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(54) Ouality control device particularly for screws, bolts and the like.

(57) The quality control device, particularly for screws, bolts and the like, has an electromagnetic vibrating feeder (1) for feeding screws and/or bolts which feeds screws and/or bolts to a conveyance and checking station (2). The conveyance and checking station (2) includes a section (3) for checking the head of the screws and/or bolts and a section (4) for checking the stem of the screws and/or bolts. The head checking section (3) removes the screws and/or bolts from the electromagnetic vibrating feeder (1) and conveys them through an analysis device toward the stem checking section (4). The stem checking section (4) is provided with a reading device (29,30), and a device (5) for selectively discharging the screws and/or bolts is located downstream of the stem checking section (4).

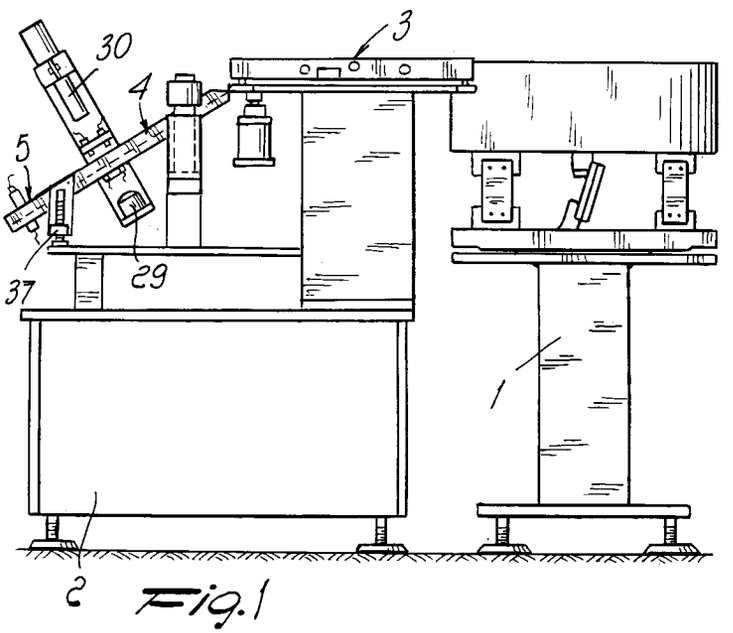

Fig.1

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The present invention relates to a quality control device particularly for screws, bolts and the like.

In facilities for the assembly of machines in general which use robots to assemble said machines, it is extremely important to check each component to be fitted to perform assembly, so as to avoid stopping the assembly line. In fact, if robots find a component, and in particular screws and/or bolts, which does not comply with the characteristics of the assembly program, they stop the line until said component is eliminated.

These unwanted stops entail, as is evident, an increase in production costs and can also risk a reduction in the quality of the final product.

In order to avoid these problems, it is evident that component checking must be performed before assembly, i.e. either during the manufacture of the component or immediately thereafter. An increase in the accuracy of the execution of the component is always desirable, but it often entails excessive costs, especially for the least expensive components such as screws and bolts, which would no longer make the component commercially competitive.

The solution based on quality control is instead easier to adopt; quality control currently tends to be a sampling check rather than an exhaustive one, due to the problems entailed by exhaustive control performed manually or semi-manually.

The aim of the present invention is to eliminate or substantially reduce the disadvantages described above by providing a quality control device particularly for screws, bolts and the like which performs an exhaustive control of a production batch and excludes human intervention almost entirely.

Within the scope of this aim, an object of the present invention is to provide a quality control device which discriminates and eliminates screws and/or bolts exceeding certain preset parameters.

Not least object of the present invention is to provide a quality control device particularly for screws, bolts and the like which is relatively easy to manufacture and at competitive costs.

This aim, the objects mentioned and others which will become apparent hereinafter are achieved by a quality control device, particularly for screws, bolts and the like, according to the invention, comprising an electromagnetic vibrating feeder for feeding screws and bolts, characterized in that said electromagnetic vibrating feeder feeds screws and bolts to a conveyance and checking station, said station comprising a section for checking the head of said screws and/or bolts and a section for checking the stem of said screws and/or bolts, said head checking section being adapted for removing said screws and/or bolts from said electromagnetic vibrating feeder and for conveying said screws and/or bolts, through analysis means, toward said stem checking section, said stem checking section being provided with reading means, means for the selective discharge of said screws and/or bolts being provided downstream of said stem checking station.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of a quality control device particularly for screws, bolts and the like according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is an elevation view of a device according to the invention;

figure 2 is a plan view of the head checking section;

figure 3 is an elevation view of the head checking section;

figure 4 is a partial sectional view of the head checking section, taken along the line IV-IV of figure 2;

figure 5 is an elevation view of the stem checking section;

figure 6 is a perspective view of a chute of the checking section;

figure 7 is a partially sectional view of the stem checking section, taken along the line VII-VII of figure 5; and

figure 8 is a plan view of an automatic discharge selector.

With reference to the above figures, a quality control device particularly for screws, bolts and the like comprises an electromagnetic vibrating feeder 1 for feeding screws and bolts, which feeds screws and bolts to a conveyance and checking station 2. The station 2 comprises a section 3 for checking the head of the screws and/or bolts and a section 4 for checking the stem thereof.

The head checking section 3 removes the screws and/or bolts from the electromagnetic vibrating feeder 1 and conveys the screws and/or bolts through analysis means, as better described hereinafter, toward the stem checking section 4. Said stem checking section is provided with reading means, as better explained hereinafter. Means 5 for the selective discharge of the screws and/or bolts are furthermore provided downstream of the stem checking section 4.

The head checking section 3 comprises means for gripping and carrying the screws and/or bolts through the analysis means; said analysis means comprise a lighting unit 6 and an optical detector 7 for detecting the lateral image of the head. The lighting unit 6 and the optical detector 7 are arranged on opposite sides with respect to the grip and conveyance means. The analysis means fur-

thermore comprise a photocell 8 for detecting the presence of machinings performed on the head.

The grip and conveyance means comprise two co-planar and parallel supports 10 and 11 which define, between them, a lane 12 for the passage of the screws and/or bolts. Each support 10 and 11 supports, at its ends, pulleys 13, 14 and 15, 16 on which the related conveyance belts 17 and 18 of the screws and/or bolts engage. The support 11 supports, with its structure, a step motor 19 which transmits motion to a pair of pulleys 13 and 15 by means of an elastic belt 20 and a driving pulley 21.

The supports 10 and 11 are rigidly fixed to a frame which is constituted by uprights 22 and 23. A step motor 24 is mounted on the upright 22 and transmits motion to a screw to adjust the internal size of the lane 12.

The operation of the head checking section is as follows: a screw, indicated by the reference numeral 25, is inserted by the electromagnetic vibrating feeder 1 into the lane 12, i.e. said screw is hung by its head between the conveyance cables 17 and 18 and is conveyed thereby toward the inspection region. When the head of the screw passes through the light beam, indicated by the horizontal arrow X of figure 4, which is emitted by the lighting unit 6, the optical detector 7 detects the dimension, i.e. the height, of said head. Said height is compared with the standard height and it is thus determined whether it is within the standard or not. In the latter case, the screw is subsequently discarded.

The stem checking section 4 comprises a transversely concave chute 26 onto which the screws are fed by the head checking section 3, or rather the chute 26 is provided, at the end adjacent to the section 3, with an abutment 28 against which the stem of the screw 25 collides, allowing it to turn over and arranging the screw 25 on the chute 26 as shown in figure 5. The chute 26 is provided with a transverse gap 27, at which reading means are provided.

Said reading means comprise a lighting unit 29, which is arranged at and below the gap 27, and an optical detector 30, which is arranged opposite to the lighting unit 29. In order to activate reading, there are photocells 32 and 33 which provide synchronization to the lighting unit and to the detector 30 in the presence of a screw 25. The lighting unit 29, the optical detector 30 and the photocells 32 and 33 are rigidly associated with the chute 26 and are mounted thereon by means of a bracket 38 which is fixed laterally to the chute 26 at the gap 27.

Advantageously, the gap 27 has no transparent panels but is open. This is done since the arrangement of sheets of transparent material, such as transparent plastics or the like, constitutes a hindrance to the correct reading of the light beam by the optical reader, since such a panel can on one hand be subjected to damage from the passing screws and on the other hand can easily become dirty, whereas the open gap allows rapid cleaning even with a simple jet of compressed air.

The concave chute 26, with the reading means rigidly associated therewith, is supported by a translatory motion unit 39 which, by means of a step motor 40, allows to move it in a vertical direction and thus to move the chute toward the section 3 or away from it, according to the length of the parts to be checked. A guide 37 guides the chute 26 in its vertical motion.

The operation of the stem checking section is as follows; the screw 25, after being deposited on the chute 26, slides downward until it reaches the photocells 32, which activate the lighting unit 29 and the detector 30; in this manner, through the gap 27, the stem of the screw is inspected and its image is detected by the optical detector 30, which collects the information related to the screw 25. The photocell 33 completes the reading cycle of the optical detector 30.

The selective discharge means 5 comprise, downstream of the chute 26, an automatic selector 34 for directing the screws either into the reject channel 35 or into the channel 36 for components complying with the specifications. The angular motion of the selector 34 is controlled by the checking sections 3 and 4. The device according to the invention causes the selector 34 to always discharge any screw into the rejects in case of malfunction at one of the checking sections 3 and/or 4, i.e. if one of the two stations is inoperative.

Advantageously, the optical detectors 7 and 30 are constituted by a television camera, whereas the lighting units 6 and 29 comprise a lamp, whereas the optical reader 8 comprises a photocell with an amplifier.

A plurality of parameters related to each screw is obtained from the readings made by the optical detectors 7, 8 and 30 by means of an electronic control system which is not illustrated, and said parameters are compared to the preset standards for that production batch and for the particular product manufactured.

It has been observed that the invention achieves the intended aim and objects, providing a device which is capable of inspecting a large number of screws and/or bolts in a short time, thus allowing an exhaustive and not statistical control of the production batch.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept. All the details may furthermore be replaced with other technically equivalent ones.

In practice, the materials employed, as well as the dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Quality control device, particularly for screws, bolts and the like, comprising an electromagnetic vibrating feeder for feeding screws and bolts, characterized in that said electromagnetic vibrating feeder feeds screws and bolts to a conveyance and checking station, said station comprising a section for checking the head of said screws and/or bolts and a section for checking the stem of said screws and/or bolts, said head checking section being adapted for removing said screws and/or bolts from said electromagnetic vibrating feeder and for conveying said screws and/or bolts through analysis means toward said stem checking section, said stem checking section being provided with reading means, means for the selective discharge of said screws and/or bolts being provided downstream of said stem checking station.

2. Device according to claim 1, characterized in that said head checking section comprises means for gripping and conveying said screws and/or bolts through said analysis means, said analysis means comprising at least one lighting unit for said screws and/or bolts and an optical detector for detecting the lateral image of said head, said lighting unit and said optical detector being arranged on opposite sides with respect to said grip and conveyance means, said analysis means furthermore comprising a photocell for detecting the presence of machinings performed on the head.

3. Device according to the preceding claims, characterized in that said grip and conveyance means comprise two co-planar and parallel supports which define between them a lane for the passage of said screws and/or bolts, said supports supporting, on their respective ends, pulleys on which belts for the conveyance of said screws and/or bolts engage, one of said supports supporting a motor which is suitable for transmitting motion to a pair of said pulleys by means of an elastic belt and a driving pulley.

4. Device according to one or more of the preceding claims, characterized in that said supports are supported by a frame which has a motor adapted for adjusting the internal size of said lane.

5. Device according to one or more of the preceding claims, characterized in that said stem checking section comprises a concave chute on which the screws are deposited by said head checking section, said chute being provided with a gap which extends transversely, reading means being arranged at said gap, said reading means comprising a lighting unit arranged at and below said gap, and an optical detector arranged opposite to said lighting unit.

6. Device according to one or more of the preceding claims, characterized in that said selective discharge means comprise, downstream of said chute, an automatic selector suitable for selecting, under the control of said checking sections, the discharge of said screws and/or bolts selectively as rejects or as components complying with the specifications.

7. Device according to one or more of the preceding claims, characterized in that said concave chute has an adjustable inclination with respect to said head checking section.

8. Quality control device, particularly for screws, bolts and the like, comprising an electromagnetic vibrating feeder for feeding screws and/or bolts, characterized in that said electromagnetic vibrating feeder feeds a section for checking the head of said screws and/or bolts, said checking section comprising two supports fixed to a frame defining a lane for the passage of said screws and/or bolts, said supports being fixed on a frame which can be actuated by means of a motor adapted for adjusting the width of said lane according to the dimensions of said screws and/or bolts, a lighting unit and an optical detector being arranged laterally and on opposite sides with respect to said lane, an optical reader being arranged above said lane, said supports supporting actuation pulleys for belts for the conveyance of said screws and/or bolts, said pulleys being motorized by a motor supported by one of said supports by means of an elastic belt, selective means for discharging defective or non-defective screws and/or bolts being provided downstream of said head checking section and being controllable by

said head checking section.

9. Quality control device, particularly for screws, bolts and the like, comprising an electromagnetic vibrating feeder for feeding screws and/or bolts, characterized in that said electromagnetic vibrating feeder feeds a section for checking the stem of said screws and/or bolts, said section comprising a concave chute which is angularly inclined and angularly adjustable, said chute being adapted for accommodating said screws and/or bolts, said chute comprising a gap defined on the bottom of said concavity, a lighting unit being arranged below said gap and an optical detector being arranged above said gap, selective means for discharging defective or non-defective screws and/or bolts being provided downstream of said stem checking section and being controllable by said stem checking section.

10. Device according to one or more of the preceding claims, characterized in that said optical detector comprises a television camera, said lighting unit comprises a lamp and said optical reader comprises a photocell.

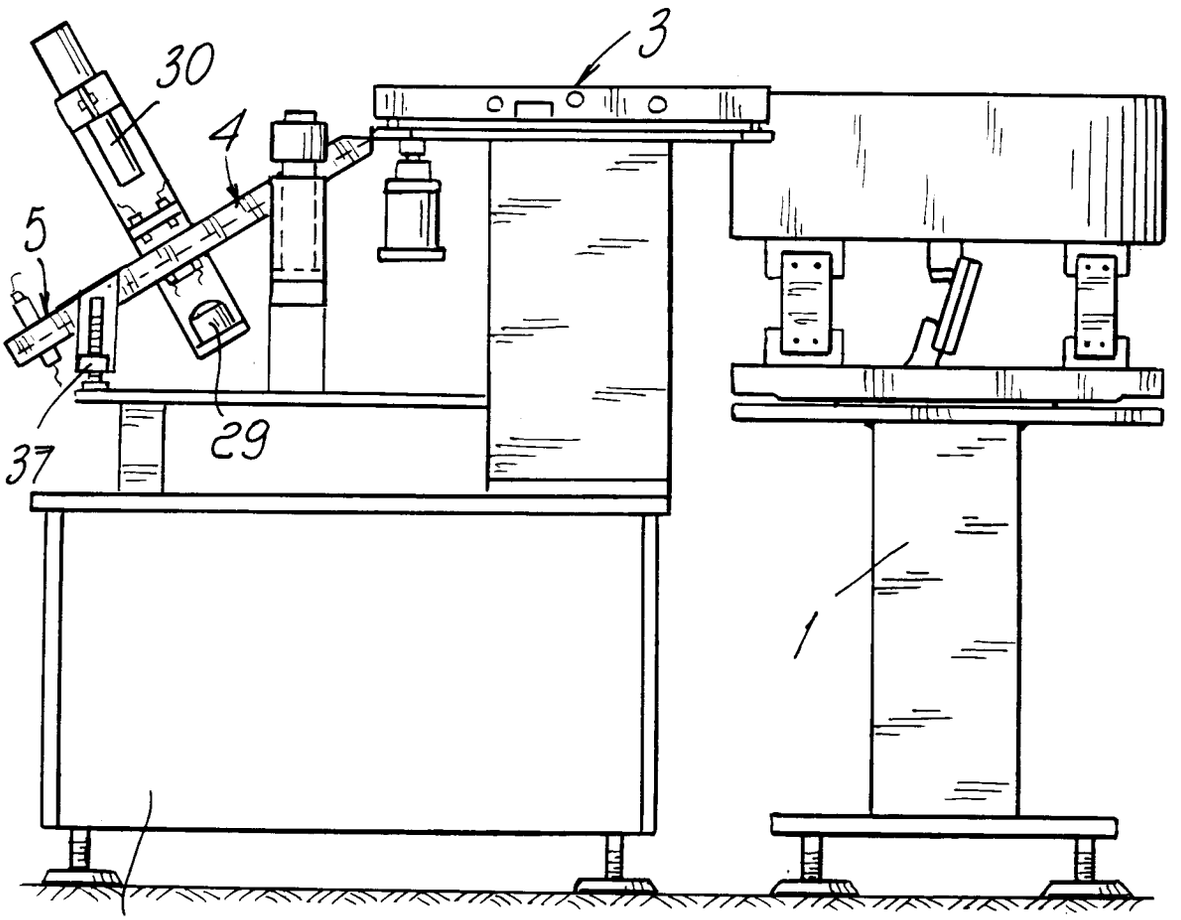

Fig.1

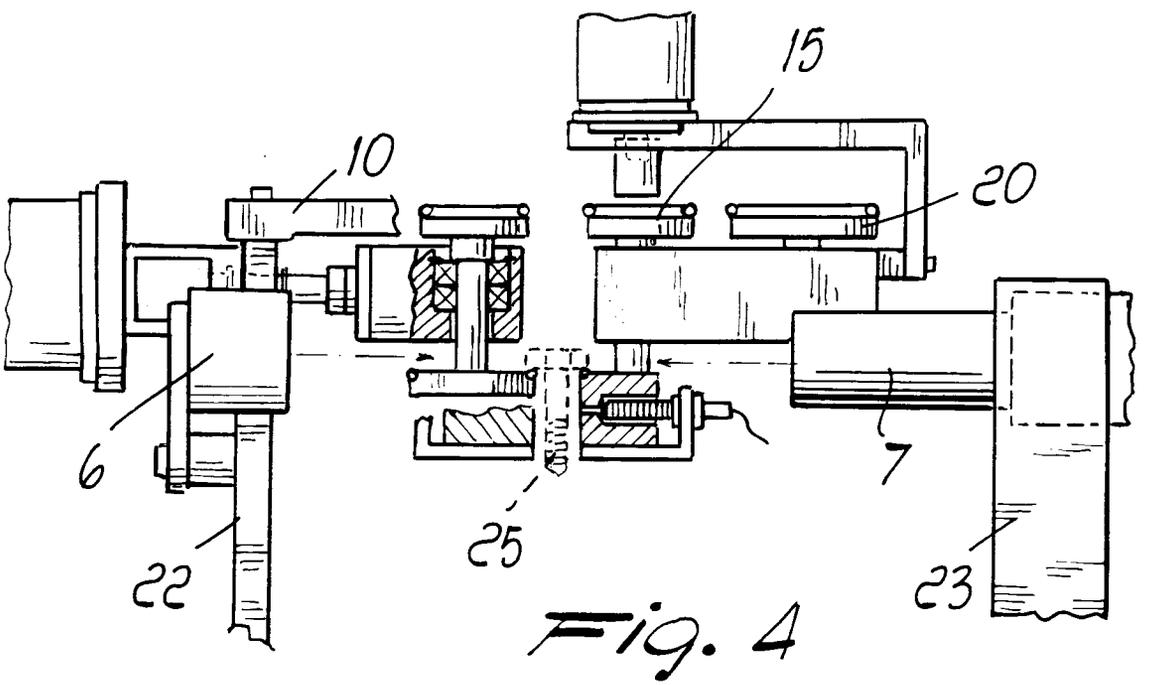

Fig. 4

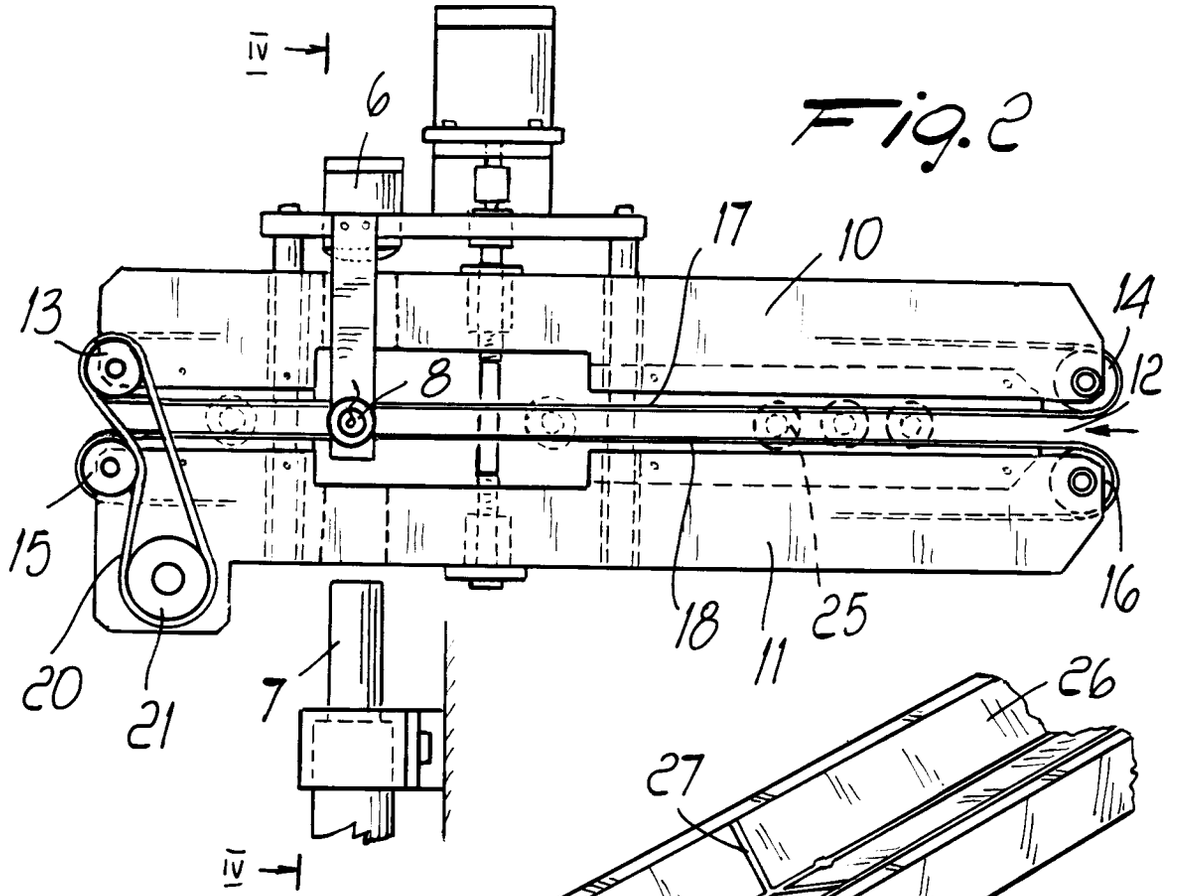

Fig. 2

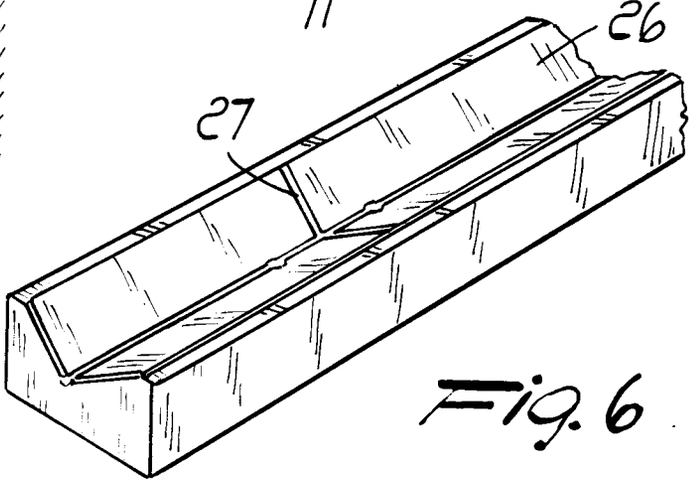

Fig. 6

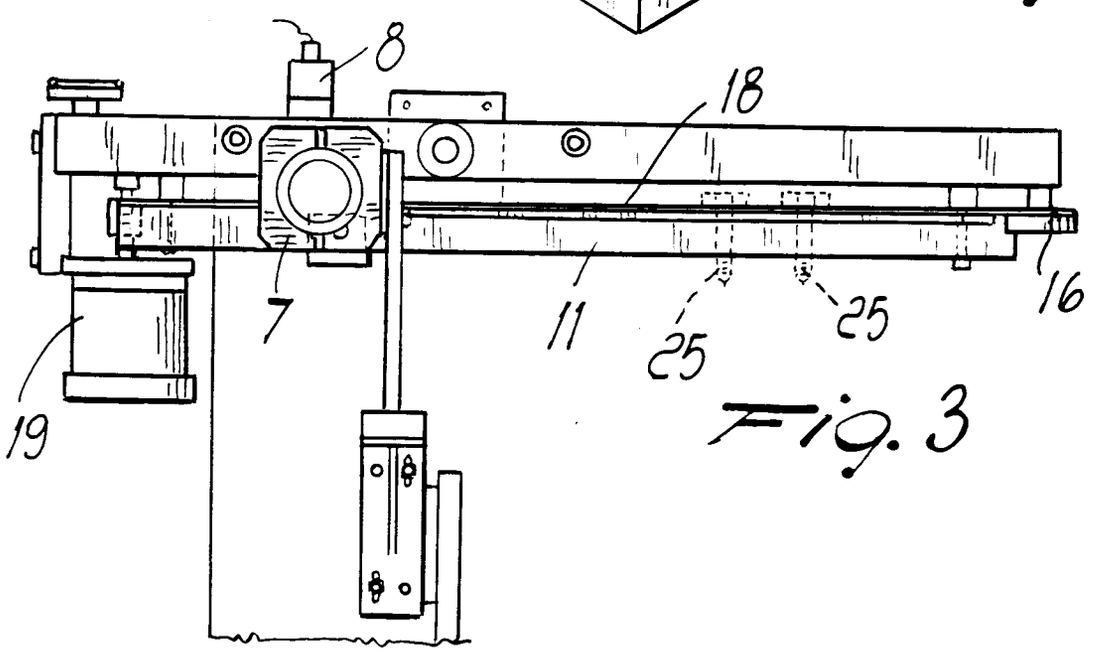

Fig. 3

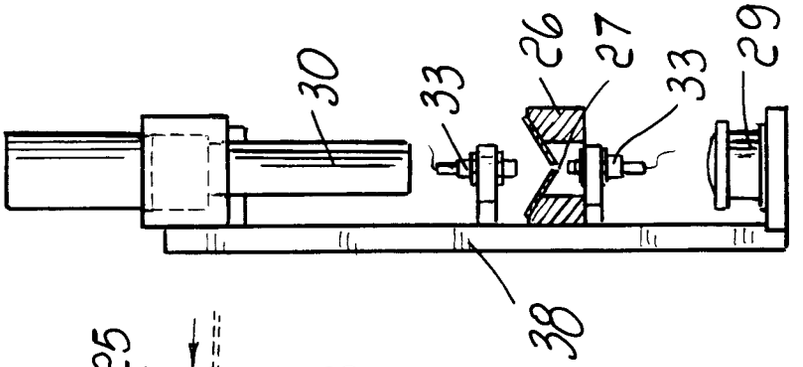

Fig.7

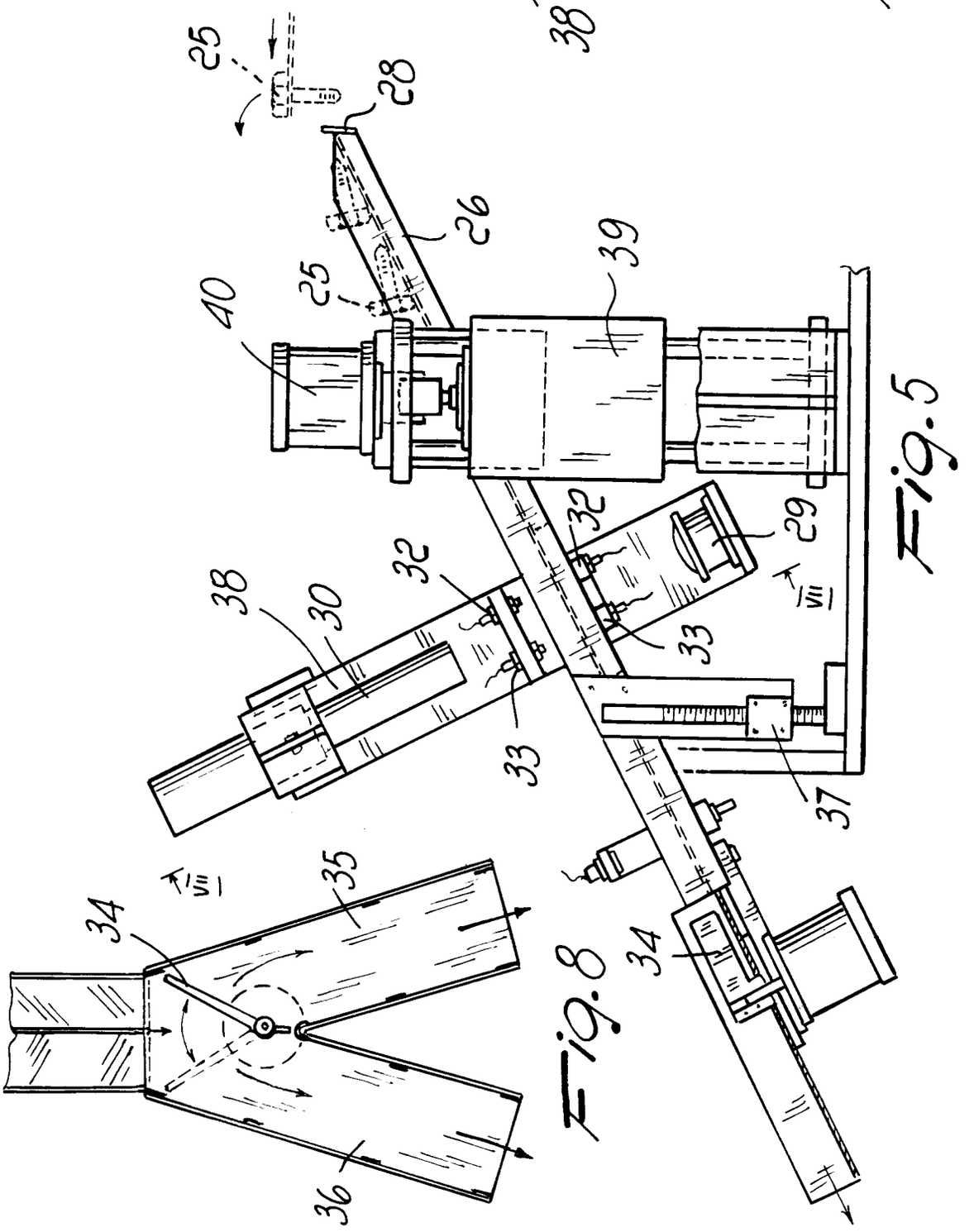

Fig.5

Fig.8