Oct. 18, 1966 F. K. NABIULLIN ETAL 3,279,649

ARRANGEMENT FOR FEEDING PARTS INTO AUTOMATIC LINES

Filed Sept. 6, 1963 4 Sheets-Sheet 1

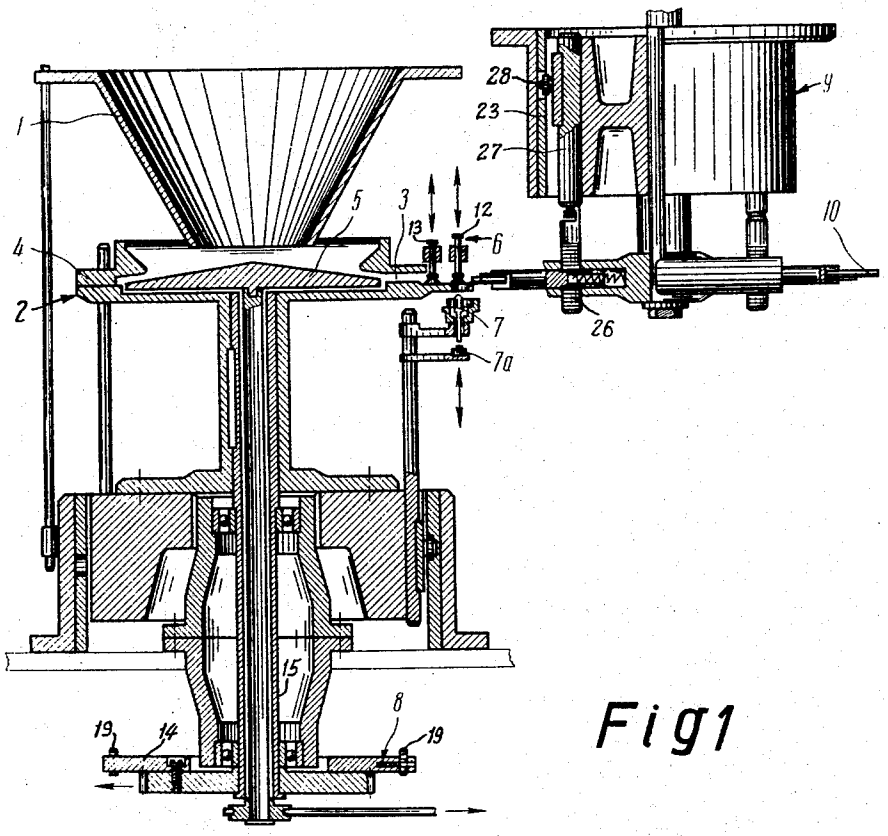


Fig1

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ARRANGEMENT FOR FEEDING PARTS INTO AUTOMATIC LINES

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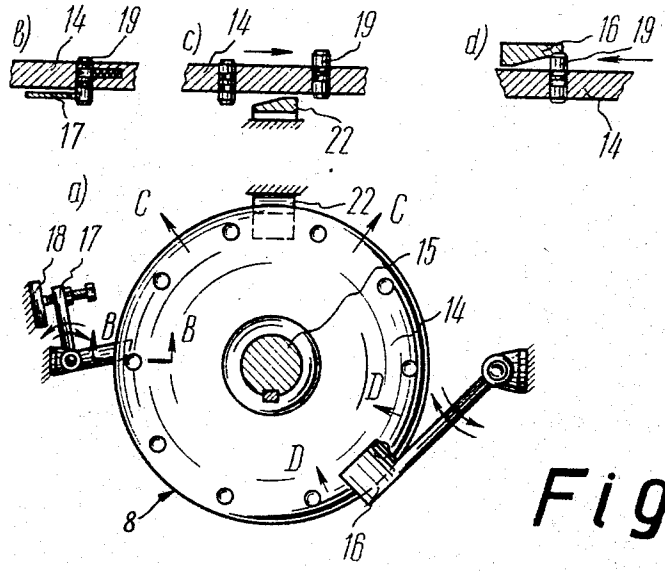


Fig 5

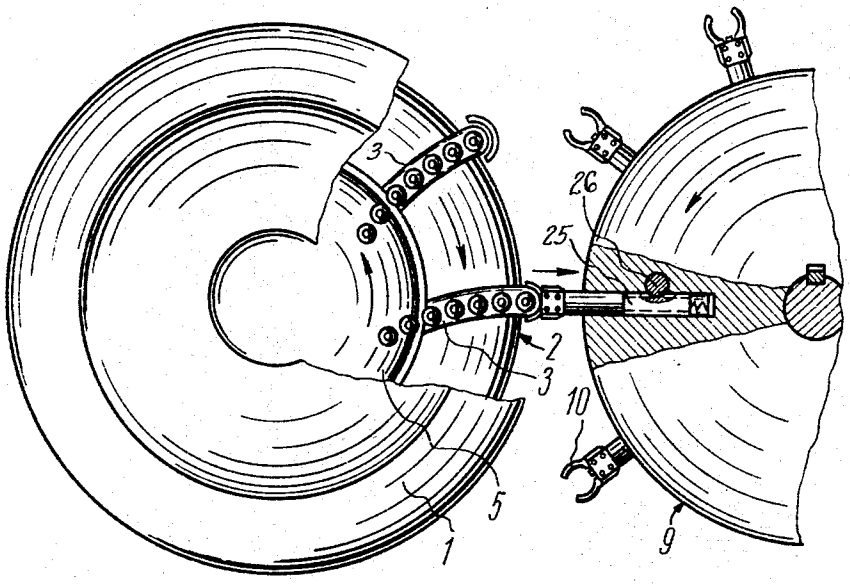


Fig 2

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ARRANGEMENT FOR FEEDING PARTS INTO AUTOMATIC LINES

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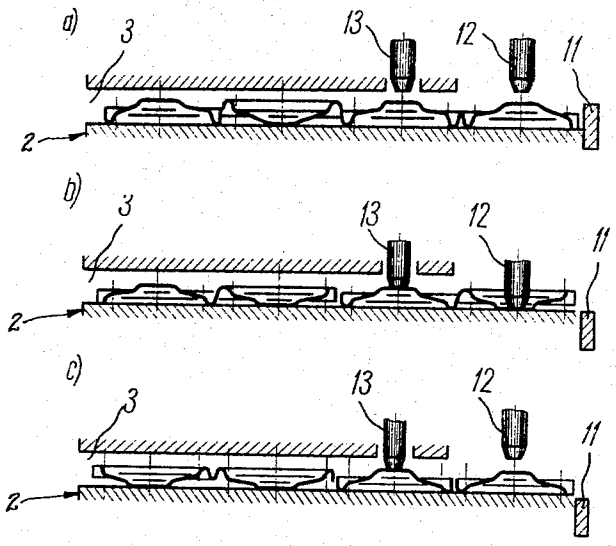


Fig 3

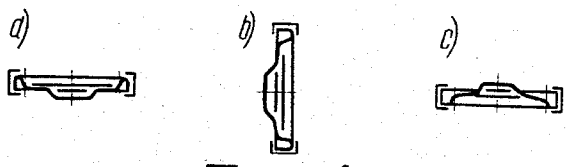


Fig 4

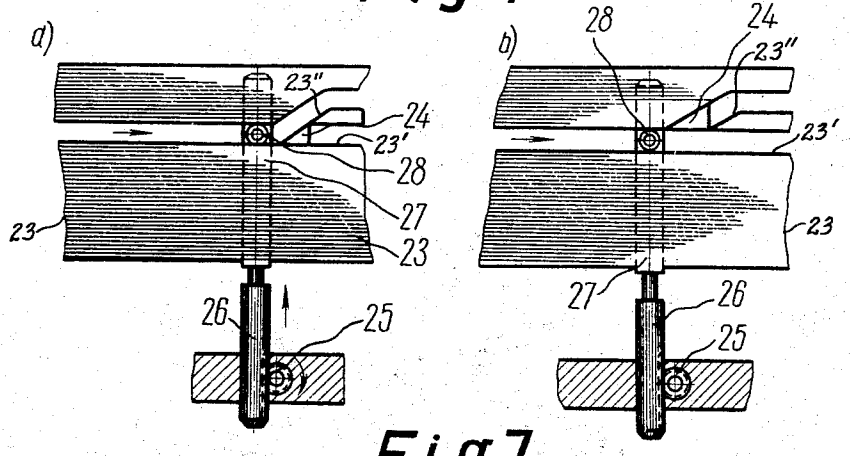
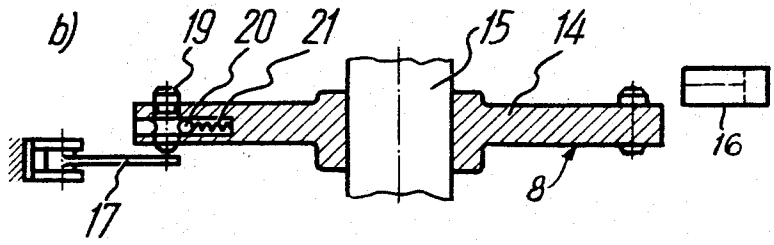


Fig 7

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ARRANGEMENT FOR FEEDING PARTS INTO AUTOMATIC LINES

Filed Sept. 6, 1963 4 Sheets-Sheet 4



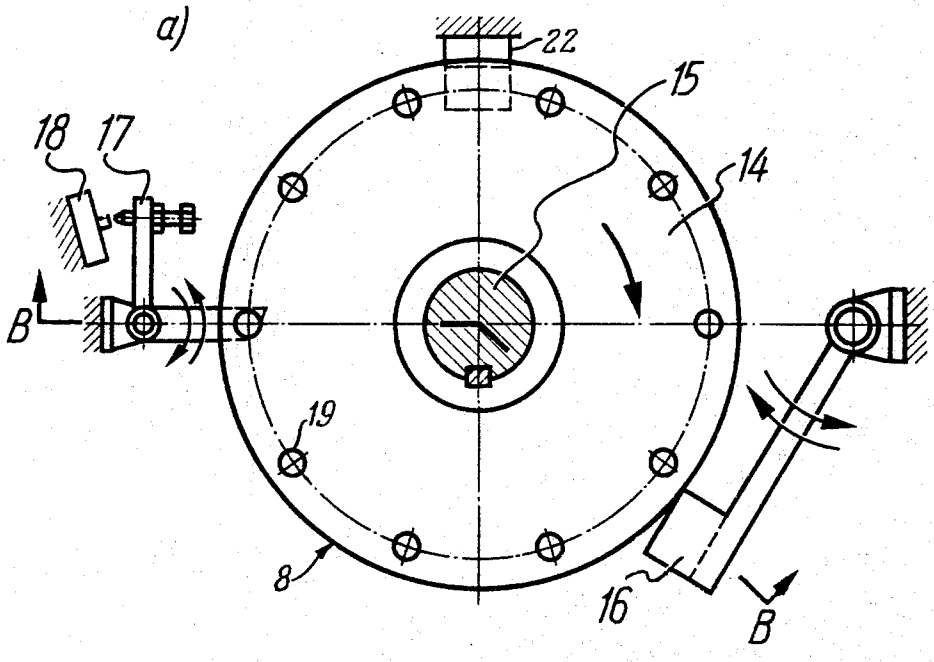


Fig6

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3,279,649

ARRANGEMENT FOR FEEDING PARTS INTO AUTOMATIC LINES

Faat Khatovich Nabiullin, 3 Mitishchinskaya St., 14–a, Apt. 78, Ruben Grigorjevich Adamjan, Pereulok Vedernikova, 4/12, Apt. 38, and Zoja Mikhailovna Buzova, 3 Mitishchinskaya St., 14–a, Apt. 89, all of Moscow, U.S.S.R.; Sarra Abramovna Gantman, B. Rupasovskaya St. 12, Apt. 87, Mitischi, Moskovskaya Oblast, U.S.S.R.; Efim Mikhailovich Gertsik, 3 Mitishchinskaya St., 14–a, Apt. 98, and Ivan Iljich Zhuravlev, Sadovo-Chernogriazskaya, 3–b, Apt. 7, both of Moscow, U.S.S.R.; Boris Vasiljevich Marfin, Partizanskaya St. 5, Platforma "Zavety Iljicha," Moskovskaya Oblast, U.S.S.R.; and Anna Vasiljevna Sladkova, Srednjaja Perejaslavskaya St. 27, Apt. 10, Sofia Shaevna Shlionskaya, Udaltsova St. 13, Apt. 1, and Lev Nikolaevich Koshkin, Pereulok M. Pionersky 3, Apt. 65, all of Moscow, U.S.S.R.

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3 Claims. (Cl. 221—9)

This invention relates to automatic production lines for assembling various articles, and more particularly it relates to devices for feeding parts into these automatic lines.

One of the main procedures in an automatic assembly process is the feeding of adequately positioned parts to a point or points of assembly. Feeding devices of most diverse types and designs have been used for this purpose. Automatic feeders associated with hoppers which deliver parts to the automatic line in an oriented position are most advantageous for this purpose.

The main functions of these devices are as follows: selecting individual parts from a bulk supply in a hopper, setting the parts in appropriate position and transferring the same to the place of assembly. These automatic feeders usually orient the part by making use of an irregularity in its shape or by use of the gravity principle (uneven distribution of weight in the part).

It must be noted, however, that these factors are liable to limit both the capacity of the feeder and the field of its application.

For example, feeders utilizing the shape irregularity principle, reject theoretically fifty percent of the parts which may have assumed an improper position, thus correspondingly reducing the capacity of the feeder. This is also true for such most effectively used devices as vibrating and centrifugal feeders. It is necessary to note that the capacity of centrifugal feeders depends to a great extent on the weight of a part to be delivered to the conveyor, since the centrifugal force developed in the part must overcome the friction force which interferes with free motion of the part.

Another serious demerit of these feeders is the fact that piece feeding and reception utilizes the same working elements and only feeds a single part at a time, which serves to seriously limit the capacity of the feeding mechanisms.

Besides, these feeders have no provisions for proper positioning of parts in which the irregularity of shape or weight is not pronounced.

These drawbacks are a serious factor in using the above mentioned feeders for stable and reliable feeding of parts to high-speed production lines, such as rotary lines.

Let us examine a case in which individual feeding of parts into an automatic rotary line is done at a 0.5 sec.-stroke.

The centrifugal system of feeding automatic lines (which is most widely used in industry) consists mainly of a feeder which takes an individual part from within a bulk supply, and of a push rod which transfers the part to the receiving element of a rotary conveyor.

Within the length of a full stroke (0.5 sec.) the following operations must take place:

(a) pushing the part forward (assume 0.15 sec.);
(b) resetting of the push rod (assume 0.15 sec.); and
(c) delivery of the isolated part (0.2 sec.).

This example shows that no stable operation of the mechanisms can be achieved under such duty conditions. Moreover, the 0.5 sec./piece rate is far from being the speed limit for a rotary line.

The main purpose of this invention is to design a feeding device which is practially unlimited in capacity while maintaining relatively low operational speeds of the mechanisms.

Another purpose of the invention is to provide an oriented feed of parts having no regular shape or weight.

The purpose of the invention is also to provide for the necessary time interval between an impulse signaling proper position of the part handled and the moment of its re-orientation.

And finally, the purpose of this invention is the construction of a simple and reliable mechanism capable of re-orienting the handled part if necessary.

Solving of these problems can be found in the proposed feeder provided with a rapidly rotating taper disc with a number of feeding chutes, rotation of the disc being in synchronism with a receiving rotary conveyor. The feeder discharges the items (one at a time) which are oriented in the plane of discharge (i.e., in one of two possible positions) and controls the actual position of the part.

Final positioning of the part is done by the rotary conveyor, whose working elements can swing through 180° on reception of the command from the mechanism controlling the actual position of the part.

To provide for a better understanding of our invention by specialists in this field we illustrate the invention by a detailed description of one of the possible applications of the automatic feeder which is constructed in accordance with the invention and is designed for feeding parts, cylindrical caps for galvanic cells in this particular case, into an automatic rotary assembly line.

The description is supported by drawings of which FIG. 1 is a schematic vertical section of the automatic feeder manufactured in accordance with this invention; FIG. 2 a top view of the feeder; FIGS. *3a–3c* fragmentary sectional views showing operation of the separators which provide for delivery of parts one at a time; FIGS. *4a–4c* diagrammatic views showing the process of accurately positioning the parts; FIG. *5a* a top view of the memory unit in a position corresponding to wrong positioning of a part; FIGS. *5b–5d* sectional views taken on lines B—B, C—C and D—D in FIG. *5a*; FIG. *6a* a top view of the memory unit in a position corresponding to a properly positioned part; FIG. *6b* a sectional view on line B—B in FIG. *6a*; and FIGS. *7a* and *7b* side elevational views along arrow A in FIG. 2 showing a portion of the receiving rotary conveyor in positions which correspond to wrong (FIG. *7a*) and to proper (FIG. *7b*) positioning of the part.

Main component parts of the feeder of this invention (FIGS. 1, 2) are as follows:

(a) hopper **1**, which accommodates the parts;

(b) mechanism for feeding parts one at a time from within the hopper, which is set into rotation synchronous to the following rotary units and which consists of housing **2** with horizontal chutes **3**, limiting wall **4**, high-speed rotating taper disc **5**, a system of separators **6**, sensing probe **7** and memory unit **8** (only the disc of this unit is shown in FIG. 1);

(c) receiving rotary conveyor **9** with swivel or rotatable part receiving elements **10**.

The operation of the feeder is as follows:

Manufactured parts are charged into hopper **1**. The centrifugal action of the high-speed rotating taper disc **5** throws the parts against the limiting wall **4**. The parts pass into horizontal chutes **3** and are propelled to the delivery zone. A system of separators **6** provide for the delivery of the parts one at a time during successive vertical movements of the separators.

The following is a detailed description of the operation of the separators which provide an escapement mechanism.

In the position show in FIG. 3*a* stop **11** prevents the parts from falling out of the chute **3**; holder **12** and fixer **13** are in their extreme upper position; horizontal chute **3** is loaded with the parts.

In the position shown in FIG. 3*b*, holder **12** has moved to its lower position in engagement with the leading part to be delivered to temporarily prevent further movement of the part.

Fixer **13** moves to its lower position to engage the second part and prevent movement of the remaining parts in the line and stop **11** moves to its lower position to permit engagement of the receiving elements of the rotary conveyor with the part.

FIG. 3*c* illustrates the moment of interaction between the receiving element of the rotary conveyor and the part to be delivered to the production line and also the transfer of this part. To this end holder **12** moves upward thus releasing the part; stop **11** and fixer **13** remain in the position shown in FIG. 3*b*.

Stop **11**, holder **12**, and fixer **13** are controlled by immovable cams (not shown in the drawing) installed in the mechanism delivering the parts from within the hopper.

The parts may assume two different positions in the horizontal chute **3**, i.e. heads up (right) or heads down (wrong). If a part is not properly positioned upon delivery from the chute (head down) as shown in FIG. 4*a* it is turned through 180°, assuming first intermediate position (FIG. 4*b*) and then the proper position (FIG. 4*c*) for discharging the part to the production line.

In the device of this invention re-orienting of a part is carried out on the rotary conveyor **9** after a definite time interval which is preset by the memory unit **8**.

Checking the part for proper orientation is done by the sensing probe **7** which is located adjacent the point of discharge of parts from the hopper. The probe is movable vertically so as to engage the part in proper or improper position prior to discharge. If a part happens to be properly positioned, engagement of the probe **7** with the part serves to actuate microswitch **7***a*, which sends an impulse to the memory unit **8**.

The memory unit (FIGS. 5 and 6) consists of disc **14**, fixed to rotating shaft **15** of the mechanism delivering parts from within the hopper; of movable cam **16** actuated by an electromagnet (not shown in the drawing) which, in turn, is controlled by a signal from microswitch **7***a* actuated by the sensing probe **7**, and of lever **17** actuating microswitch **18**.

Disc **14** is provided with perforations, the number of which is equal to the number of positions in the feeder taper disc **5**. Pins **19** are slidably disposed in the perforations and are releasably held in place by balls **20** and springs **21** which provide detents.

The operating principle of the memory unit is as follows: if a part is in improper position, the movable cam **16** assumes a position shown in FIGS. 5*a* and 5*d* above pin **19**, and engages the latter to move the same downwardly to the position shown in FIG. 5*b*.

At the proper moment the lower portion of the pin **19** engages lever **17** (FIG. 5*a*) which actuates microswitch **18**; as a result a signal is sent to the swivel receiving elements **10** of the rotary conveyor **9** and the part is turned through 180°. It will therefore be seen that the pin **19** constitutes and operating means for actuating the switch

18 to actuate the control means **24** for rendering the cam track **23** operative or inoperative.

The immovable cam **22** resets pins **19** to their initial position (FIG. 5*c*).

If the part is in a proper position the movable cam **16** is retracted (see FIG. 6*a*) and pin **19** remains in its initial position. Since the pin **19** is not lowered lever **17** will not move, microswitch **18** is not actuated and no swivel or rotary movement of the receiving elements **10** take place.

Templet or cam track **23** in the rotary conveyor **9** is intended to control the swivel movement or rotation receiving elements **10** of the rotary conveyor **9** whose sense of rotation is indicated by an arrow in FIG. 7.

The templet or cam track **23** is provided with a straight channel **23'** and an inclined channel **23''** and control means in the form of a movable switch block **24**, whereas the receiving elements **10** are connected to pinion **25** which is turned by rack **26** as stem **27** is moved. The stem is provided with roller **28** providing a follower which enters the channels.

If a part is in a proper position, switch block **24** actuated by an electromagnet (not shown in the drawing) connected into the circuit which is controlled by the microswitch **18**, blocks the upper channel (FIG. 7*b*) and the vertical movement of the stem **27** is prevented.

In the case of an improperly positioned part, the switch block **24** closes the lower channel (FIG. 7*a*) and the stem **27** moves vertically and through the rack **26** and pinion **25** rotates the receiving elements **10** of the rotary conveyor to properly orient the part carried thereby.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawings and described in the specification but only as indicated in the appended claims.

What we claim is:

1. A device for feeding parts in properly oriented position to an assembly line, said device comprising a hopper for receiving said parts, a rotatable tapered disc in the lower end of said hopper, a chute disposed adjacent the periphery of said disc for receiving parts discharged from said disc by centrifugal force, an escapement mechanism adjacent the discharge end of said chute for causing intermittent discharge of individual parts from said chute, a sensing means adjacent the discharge end of said chute for sensing the orientation of parts discharged from said chute, a rotary conveyor for receiving parts from said chute and transferring the same to said assembly line, said conveyor including a plurality of grippers, each gripper serving to receive and grip an individual part discharged from said chute, each gripper being mounted for rotation to permit turning a part carried thereby through one hundred eighty degrees, rack and pinion means for rotating each gripper, a cam track for actuating said rack, and control means to render said cam track inoperative, and a memory unit operating in timed relationship to the discharge of parts from said chute, said memory unit including operating means for actuating said control means to render said cam track operative or inoperative and means responsive to said sensing means in sensing the orientation of parts discharged from said chute to render said operating means operative or inoperative.

2. A device for feeding parts as defined in claim **1** in which said cam track includes a straight portion and an inclined portion, a follower on said rack received in said track, and said control means comprising a block movable to one position to direct said follower into engagement with said inclined portion to render said cam track operative and movable to another position to prevent engagement of said follower with said inclined portion to render said cam track inoperative.

3. A device for feeding parts as defined in claim **1** in which said memory unit includes a disc rotating in timed

relationship to the discharge of parts from said chute, a plurality of circumferentially spaced pins slidably mounted in said last named disc and movable between an operative and inoperative position, detent means for releasably holding each pin in operative or inoperative position, cam means operative in response to said sensing means in sensing the orientation of parts discharged from said chute to move said pins to operative position in the event a part is improperly oriented, a switch actuated by a pin in operative position to actuate said control means and render said cam track operative, and additional cam means to return said pins from operative to inoperative position.

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ROBERT B. REEVES, *Primary Examiner.*
KENNETH N. LEIMER, *Examiner.*