

# (12) Indian Patent Application

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(71) Applicant(s): L&T TECHNOLOGY SERVICES LIMITED

(72) Inventor(s): Narharilal, Shah Ankit

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(54) Title: A VIBRATION FEEDING APPARATUS FOR FEEDING COMPONENTS

(57) Abstract: A vibration feeding apparatus for feeding components is disclosed. The apparatus includes a receptacle for containing and conveying components. The apparatus further includes an actuation unit coupled to the receptacle. The actuation unit is configured to vibrate the receptacle. The apparatus further includes a mechanical control device comprising a pair of switches. During operation of the apparatus, the actuation unit selectively contacts each of the pair of switches. The mechanical control device is configured to regulate directional displacement of the actuation unit based on selective contact of the actuation unit with each of the pair of switches.

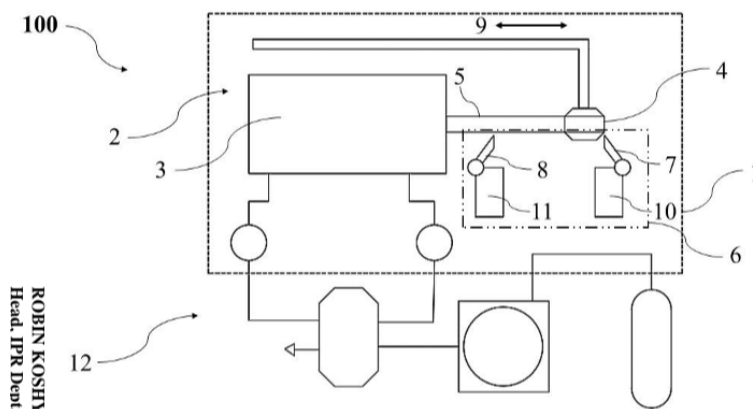


FIGURE 1

ROBIN KOSHY VARGHESE (INPA No. Head, IPR Dept.,

# **FORM 2**

THE PATENTS ACT 1970  
(39 OF 1970)  
&  
The Patent Rules, 2003  
**Complete Specification**  
(See Section 10 and Rule 13)

## **1. TITLE OF THE INVENTION**

**A VIBRATION FEEDING APPARATUS FOR FEEDING COMPONENTS**

## **2. APPLICANT(S)**

(a) NAME : **L&T TECHNOLOGY SERVICES LIMITED**  
(b) NATIONALITY : **INDIAN**  
(c) ADDRESS : **DLF IT SEZ Park, 2<sup>nd</sup> Floor – Block 3,  
1/124, Mount Poonamallee Road, Ramapuram,  
Chennai – 600 089, INDIA.**

## **3. PREAMBLE TO THE DESCRIPTION**

**COMPLETE**

The following specification particularly describes the invention and the manner in which it is to be performed.

## **DESCRIPTION**

### Technical Field

[001] This disclosure relates generally to conveyors, and more particularly to vibrating feeders configured to feed components and a control device for vibrating feeders.

## **BACKGROUND**

[002] Vibratory feeders are compact sized conveyors structured to contain and convey materials and components at a predetermined feed rate, so as to realize automatic feeding operation. Vibratory feeders are generally employed in conveying applications such as, but not limited to, industrial production/assembly lines, that require continuous feed of components at predetermined rate. Vibratory feeders are generally classified into linear feeders and rotary feeders (also called as bowl feeders). Linear feeders are used in applications requiring horizontal conveying of components from one end to another end. Rotary feeders include customized bowls and are used in applications requiring feeding of components in specific orientation. Vibratory feeders generally include elements such as, but not limited to, a trough or bowl for containing components, at least one hopper for supplying components to the trough or bowl, and a vibration generation module for imparting vibration to the trough or the bowl. The vibration generation module is a controlled vibratory force generation unit configured to vibrate the trough or bowl at predefined frequency. A typical vibration generation module includes an electromagnet configured to impart vibration to the trough or bowl at the predefined frequency. Components conveyed by vibratory feeders also include electronic components such as a microchip (also called a chip, a computer chip, an integrated circuit, or IC), transistors, capacitors, inductors, resistors, diodes, and the like. Said electronic components may be subjected to electromagnetic interference, during operation of the electromagnetic solenoid for imparting vibrations. Electromagnetic interference may cause degradation of such components. Another drawback associated with employing electrical means for generating vibrations and for controlling operation of the vibrating feeder is that of fire hazard in hazardous environments such as but not limited to, clean rooms, access-controlled areas and the like.

[003] Therefore, there is a need for vibrating feeders that are configured to operate without requirement of any electrical means for generating vibration as well as for controlling operation of the vibrating feeder and without electromagnetic interference. There is a further need for reducing fire hazard risks associated with vibrating feeders in hazardous zones.

## **SUMMARY OF THE INVENTION**

**[004]** In an embodiment, a vibration feeding apparatus for feeding components is disclosed. The vibration feeding apparatus (referred to as the 'apparatus' hereinafter) includes a receptacle for containing and conveying components. The apparatus further includes an actuation unit coupled to the receptacle. The actuation unit is configured to vibrate the receptacle. The apparatus further includes a mechanical control device comprising a pair of switches. During operation of the apparatus, the actuation unit selectively contacts each of the pair of switches. The mechanical control device is configured to regulate directional displacement of the actuation unit based on selective contact of the actuation unit with each of the pair of switches.

**[005]** In an embodiment, the actuation unit is a fluid actuation unit, and the pair of switches are fluid limit switches. The actuation unit is a pneumatic actuation unit, and the pair of switches are pneumatic limit switches. The actuation unit includes an actuator and a force transmitting member secured to an end of an output shaft of the actuator. The force transmitting member is structured to selectively contact at least a portion of the receptacle for imparting vibrations to the receptacle. Further, the mechanical control device is configured to regulate directional displacement of the force transmitting member between a forward stroke and a return stroke for imparting vibrations to the receptacle.

**[006]** In an embodiment, the pair of switches include a first switch and a second switch. The first switch is configured to regulate directional displacement of the force transmitting member in the forward stroke. The second switch is configured to regulate directional displacement of the force transmitting member in the return stroke. The mechanical control device comprises a pilot valve coupled to each of the pair of switches. The pilot valve is configured to generate a pilot signal upon selective engagement of each of the pair of switches with the actuation unit. The pilot signal generated by the pilot valve eliminates possibility of electrical interference during operation of the apparatus. The apparatus also includes a fluid control circuit fluidly coupled to the mechanical control device. The fluid control circuit is configured to receive the pilot signal generated by the pilot valve, for regulating operation of the actuation unit. The fluid control circuit includes one or more flow control valves and directional control valves configured to regulate operation of the actuation unit.

## BRIEF DESCRIPTION OF THE DRAWINGS

[007] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles.

[008] **FIG. 1** illustrates a schematic diagram of a vibration feeding apparatus for feeding components, in accordance with an embodiment of the present disclosure;

[009] **FIG. 2** illustrates a schematic layout of the apparatus of FIG. 1, including fluid control circuit, in accordance with an embodiment of the present disclosure;

[010] **FIG. 3** illustrates a schematic diagram of the vibration feeding apparatus for feeding components, in accordance with another embodiment of the present disclosure;

[011] **FIG. 4** illustrates a schematic layout of the apparatus of FIG. 3, including fluid control circuit, in accordance with another embodiment of the present disclosure;

## DETAILED DESCRIPTION OF THE DRAWINGS

[012] Exemplary embodiments are described with reference to the accompanying drawings. Wherever convenient, the same reference numbers are used throughout the drawings to refer to the same or like parts. While examples and features of disclosed principles are described herein, modifications, adaptations, and other implementations are possible without departing from the spirit and scope of the disclosed embodiments. It is intended that the following detailed description be considered as exemplary only, with the true scope and spirit being indicated by the following claims. Additional illustrative embodiments are listed.

[013] In an embodiment, a vibration feeding apparatus for feeding components is disclosed. The vibration feeding apparatus (referred to as the ‘apparatus’ hereinafter) includes a receptacle for containing and conveying components. The apparatus further includes an actuation unit coupled to the receptacle. The actuation unit is configured to vibrate the receptacle. The apparatus further includes a mechanical control device comprising a pair of switches. During operation of the apparatus, the actuation unit selectively contacts each of the pair of switches. The mechanical control device is configured to regulate directional displacement of the actuation unit based on selective contact of the actuation unit with each of the pair of switches.

[014] The term ‘components’ as used herein refers to at least one of an article, a part, a workpiece, a product (finished/unfinished), material, granular material, stock, goods, packages, and the like, that

needs to be transported from one location to another. The term ‘components’ as used herein also includes electronic components such as, but not limited to, a microchip (also called a chip, a computer chip, an integrated circuit, or IC), transistors, capacitors, inductors, resistors, diodes, and the like. Although the apparatus of the present disclosure is described in the context of being employed in a manufacturing facility, and the component being described as an electronic component, such description is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternative falling within the scope of the disclosure.

**[015]** Referring now to **FIG.1**, a schematic diagram of a vibration feeding apparatus 100 for feeding components, is illustrated, in accordance with an embodiment of the present disclosure. As will be understood, the apparatus 100 is configured to feed components at a predetermined feed rate. In an embodiment, the apparatus 100 includes a receptacle 1 for containing and conveying components. The term ‘receptacle’ as used herein refers to a container, a tray, a trough, a holder, a pan, a bowl, and the like, that is structured to contain and convey components.

**[016]** In an embodiment, the apparatus 100 includes an actuation unit 2 coupled to the receptacle 1. The actuation unit 2 is configured to vibrate the receptacle 1. The actuation unit 2 may be configured to vibrate the receptacle 1 by imparting motion (displacement) to the receptacle 1. The actuation unit 2 may be configured to produce at least one of a linear motion, a rotary motion, and a reciprocating motion, of the receptacle 1. The actuation unit 2 is a fluid actuation unit. The actuation unit 2 may be at least one of a pneumatic actuation unit and a hydraulic actuation unit.

**[017]** In an embodiment, the actuation unit 2 includes an actuator 3 and a force transmitting member 4. The force transmitting member 4 is secured to an end of an output shaft 5 of the actuator 3. The force transmitting member 4 is structured to selectively contact at least a portion of the receptacle 1 for imparting vibrations to the receptacle 1. In an embodiment, at least a portion of the receptacle 1 may be mounted on the force transmitting member 4, so as to vibrate the receptacle 1 at a predefined frequency. In an embodiment, the force transmitting member 4 may be structured to selectively engage with at least a portion of the receptacle 1, so as to vibrate the receptacle 1 at the predefined frequency. In an embodiment, a base portion of the receptacle 1 may be supported and/or mounted on the force transmitting member 4, so as to vibrate the receptacle 1 at the predefined frequency. The force transmitting member 4 is configured to be displaced by the actuator 3, between a forward stroke and a return stroke (as depicted by pointer 9 in Figure 1), for imparting vibrations to the receptacle 1.

[018] In an embodiment, the apparatus 100 includes a mechanical control device 6 (roughly outlined in Figure 1). The mechanical control device 6 is configured to regulate directional displacement of the force transmitting member 4, between the forward stroke and the return stroke (as depicted by pointer 9 in Figure 1), for imparting vibrations to the receptacle 1.

[019] In an embodiment, the mechanical control device 6 includes a pair of switches 7, 8. The pair of switches 7, 8 are fluid limit switches. The term 'limit switch' as used herein refers to a switch that is configured to be operated by a physical force or displacement applied to it by the force transmitting member 4. The pair of switches 7, 8 switches are configured to define the limit of travel of the force transmitting member 4 in the forward stroke and the return stroke, respectively. By limiting the travel of the force transmitting member 4, the pair of switches 7, 8 indirectly limit the travel of the output shaft 5 of the actuator 3, whereby regulating displacement/vibration of the receptacle 1.

[020] In an embodiment, the pair of switches 7, 8 include a first switch 7 and a second switch 8. The first switch 7 is configured to regulate directional displacement of the force transmitting member 4 in the forward stroke. The second switch 8 is configured to regulate directional displacement of the force transmitting member 4 in the return stroke. The mechanical control device 6 further comprises pilot valves 10, 11 coupled to each of the pair of switches 7, 8. A first pilot valve 10 is coupled to the first switch 7. A second pilot valve 11 is coupled to the second switch 8. The pilot valves 10, 11 are configured to generate a pilot signal upon selective engagement of each of the pair of switches 7, 8 with the force transmitting member 4 of the actuation unit 2. In an embodiment, the pilot signal generated by the pilot valves 10, 11 eliminates possibility of electrical interference during operation of the apparatus 100.

[021] In an embodiment, the apparatus 100 includes a fluid control circuit 12 (roughly pointed out in Figure 1) fluidly coupled to the mechanical control device 6. The fluid control circuit 12 is configured to receive the pilot signal generated by the pilot valves 10, 11, for regulating operation of the actuation unit 2. In an embodiment, the fluid control circuit 12 includes one or more flow control valves and directional control valves (depicted in Figure 2 and detailed in description related to Figure 2) configured to regulate operation of the actuation unit 2.

[022] **FIG. 2** illustrates a schematic layout of the apparatus 100 including the fluid control circuit 12 (also referred to as the 'circuit' hereinafter) and the mechanical control device 6 (also referred to as the 'device' hereinafter, as previously shown in Figure 1) that is employed in the apparatus 100 of the present disclosure. Operation and working of the apparatus 100 is described with reference to the schematic layout depicted in Figure 2. The apparatus 100 includes one or more compressed fluid

sources 13 (also referred to as the 'source' hereinafter) configured to provide supply of compressed fluid (either pressurized air or pressurized hydraulic fluid) required for operation of the apparatus 100. Compressed fluid from the source 13 is routed to an FRL unit 14 (including a filter (F), regulator (R), and a lubricator (L), not shown in figures in detail for purpose of simplicity) through a shut-off valve 15. The FRL unit 14 may be configured to regulate pressure of the compressed fluid, to further regulate frequency (vibration frequency) of operation of the receptacle 1. The shut-off valve 15 may be configured to regulate operation of the apparatus 100. The apparatus may be turned ON and OFF by operating the shut-off valve 15.

**[023]** The compressed fluid is further routed to a directional control valve 16. The directional control valve 16 may be a pilot operated directional control valve. The compressed air from the directional control valve 16 is routed to the actuation unit 2 for operation of the actuator 3 and thereby the force transmitting member 4 between a forward stroke and a return stroke (as depicted by pointer 9 in Figures 1 and 2), for imparting vibrations to the receptacle 1. The compressed air from the directional control valve 16 is routed to the actuation unit 2 via flow control valves 17, 18. Supply of the compressed air via first flow control valve 17 operates the actuator 3 in forward stroke. Supply of the compressed air via second flow control valve 18 operates the actuator 3 in return stroke. The pair of switches 7, 8 switches are configured to define the limit of travel of the force transmitting member 4 in the forward stroke and the return stroke, respectively. During operation, the force transmitting member 4 selectively contacts each of the pair of switches 7, 8. During operation, selective contact between the pair of switches 7, 8 and the force transmitting member 4 triggers the pair of switches 7, 8. Upon such triggering of the pair of switches 7, 8, a pilot signal is generated by the pilot valves 10, 11 coupled to the pair of switches 7, 8. The pilot signal generated by the pilot valves 10, 11 is received by the directional control valve 16, for regulating operation of the actuation unit 2, between the forward stroke and the return stroke.

**[024]** In an embodiment, the pair of switches 7, 8 may be mechanical limit switches. Operation frequency i.e., speed of actuation of the output shaft 5 of the actuator 3 may be independently controlled by operation of the flow control valves 17, 18. In an embodiment, the pilot valves 10, 11 and the directional control valve 16, may include one or more silencers 19 for reducing noise generated by exhaust of pressurized fluid from the pilot valves 10, 11 and the directional control valve 16.

**[025]** Referring now to **FIG. 3**, a schematic diagram of another embodiment of the vibration feeding apparatus 100, is illustrated, in accordance with an embodiment of the present disclosure.

The apparatus 100 depicted in Figure 3 is customized for a rotary feeder (also called as bowl feeder), whereas the apparatus 100 depicted in Figure 1 is customized for linear feeder. Accordingly, the receptacle 1 of the Figure 3 is in form of a bowl and includes two actuation units 2, 2', for producing rotary displacement of the receptacle 1. In an embodiment, the two actuation units 2, 2' may be replaced by a single actuation unit that is configured with special mechanical arrangements for producing rotary displacement of the receptacle 1.

**[026]** Referring now to **FIG. 4**, a schematic layout of the apparatus 100 including the fluid control circuit 12 (also referred to as the 'circuit' hereinafter) and the mechanical control device 6 (also referred to as the 'device' hereinafter, as previously shown in Figure 1) that is employed in the apparatus 100 (for rotary feeder embodiment) is illustrated. Same reference numbers represent same features depicted in Figures 1 and 2. Operation and working of the apparatus 100 of Figures 3 and 4 is similar to that of operation and working of the apparatus 100 of Figures 1 and 2. However, the apparatus 100 of Figure 3 and 4 includes fluid lines that are branched out (depicted at points 20 and 21 in Figure 4) from a single/primary fluid line for supplying pressurized fluid to the pair of actuation units 2, 2'. Such configuration of the fluid lines allows synchronized control of the pair of actuation units 2, 2', for imparting rotary displacement to the actuators 3. Further, such configuration of the fluid lines also eliminate requirement of additional flow control valves and directional control valve for regulating operation of the pair of actuation units 2, 2'. However, in an embodiment, the pair of actuation units 2, 2' may have independent control, by employing additional flow control valves and directional control valves.

**[027]** In an embodiment, the pair of actuation units 2, 2' may be configured to impart displacement to opposite ends of the receptacle 1 (bowl), whereby imparting rotary displacement to the receptacle 1. Accordingly, as illustrated in Figure 4, the pair of actuation units 2, 2' may be positioned relatively opposite to each other, for imparting displacement to opposite ends of the receptacle 1 (bowl). Alternatively, in another embodiment, the pair of actuation units 2, 2' may be positioned in any other suitable orientation (that is, not relatively opposite to each other), for imparting displacement to opposite ends of the receptacle 1 (bowl).

**[028]** In an embodiment, the actuation units 2, 2' may also be an electric actuation unit. In an embodiment, operation of the apparatus 100 and the components included therein may be controlled by a controller. The actuation units 2, 2' may be any actuation unit such as, but not limited to, single acting cylinder type actuation units, double acting cylinders type actuation units, telescoping cylinders type actuation units, and the like.

**[029]** In an embodiment, the actuation units 2, 2' may be configured to suit operational requirement of the apparatus 100, based on parameters such as, but not limited to, stroke length, pressure capacity, type of mechanism-operated cell (MOC) switches required and the like.

**[030]** In an embodiment, the actuation units 2, 2' may be configured to retract through spring loaded mechanism in return stroke and *vice versa*. In an embodiment, the actuation units 2, 2' may be a single acting cylinder type actuation unit, configured to retract through an internal spring loaded mechanism.

**[031]** In an embodiment, the apparatus 100 of the present disclosure is configured to operate without requirement of any electrical means for generating vibration as well as for controlling operation of the feeder. That is, the configuration of the apparatus 100 facilitates operation of apparatus 100 without requirement of electrical components and electric control means. Operation of the apparatus 100 of the present disclosure is entirely regulated by fluid supply and fluid control means, whereby eliminating requirement of electromagnet and the like, for imparting vibration to the receptacle 1. The configuration of the apparatus 100 eliminates possibility of electromagnetic interference, whereby making the apparatus 100 suitable for feeding electronic components such as, but not limited to, a microchip (also called a chip, a computer chip, an integrated circuit, or IC), transistors, capacitors, inductors, resistors, diodes, and the like, that are sensitive to electromagnetic interference. Furthermore, fire hazard and explosion risks in hazardous environments, associated with employing electrical means for generating vibrations and for controlling operation of the feeder is reduced by the configuration of the apparatus 100.

**[032]** It is intended that the disclosure and examples be considered as exemplary only, with a true scope and spirit of disclosed embodiments being indicated by the following claims.

## CLAIMS

### We Claim:

1. A vibration feeding apparatus (100) for feeding components, the vibration feeding apparatus (100) comprising:
  - a receptacle (1) for containing and conveying components;
  - an actuation unit (2) coupled to the receptacle (1), the actuation unit (2) configured to vibrate the receptacle (1); and
  - a mechanical control device (6) comprising a pair of switches (7, 8), wherein the actuation unit (2) selectively contacts each of the pair of switches (7, 8) and wherein the mechanical control device (6) is configured to regulate directional displacement of the actuation unit (2) based on selective contact of the actuation unit (2) with each of the pair of switches (7, 8).
2. The vibration feeding apparatus (100) as claimed in claim 1, wherein the actuation unit (2) is a fluid actuation unit, and wherein the pair of switches (7, 8) are fluid limit switches.
3. The vibration feeding apparatus (100) as claimed in claim 1, wherein the actuation unit (2) is a pneumatic actuation unit, and wherein the actuation unit (2) comprises an actuator (3) and a force transmitting member (4) secured to an end of an output shaft (5) of the actuator (3).
4. The vibration feeding apparatus (100) as claimed in claim 3, wherein the force transmitting member (4) is structured to selectively contact at least a portion of the receptacle (1) for imparting vibrations to the receptacle (1).
5. The vibration feeding apparatus (100) as claimed in claim 1, wherein the mechanical control device (6) is configured to regulate directional displacement of the force transmitting member (4) between a forward stroke and a return stroke for imparting vibrations to the receptacle (1).
6. The vibration feeding apparatus (100) as claimed in claim 1, wherein the pair of switches (7, 8) are pneumatic limit switches and wherein the pair of switches (7, 8) comprise:
  - a first switch (7) configured to regulate directional displacement of the force transmitting member (4) in the forward stroke; and
  - a second switch (8) configured to regulate directional displacement of the force transmitting member (4) in the return stroke.

7. The vibration feeding apparatus (100) as claimed in claim 1, wherein the mechanical control device (6) comprises a pilot valve (10, 11) coupled to each of the pair of switches (7, 8), and wherein the pilot valve (10, 11) is configured to generate a pilot signal upon selective engagement of each of the pair of switches (7, 8) with the actuation unit (2).
8. The vibration feeding apparatus (100) as claimed in claim 1, comprises a fluid control circuit (12) fluidly coupled to the mechanical control device (6), wherein the fluid control circuit (12) is configured to receive the pilot signal generated by the pilot valve (10, 11), for regulating operation of the actuation unit (2).
9. The vibration feeding apparatus (100) as claimed in claim 8, wherein the fluid control circuit (12) comprises one or more flow control valves (17, 18) and directional control valves (16) configured to regulate operation of the actuation unit (2).
10. The vibration feeding apparatus (100) as claimed in claim 7, wherein the pilot signal generated by the pilot valve (10, 11) eliminates possibility of electrical interference during operation of the apparatus (100).

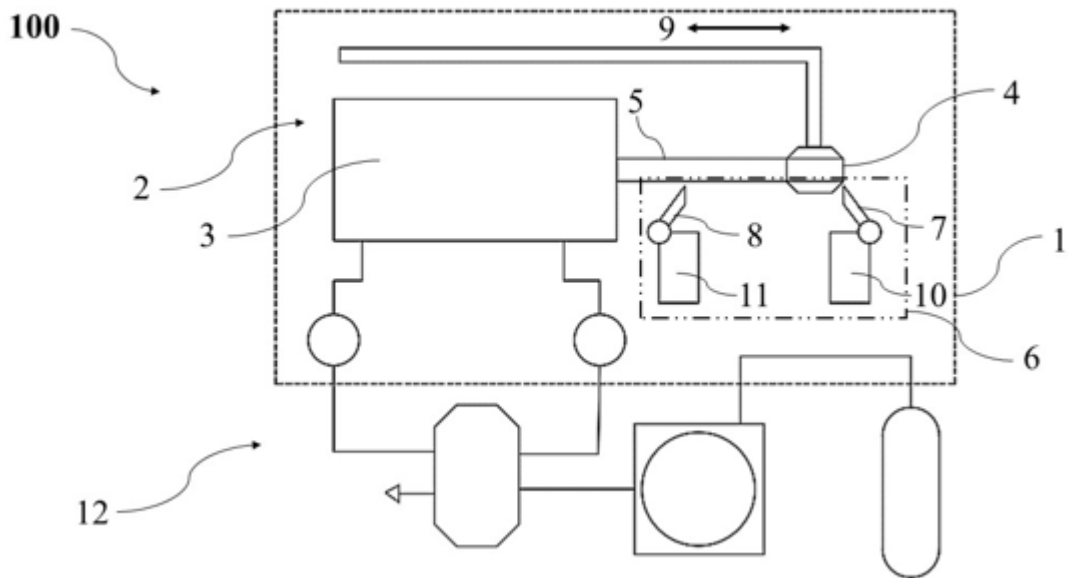
**Dated this 18<sup>th</sup> Day of March 2022**

**Robin Koshy Varghese (INPA No: 3705)**  
**Head, IPR Dept.**  
**L&T Technology Services Ltd.**  
**DLF 3rd Block, 2nd Floor,**  
**Manapakkam, Chennai - 600089.**

# A VIBRATION FEEDING APPARATUS FOR FEEDING COMPONENTS

## ABSTRACT

A vibration feeding apparatus for feeding components is disclosed. The apparatus includes a receptacle for containing and conveying components. The apparatus further includes an actuation unit coupled to the receptacle. The actuation unit is configured to vibrate the receptacle. The apparatus further includes a mechanical control device comprising a pair of switches. During operation of the apparatus, the actuation unit selectively contacts each of the pair of switches. The mechanical control device is configured to regulate directional displacement of the actuation unit based on selective contact of the actuation unit with each of the pair of switches.



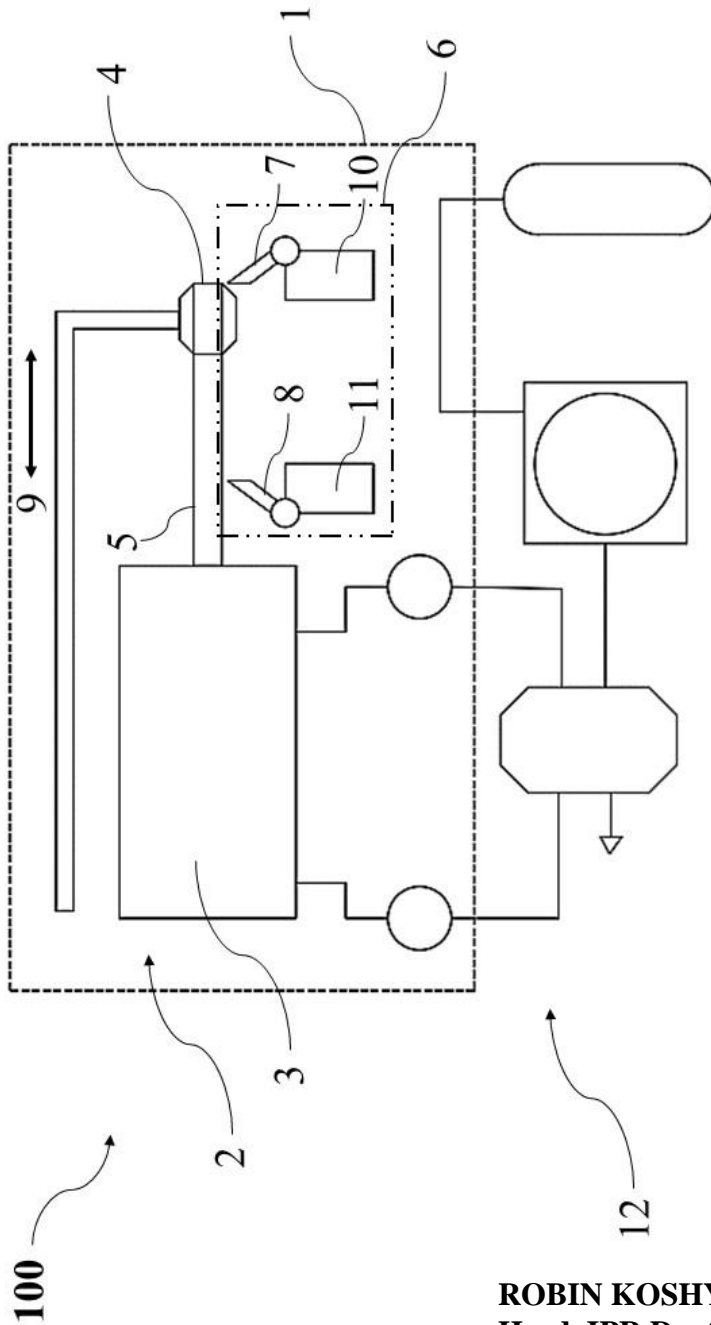


FIGURE 1

**ROBIN KOSHY VARGHESE (INPA No.: 3705)**  
Head, IPR Dept.,  
L&T Technology Services Limited,  
DLF 3rd Block, 2nd Floor,  
Manapakkam, TN, Chennai - 600 089.

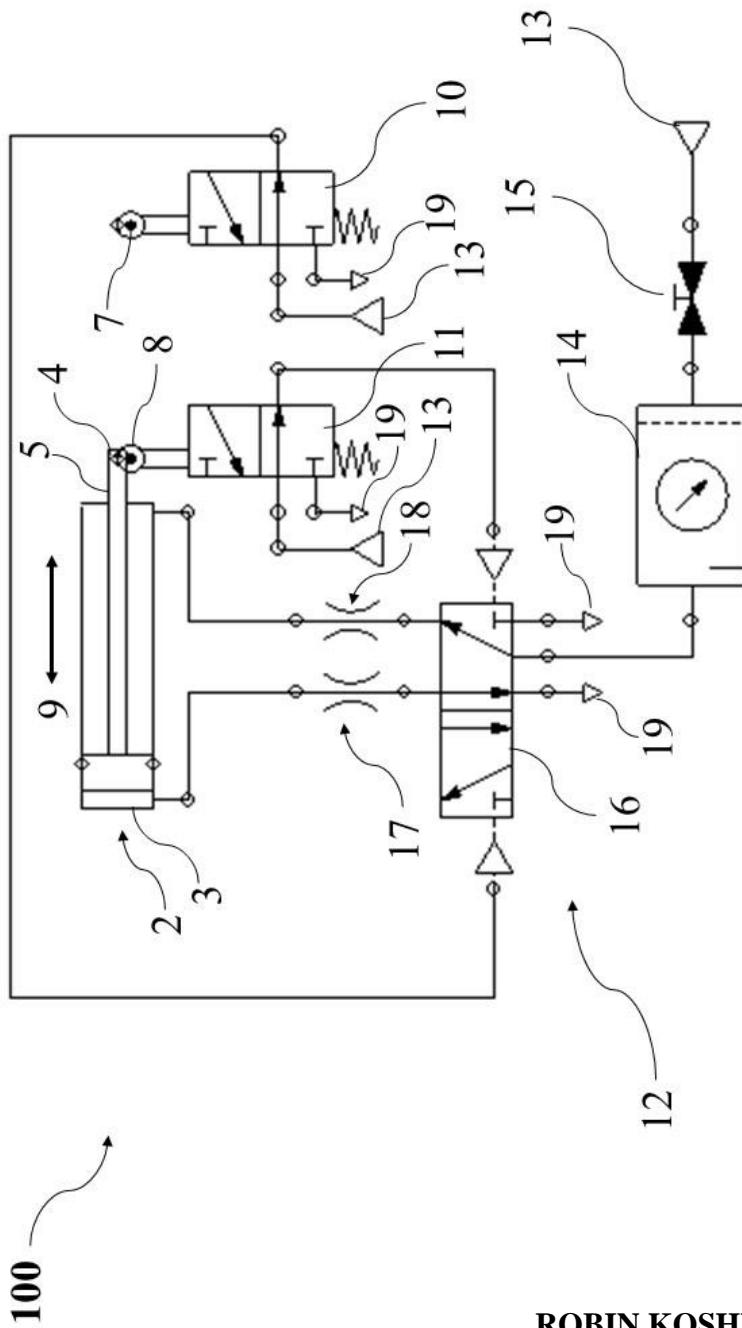
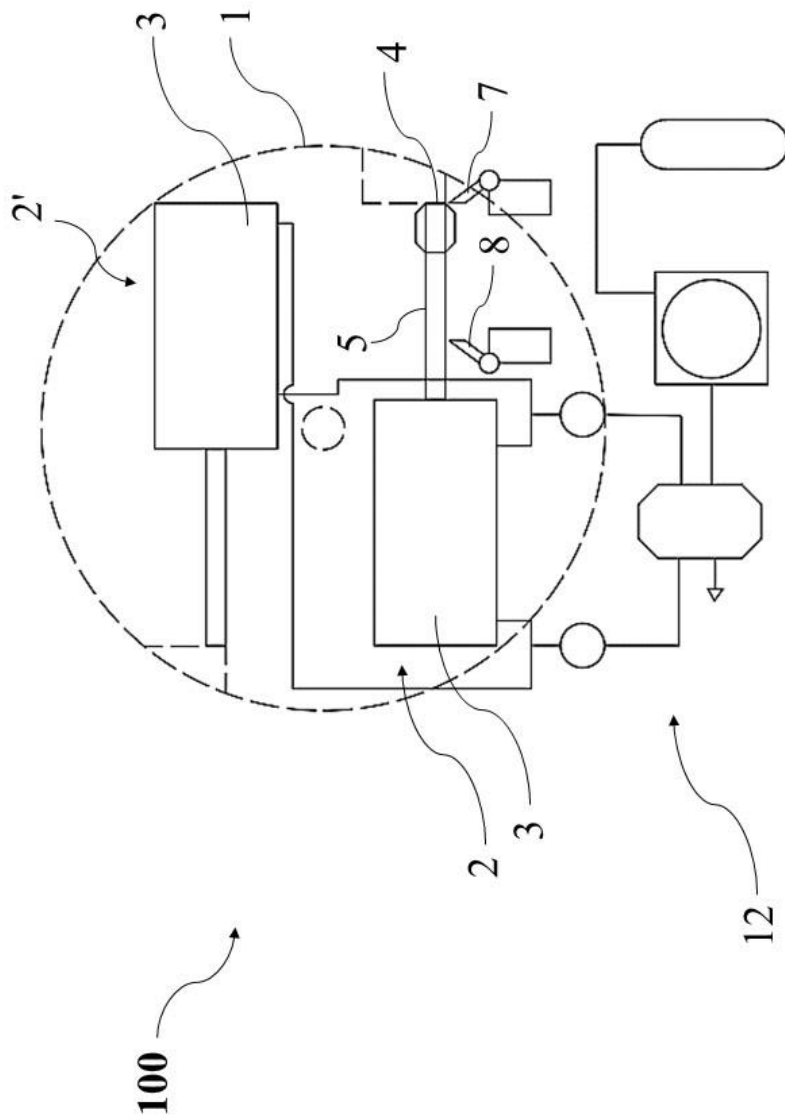


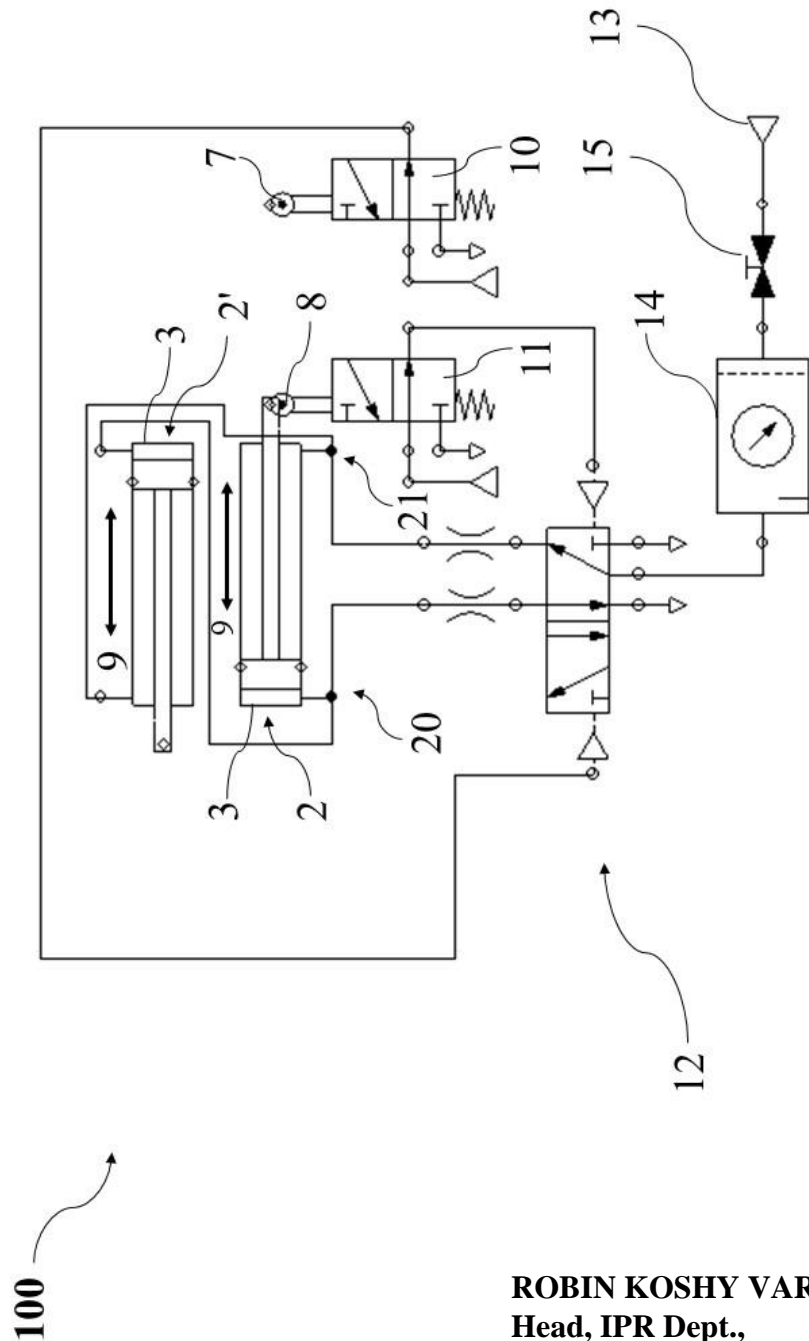
FIGURE 2

ROBIN KOSHY VARGHESE (INPA No.: 3705)  
Head, IPR Dept.,  
L&T Technology Services Limited,  
DLF 3rd Block, 2nd Floor,  
Manapakkam, TN, Chennai - 600 089.



**FIGURE 3**

**ROBIN KOSHY VARGHESE (INPA No.: 3705)**  
Head, IPR Dept.,  
L&T Technology Services Limited,  
DLF 3rd Block, 2nd Floor,  
Manapakkam, TN, Chennai - 600 089.



**FIGURE 4**

**ROBIN KOSHY VARGHESE (INPA No.: 3705)**  
Head, IPR Dept.,  
L&T Technology Services Limited,  
DLF 3rd Block, 2nd Floor,  
Manapakkam, TN, Chennai - 600 089.