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(54) **Inspecting apparatus with eddy current inspection**

Prüfvorrichtung mit Wirbelstromprüfung

Appareil d'inspection avec inspection de courant de Foucault

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(73) Proprietor: **TE Hung en Enterprise Co., Ltd.
Gangshan Township
Kao hsiung 82062 (TW)**

(72) Inventor: **Yang, Ming-Liau
82062, Kaohsiung County (TW)**

(74) Representative: **Chaillot, Geneviève et al
Cabinet Chaillot
16-20 Avenue de l'Agent Sarre
B.P. 74
92703 Colombes Cedex (FR)**

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Description**BACKGROUND OF THE INVENTION****1. Field of the Invention**

[0001] The present invention relates to an inspecting apparatus, more particularly to an inspecting apparatus with eddy current inspection.

2. Description of the Related Art

[0002] Referring to Fig. 1, a conventional inspecting apparatus **1** for detecting material properties, such as hardness, mainly consists of a base **11**, an inlet feeding system **12** for transporting objects **2** (for instance of screws or nuts), an inspecting rail **13** attached to the feeding system **12**, an eddy current machine **14** disposed on the rail **13**, and a determining device **15** communicating with the eddy current machine **14**. By the concatenation of the above elements, the objects **2** are continuously introduced into the rail **13** by the feeding system **12** and inspected by passing through the eddy current machine **14**. The eddy current machine **14** thus transmits the signals to the determining device **15** for the detail analyses.

[0003] In operation, for further defects detection such as external cracks are carried out by human visual inspection and handling; however, the object **2** additionally requires appropriate apparatuses (not shown in the figure) for detecting other items thereof, for instance of the thread diameter or the pitch measurements, so that the detection of the object would be interrupted and the detecting speed thus is suspended while moving the object **2** to other apparatuses for multiple inspections, thus affecting the detecting speed. Moreover, the inlet feeding system **12** is not able to properly space the objects **2** apart while introducing them into the rail **13**, which would easily result in that the object thrusts to its front detecting object in time of feeding, thus affecting the detecting signals of the eddy current machine **14**. Therefore, the determining device **15** may still have higher possibility of the inaccurate inspection. An inspection apparatus of the prior art is e.g. known from US-A-3,235,075 or GB-A-2 266 774.

SUMMARY OF THE INVENTION

[0004] The object of the present invention is to provide an inspecting apparatus with eddy current inspection which is conducive to obtain rapid speed detection and increase the inspecting efficiency.

[0005] The inspecting apparatus with eddy current inspection in conformity with the present invention essentially comprises a determining device, an inlet conveyer system, a turntable connecting to the inlet conveyer system, a shield board surrounding the turntable, an outlet conveyer system disposed beside the turntable and an eddy current sorting assembly engaged to the outlet conveyer system; wherein, the eddy current sorting assembly has a detecting entrance, a detector connected to the determining device, and a stopper mechanism and a dispensing system respectively disposed on the entrance. Therefore, the object is able to be sequentially introduced into the detecting entrance by assistance of the turntable and the outlet conveyer system, then detected under a nondestructive inspection and analyzed by the determining device; further the dispensing system sorts the object into defective or non-defective according to the analyzed record. Furthermore, the present invention performs preliminary examinations and discards non-conformed objects prior to the eddy current assembly, consequently, the amount of objects needed to pass through the assembly are reduced and thus higher sorting speed is obtained. By streamlining all the sorting processes (computer visual dimensional inspection and material properties sorting) onto a single procession, it not only increases the sorting performance but also reduces the level of object damages from crushing during the conveying of the objects.

[0006] The advantages of the present invention over the known prior arts will become more apparent to those of ordinary skilled in the art by reading the following descriptions with the relating drawings.

BRIEF DESCRIPTION OF THE DRAWINGS**[0007]**

Fig. 1 is a perspective view showing a conventional invention;
 Fig. 2 is a perspective view showing a first preferred embodiment of the present invention;
 Fig. 3 is a partial enlarged view showing the eddy current sorting assembly of the first embodiment;
 Fig. 4 is a side view showing the first embodiment;
 Fig. 5 and Fig. 6 are schematic views showing the eddy current sorting assembly in time of operation; and
 Fig. 7 is a perspective view showing another preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] Before describing in greater detail, it should note that the like elements are denoted by the similar reference numerals throughout the disclosure.

[0009] Referring to Fig. 2, an inspecting apparatus 3 with eddy current inspection of the first preferred embodiment comprises a determining device 31, an inlet conveyer system 32 for orientating and aligning objects 5 (for instance of screws or nuts), a turntable 33 connecting to an exit of the inlet conveyer system 32, a shield board 34 surrounding the turntable to prevent drops of the objects 5, an outlet conveyer system 35 disposed at one side of the turntable 33, and an eddy current sorting assembly 4 engaged to the outlet conveyer system 35 and communicating with the determining device 31; wherein, the turntable 33 includes a plurality of cutout grooves 331 spaced around an outer periphery thereof to receive and position the objects 5 therein.

[0010] Still further, referring to Fig. 2 and 3, the eddy current sorting assembly 4 provides with a detecting entrance 41 for the objects 5 traveling therein, a detector 42 disposed on an outer circumference of the detecting entrance 41 and communicating with the determining device 31, and a stopper mechanism 43 and a dispensing system 44 respectively mounted on the detecting entrance 41; wherein, the stopper mechanism 43 has a power motor 432, and a stopper rod 431 driven by the power motor 432 and laterally mounted through the detecting entrance 41 for resting the objects 5. Additionally, the dispensing system 44 is located below the stopper mechanism 43, whereby the objects 5 are able to remain shortly within the detector 42 till the nondestructive inspection process for the object 5 is finished and then be sorted into defectives or non-defectives based on analyses of the determining device 31. As shown in Fig. 4, the outlet conveyer system 35 is adopted to include two guiding rails 45 and a channel 451 formed therebetween; that is, the two guiding rails 45 have their ends disposed below the turntable 33 and their other ends contacted with the inspecting entrance 41, so that the objects 5 are able to be sequentially transported from the turntable 33 to the eddy current sorting assembly 4.

[0011] While in detecting, referring to Fig. 2 to 5, each object 5 is initially introduced into the cutout groove 331 by the inlet conveyer system 32, so that the turntable 32 can equidistantly transport the objects 5. Further, the output conveyer system 35 propels the object 5 to sequentially enter into the inspecting entrance 41 through the guiding rail 45 so as to prevent the shoving among the objects 5. Subsequently, the stopper rod 431 driven by the power motor 432 initially blocks each object 5 (shown in Fig. 5) and makes it stay within the detector 42 for a nondestructive inspection. The detector 42 receives the detecting signals and transmits them to the determining device 31 for analyzing the quality of the object 5. Finally, the stopper rod 431 frees the object 5 and passes it through the dispensing system 44 (shown in Fig. 6) for sorting the object 5 into defective or non-defective according to the analyzed record, thus achieving high speed detection and increasing the inspecting efficiency.

[0012] Referring to Fig. 7, another preferred embodiment of the present invention still comprises a determining device 31, an eddy current sorting assembly 4, an inlet conveyer system 32, a turntable 33 with a shield board 34 disposed therearound, and an outlet conveyer system 35. Particularly, a camera 6 is mounted on the turntable 33 and electrically connected to the determining device 31; further, the outlet conveyer system 35 includes a pusher 352 separately disposed on the turntable 33 so as to initially discard the defective and malformed object 5. The pusher 352 is adopted as a jet of high pressure gas in this embodiment.

[0013] Still referring to Fig. 7, the object 5 is firstly introduced into cutout groove 331 and sequentially transported by the turntable 33. The object 5 is then moved below the camera 6 for providing precedence to the optical detection, e.g. receiving the surface signal thereof, and the camera 6 transmits the signal to the determining device 31 to attain the initial analysis. Immediately, the outlet conveyer system 35 sorts the objects 5 into defectives and non-defectives based on the analysis, namely the pusher 352 directs its jet at the flaw object 5 to deviate it from the turntable 33 and keeps the retaining flawless objects 5 staying at their positions, the two guiding rails 45 thus guide the flawless objects 5 in sequence into the eddy current sorting assembly 4 along the channel 451, thereby preventing the problem of shoving. In this manner, the flawless objects 5 is initially selected by the camera 6 and detected once again under the nondestructive inspection of the eddy current sorting assembly 4, which is conducive to ensure more precise inspections and increase the detecting efficiency.

[0014] To sum up, the present invention takes advantages of the turntable transporting the objects and sequentially introducing them into the eddy current sorting assembly to have a nondestructive inspection and dispense the objects into defectives or non-defectives, thereby increasing the detecting speed. In addition, the present invention can also have the preliminary examination by the camera before guiding the objects into the eddy current sorting assembly, the initial flawless objects thus has dual detections, thereby promoting the inspection quality and efficiency.

[0015] While we have shown and described the embodiment in accordance with the present invention, it should be clear to those skilled in the art that further embodiments may be made without departing from the scope of the present invention.

Claims

1. An inspecting apparatus (3) with eddy current inspection comprising a determining device (31), an inlet conveyer system (32) for orientating and aligning objects (5), and an eddy current sorting assembly (4) electrically commu-
 5 nicated with said determining device (31);
 said inspecting apparatus (3) having a turntable (33) connecting to an exit of said inlet conveyer system (32), a shield board (34) surrounding said turntable (33), and an outlet conveyer system (35) disposed at one side of said turntable (33) so as to sequentially output said objects (5); wherein, said turntable (33) including a plurality of cutout grooves (331) spaced around an outer periphery thereof to position said objects (5) therein; said eddy current sorting
 10 assembly (4) being pivoted to an exit of said outlet conveyer system (35) to receive said objects (5) and further comprising:
 a detecting entrance (41) for passing said objects (5) therethrough;
 a detector (42) disposed on an outer circumference of said detecting entrance (41) and communicating with
 15 said determining device (31); and
 a stopper mechanism (43) and a dispensing system (44) respectively mounted on said detecting entrance (41);
 wherein, said stopper mechanism (43) having a power motor (432), and a stopper rod (431) driven by said power motor (432) and laterally mounted through said detecting entrance (41) to pause movements of said
 20 objects (5), whereby said objects (5) would remain shortly within said detector (42) till a nondestructive inspection process for said object (5) being finished; said dispensing system (44) being located below said stopper mechanism (43) so as to sort said objects (5) into defectives or non-defectives based on analyses of said determining device (31).
2. The inspecting apparatus with eddy current inspection as claimed in claim 1, wherein, said output conveyer system
 25 (35) substantially connects said turntable (33) and said eddy current sorting assembly (4); said output conveyer system (35) further provides with two guiding rails (45) and a channel (451) formed therebetween; said guiding rail (45) has ends thereof disposed below said turntable (33) and the other ends thereof contacted with said inspecting entrance (41) for guiding said objects (5) to easily enter therein.
3. The inspecting apparatus with eddy current inspection as claimed in claim 1, wherein, a camera (6) is mounted
 30 beside said turntable (33) and electrically connected to said determining device (31).

Patentansprüche

1. Prüfgerät (3) mit Wirbelstromprüfung enthaltend eine Erfassungsvorrichtung (31), ein Einlassfördersystem (32) zur
 35 Orientierung und zum Ausrichten von Gegenständen (5), und eine Wirbelstromsortierbaugruppe (4) in elektrischer Verbindung mit der Erfassungsvorrichtung (31);
 wobei das Prüfgerät (3) einen mit einem Ausgang des Einlassfördersystems (32) verbundenen Drehtisch (33), eine
 40 den Drehtisch (33) umgebende Schutzplatte (34), und ein Auslauffördersystem (35) umfasst, das an einer Seite des Drehtisches angeordnet ist, um die Gegenstände (5) sequenziell abzugeben; wobei der Drehtisch (33) eine Vielzahl von geschnittenen Rillen (331) enthält, die herum seinen Außenumfang beabstandet sind, um die Gegenstände (5) darin aufzustellen; wobei die Wirbelstromsortierbaugruppe (4) an einem Ausgang des Auslauffördersystems (35) angelenkt ist, um die Gegenstände (5) aufzunehmen, und weiterhin umfasst :
 45 einen Erfassungseingang (41), um die Gegenstände (5) **dadurch** hindurchzuführen;
 einen an einem Außenumfang des Erfassungseingangs (41) angeordneten Detektor (42), der mit der Erfassungsvorrichtung (31) verbunden ist; und
 einen Haltemechanismus (43) und ein Abgabesystem (44) jeweils angebracht auf dem Erfassungseingang (41);
 50 wobei der Haltemechanismus (43) einen Elektromotor (432) und einen von dem Elektromotor (432) angetriebenen Haltestab (431) hat, der seitlich durch den Erfassungseingang (41) angebracht ist, um die Bewegung der Gegenstände (5) zu stoppen, wodurch die Gegenstände (5) kurz innerhalb des Detektors (42) bis ein zerstörungsfreies Prüfungsverfahren für den Gegenstand (5) beendet; wobei das Abgabesystem (44) unterhalb des Haltemechanismus (43) angeordnet ist, um die Gegenstände (5) als defekt oder nicht defekt basierend auf
 55 Analysen der Erfassungsvorrichtung (31) zu sortieren.
2. Prüfgerät mit Wirbelstromprüfung nach Anspruch 1, wobei das Auslauffördersystem (35) im Wesentlichen den Drehtisch (33) und die Wirbelstromsortierbaugruppe (4) verbindet; das Auslauffördersystem (35) umfasst weiterhin

zwei Führungsschienen (45) und einen zwischen diesen ausgebildeten Kanal (451); die Führungsschiene (45) hat Enden angeordnet unterhalb des Drehtisches (33) und hat seine anderen Enden in Kontakt mit dem Prüfungseingang (41), um die Gegenstände (5) zu einem einfachen Eingang darin zu führen.

- 5 **3.** Prüfgerät mit Wirbelstromprüfung nach Anspruch 1, wobei eine Kamera (6) neben dem Drehtisch (33) angebracht und elektrisch mit der Erfassungsvorrichtung (31) verbunden ist.

Revendications

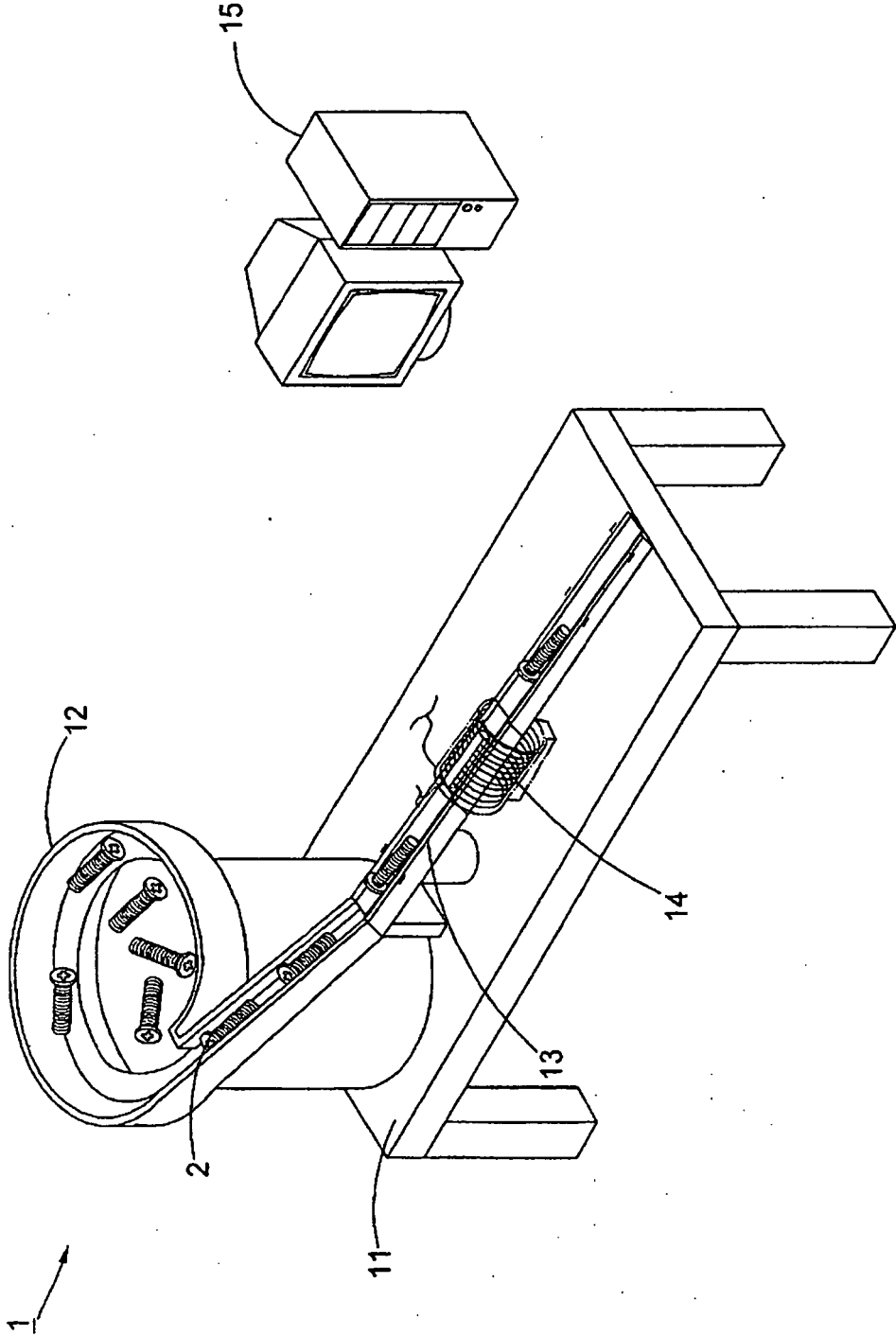
- 10 **1.** Appareil d'inspection (3) avec inspection par courants de Foucault comprenant un dispositif de détermination (31), un système transporteur d'entrée (32) pour orienter et aligner des objets (5), et un ensemble de tri par courants de Foucault (4) en communication électrique avec ledit dispositif de détermination (31) ;
 15 ledit appareil d'inspection (3) ayant un plateau tournant (33) raccordé à une sortie dudit système transporteur d'entrée (32), une plaque de protection (34) entourant ledit plateau tournant (33), et un système transporteur de sortie (35) disposé sur un côté dudit plateau tournant (33) de façon à évacuer séquentiellement lesdits objets (5) ; ledit plateau tournant (33) comprenant une pluralité de rainures découpées (331) espacées autour d'une périphérie externe de celui-ci pour positionner lesdits objets (5) dans le plateau tournant ; ledit ensemble de tri par courants de Foucault (4) étant apte à pivoter vers une sortie dudit système transporteur de sortie (35) pour recevoir lesdits objets (5), et
 20 comprenant en outre :

une entrée de détection (41) apte à faire passer lesdits objets (5) à travers elle;
 un détecteur (42) disposé sur une circonférence externe de ladite entrée de détection (41) et communiquant avec ledit dispositif de détermination (31) ; et

- 25 un mécanisme d'arrêt (43) et un système de distribution (44) respectivement montés sur ladite entrée de détection (41) ; ledit mécanisme d'arrêt (43) ayant un moteur électrique (432) et une tige d'arrêt (431) entraînée par ledit moteur électrique (432) et montée latéralement à travers ladite entrée de détection (41) pour interrompre les mouvements desdits objets (5), ce par quoi lesdits objets (5) resteraient peu de temps à l'intérieur dudit détecteur (42) jusqu'à ce qu'un processus d'inspection non destructif pour ledit objet (5) soit fini, ledit système
 30 de distribution (44) étant situé au-dessous dudit mécanisme d'arrêt (43) de façon à trier lesdits objets (5) en défectueux ou non défectueux sur la base d'analyses dudit dispositif de détermination (31).

- 2.** Appareil d'inspection avec inspection par courants de Foucault selon la revendication 1, dans lequel ledit système transporteur de sortie (35) relie sensiblement ledit plateau tournant (33) et ledit ensemble de tri par courants de Foucault (4) ; ledit système transporteur de sortie (35) comporte en outre deux rails de guidage (45) et un canal (451) formé entre ceux-ci ; ledit rail de guidage (45) a des extrémités disposées au-dessous dudit plateau tournant (33) et ses autres extrémités en contact avec ladite entrée d'inspection (41) pour guider lesdits objets (5) afin qu'ils y entrent facilement.

- 40 **3.** Appareil d'inspection avec inspection par courants de Foucault selon la revendication 1, dans lequel une caméra (6) est montée à côté dudit plateau tournant (33) et connectée électriquement audit dispositif de détermination (31).



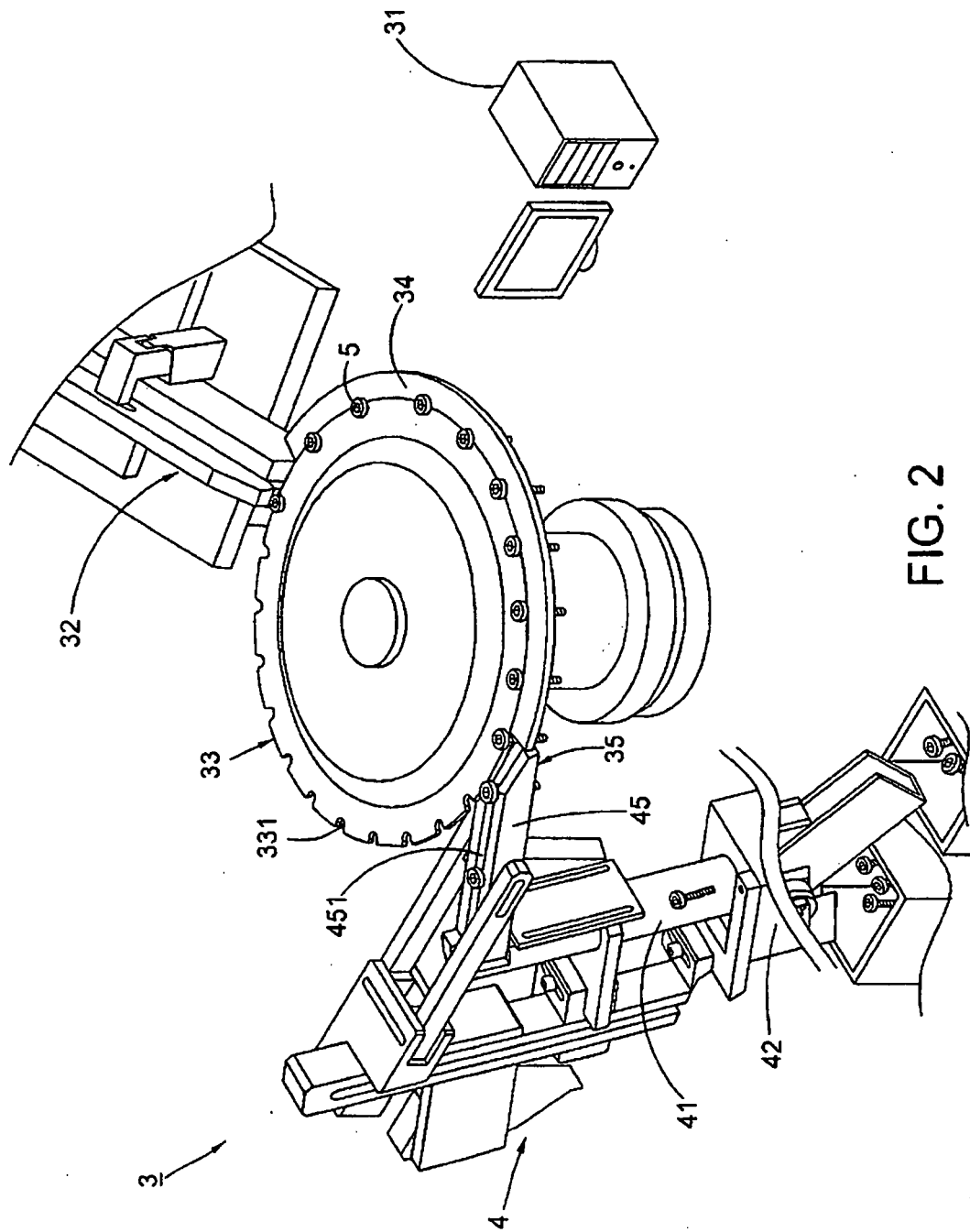


FIG. 2

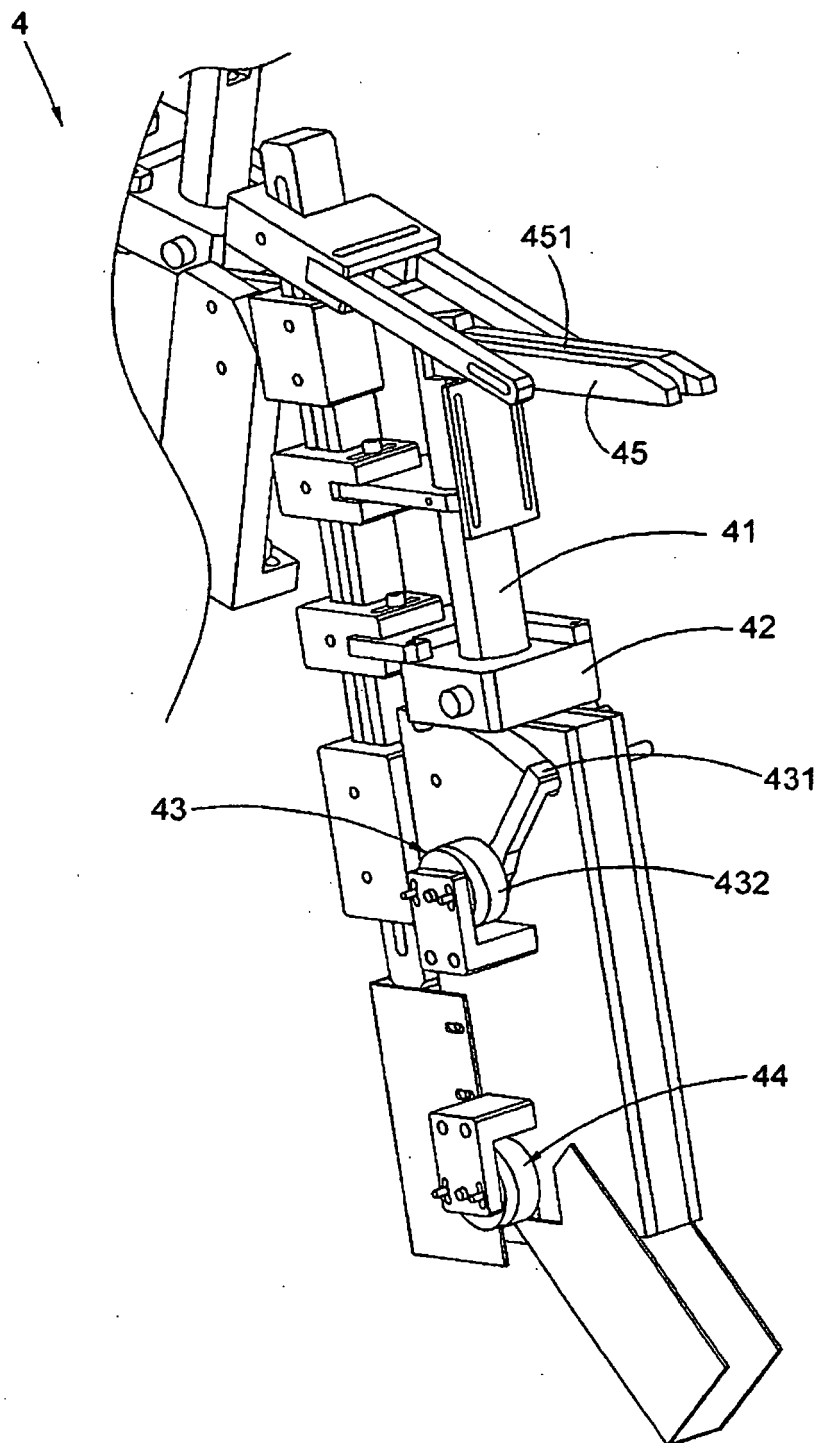


FIG. 3

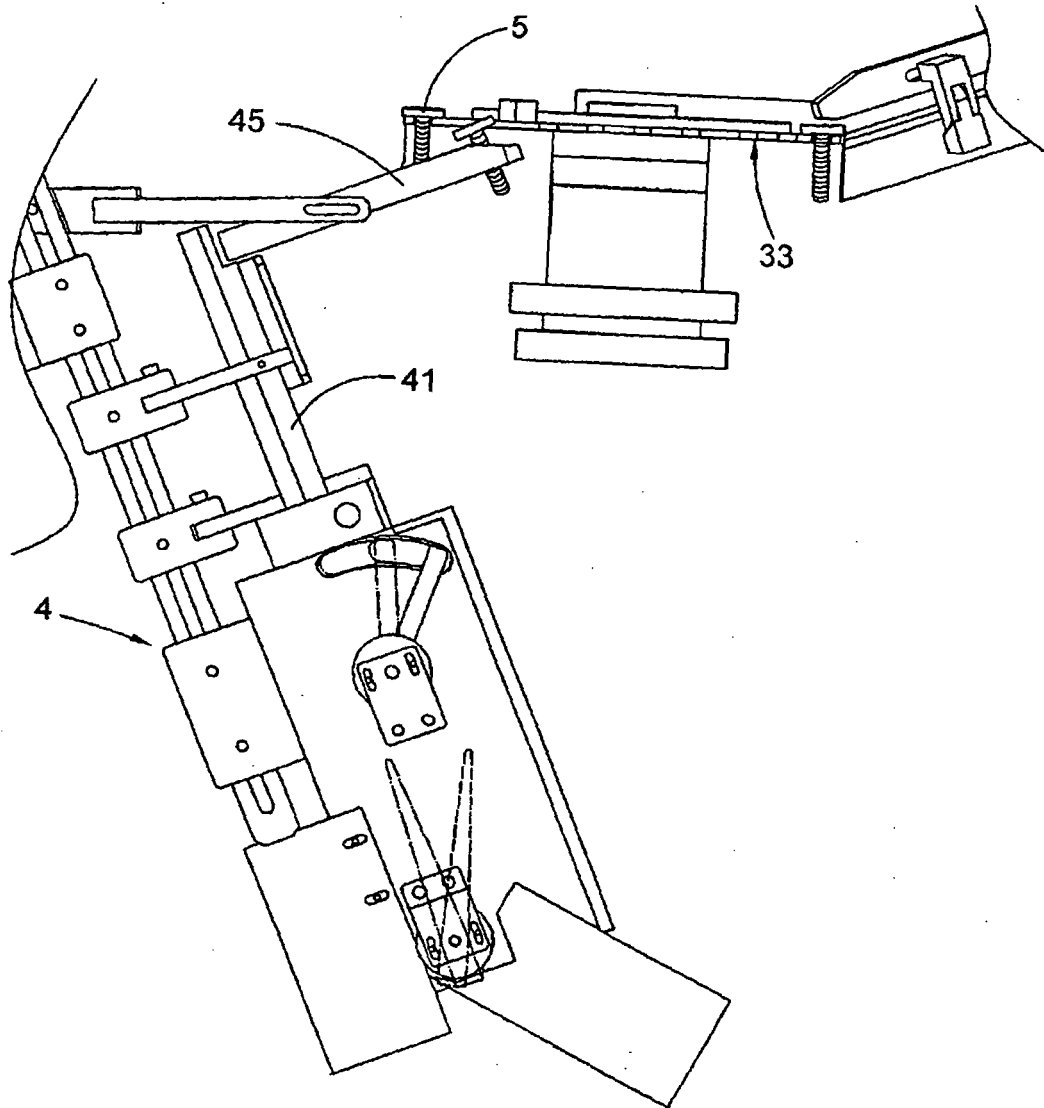


FIG. 4

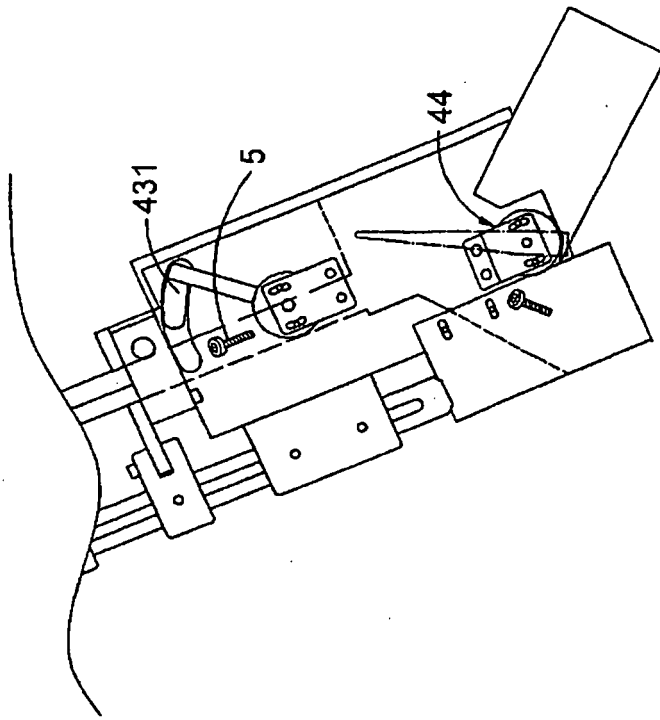


FIG. 6

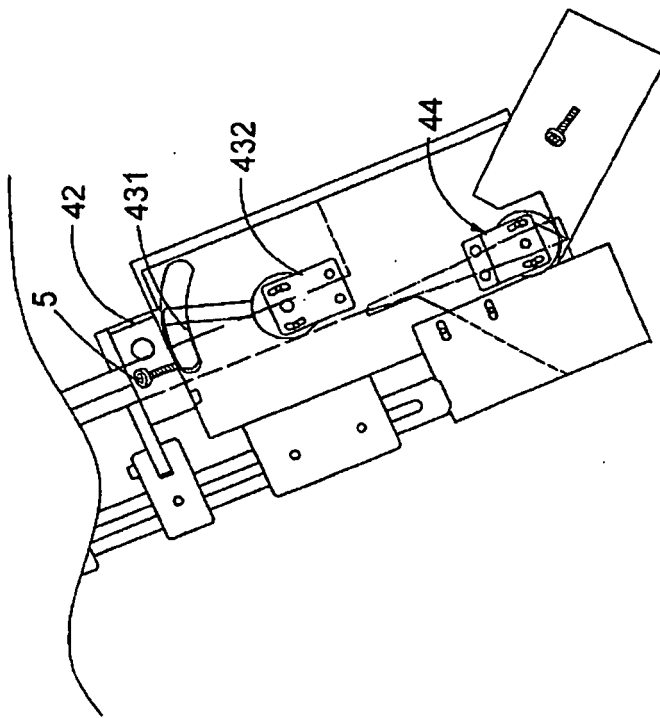


FIG. 5

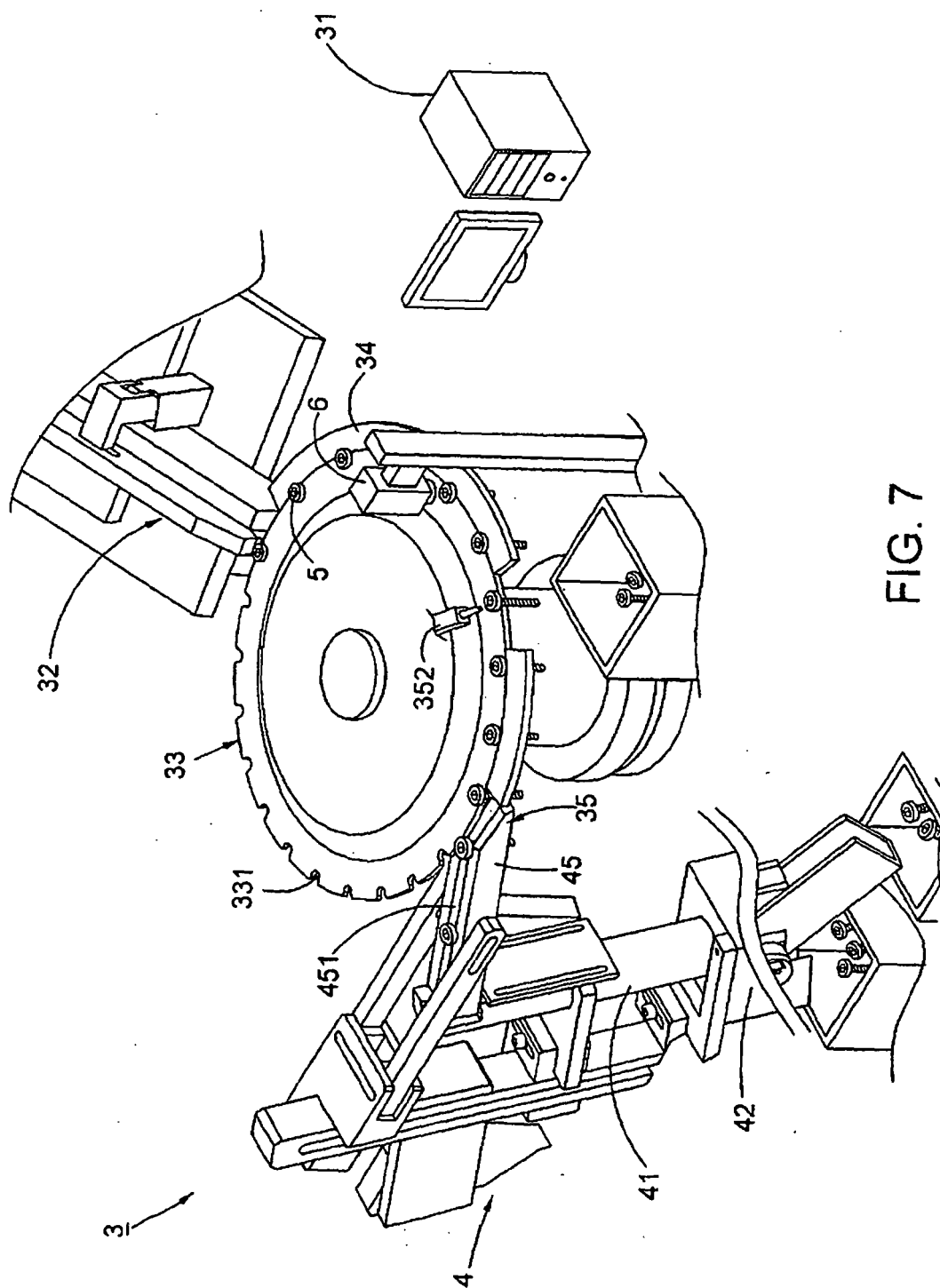


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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