**, for example, photoelectric cells, photoconductive cells or the like. The light sources **155** are disposed within a perpendicular row in bores which are provided in one side wall of slot **115**, while corresponding bores in the opposite wall of slot **115** which are in alignment with the bores in the first wall contain the photoelectric elements **156**. The light beams of the light sources **155** therefore pass transversely through the slot **115** and hit upon the photoelectric elements **156**. In order to provide the necessary space for the light sources **155** and the photoelectric elements **156**, slide plate **145** is provided with outwardly curved parts **157** of a substantially semicylindrical shape.

While the apparatus according to FIGS. **4** and **5** is in operation, the U-shaped bracket **149** reciprocates continuously between its retracted position as shown in FIG. **4** and its advanced position. During each reciprocation a single nail **101** is separated by the segregating device **146** from the nails behind and blown by the nozzles **151** and **152** into the slot **115**. If this nail fills out this slot completely, the light beams of all light sources **155** are interrupted and the gauging device in the form of the photoelectric elements indicates that the nail is proper and thereby connects the nozzles **153** to the source of pressure so that, after the U-shaped bar has been returned to its inactive position, the nail will be blown into the delivery rail **139**. If, however, at least one of the light beams **155** is not or only partly interrupted, for example, because the nail is too short, too thin or bent, the gauging device will indicate the pressure of an improper nail and switch on the nozzle **154** which, when the slide plate **145** has been retracted to its inactive position, then blows this nail out of the slot **115** and into the ejecting slot **150**.

The apparatus as illustrated in FIGS. **4** and **5** may be modified by designing one side wall of the slot **115**, for example, the upper side wall according to FIG. **4**, as an element separate from the feed rail **102** which is movable against spring action from its normal position so as to permit this slot **115** to be temporarily widened. Thus, if a nail is too thick to enter the slot **115** and the gauging device would therefore indicate the presence of an improper nail, the U-shaped bracket **149** while moving to its retracted position takes along the movable side wall of slot **115**, for example, against the action of a spring (not shown), and thus widens the slot **115** so that the nail may then be blown through this slot into the ejecting slot **150**.

While in the embodiment of the invention as illustrated in FIGS. **4** and **5** the side walls of slot **115** have a narrow depth as seen in the direction of feed, a further modification of the invention provides that these side walls of slot **115** extend from the segregating device **146** to the slide plate **145**. This embodiment of the invention may, however, be employed only if none of the nails to be fed and gauged has a shank of a diameter larger than the width of this slot **115**. The operation of gauging the nails is then carried out only at the end of the slot where the light beams of the light sources **155** pass to the corresponding photoelectric means **156**.

Although our invention has been illustrated and described with reference to the preferred embodiments thereof, we wish to have it understood that it is in no way limited to the details of such embodiments but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed our invention, what we claim is:

1. A sorting apparatus for segregating improperly-shaped fasteners comprising a feed conveyor for feeding a plurality of substantially parallel fasteners in a row in one direction, at least one gauging pocket substantially in straight alignment with said feed conveyor and having one open side adapted to receive one fastener at a time from said conveyor, and having two wall members limiting said pocket at substantially opposite sides thereof, a third wall member for limiting a third side of said pocket, said gauging pocket having a length substantially equal to the length of said fasteners, means for moving at least one of said wall members relative to said feed conveyor, means for ejecting an improperly-shaped fastener from said pocket and from the general feeding direction of said row of fasteners, and gauging means for detecting said improper fastener in said pocket and for then actuating said ejecting means.

2. A sorting apparatus as defined in claim 1, in which said gauging means comprise at least one mechanical gauging element having a length substantially equal to the length of said gauging pocket and disposed immediately adjacent to an open side of said gauging pocket and adapted to be moved by any part of an improper fastener projecting from the open side of said pocket and then adapted to actuate said adapting means.

3. A sorting apparatus as defined in claim 1, in which said gauging means comprise testing means for directing a beam upon a fastener within said gauging pocket for scanning the same.

4. A sorting apparatus as defined in claim 3, in which said testing means comprise at least one photoelectric element at one side of said gauging pocket and at least one light source at the opposite side of said pocket and directed toward said photoelectric element.

5. A sorting apparatus as defined in claim 2, further comprising an element at one side of said conveyor and adapted to revolve continuously in one direction corresponding to the direction of feed of said fasteners along said conveyor and having a plurality of outwardly open grooves each forming one of said gauging pockets and spaced from each other so as to be adapted to receive successive fasteners of said row from said conveyor.

6. A sorting apparatus as defined in claim 5, further comprising a second element at the opposite side of said conveyor and also adapted to revolve continously in the direction of feed of said fasteners along said conveyor and having projections adapted to engage between the adjacent fasteners of said row in said conveyor and to guide said adjacent fasteners into said grooves of said first element.

7. A sorting apparatus as defined in claim 6, further comprising means for mounting said second element so as to be movable relative to said first element, and spring means tending to move said second element in the direction toward said first element.

8. A sorting apparatus as defined in claim 5, in which said element comprises a cylindrical wheel, said grooves being formed in the outer peripheral surface of said wheel, and further comprising means for driving said wheel.

9. A sorting apparatus as defined in claim 8, in which said wheel has an axis of rotation obliquely inclined to the axes of said fasteners in said feed conveyor preceding said wheel, said grooves extending parallel to said axis of rotation, and further comprising magnetic means for drawing said fasteners into said grooves after passing from said conveyor to said grooves.

10. A sorting apparatus as defined in claim 2, in which said gauging element comprises a winglike member pivotably mounted about an axis, and spring means tending to maintain said member in its normal position and adapted to return it to said position if engaged by a projecting part of an improper fastener and deflected from said normal position.

11. A sorting apparatus as defined in claim 10, further comprising a switch element for actuating said ejecting means, said winglike member having two arms, one of said arms projecting toward said gauging pocket and the other arm adapted to act upon said switch element when said member is pivoted from its normal position.

12. A sorting apparatus as defined in claim 5, further comprising a wedgelike member mounted in a position subsequent to said ejecting means, as seen in the direction of rotation of said element, for removing the proper fasteners from said element.

13. A sorting apparatus as defined in claim 9, in which all of the elements of said apparatus, except said magnetic means, which are located adjacent to said fasteners consist of a non-magnetizable material.

14. A sorting apparatus as defined in claim 1, in which said gauging pocket forms a slot defined by a pair of opposite wall portions of said conveyor spaced from each other at a width substantially equal to the thickness of said fasteners, said slot being open at the rear side for receiving one fastener at a time from said conveyor, and a stop member adapted to reciprocate from a closing position, in which it covers the front side of said slot so as to hold a fastener in said slot while being tested, to an open position in which it is withdrawn from said front side so as to permit the tested fastener to be moved out of said slot.

15. A sorting apparatus as defined in claim 14, further comprising segregating means preceding said open end of said slot for segregating one fastener at a time from said row in said conveyor to permit the same to be fed into said slot when the previous fastener in said slot has been tested and moved out of said slot and said stop member has again been moved to its closing position.

16. A sorting apparatus as defined in claim 15, further comprising conveying means for moving said segregated fastener toward and into said slot, and out of said slot when said stop member is moved to its open position.

17. A sorting apparatus as defined in claim 16, in which said conveying means comprise inclined nozzle means for blowing compressed air against said segregated fastener in a direction toward said slot but inclined to the direction of feed of said fastener to and from said slot.

18. A sorting apparatus as defined in claim 1, further comprising means for moving a properly-shaped fastener in one direction from said pocket, said ejecting means comprising means for blowing compressed air against an improperly-shaped fastener to eject the same from said pocket in a direction different from the direction of movement of said properly-shaped fastener from said pocket.

19. A sorting apparatus as defined in claim 17, further comprising guide means for guiding a properly-shaped fastener in one direction from said pocket, said guide means having opposite walls separated by a longitudinal channel, one of said walls having an ejecting aperture, said nozzle means being disposed at one lateral side of said feed conveyor between said segregating means and said slot and forming the same side in which said ejecting aperture is located, said ejecting means comprising second inclined nozzle means at the other lateral side of said feed conveyor for blowing compressed air against an improperly shaped fastener for ejecting the same from said pocket and through said ejecting aperture in a direction different from the direction of movement of said properly-shaped fastener, and control means responsive to the operation of said stop member for actuating said second nozzle means.

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