June 4, 1968 G. N. WILLIS 3,386,297

MOTION CONVERSION MECHANISM

Filed May 23, 1966

Fig. 1

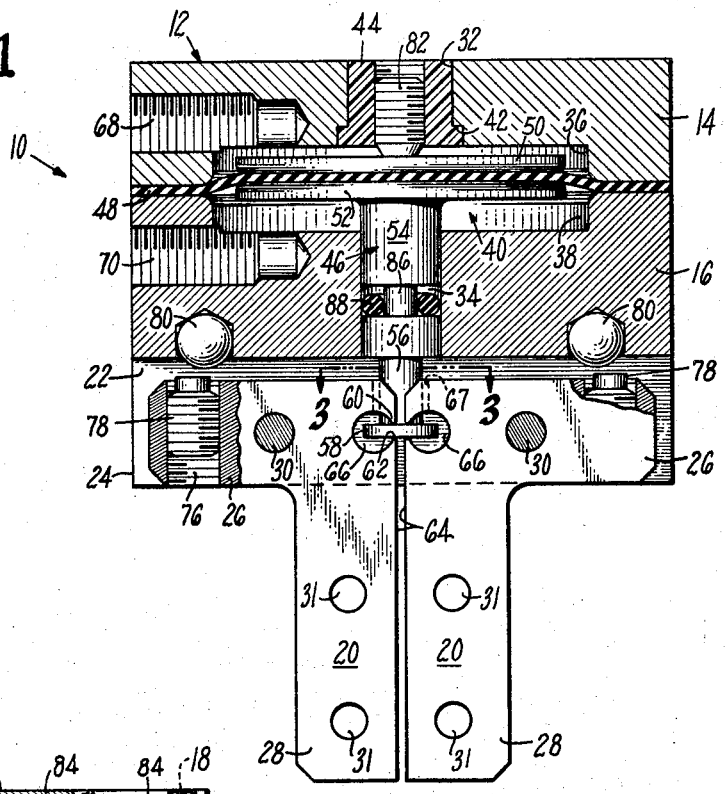
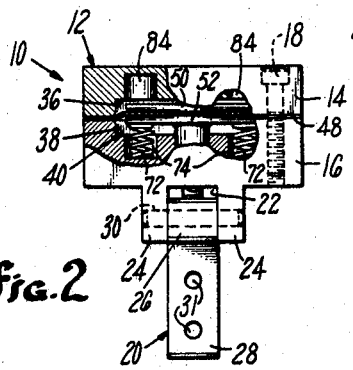


Fig. 2



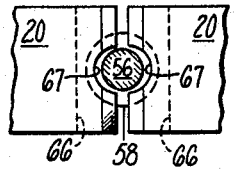


Fig. 3

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MOTION CONVERSION MECHANISM

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ABSTRACT OF THE DISCLOSURE

Mechanism comprising a housing, a pair of cooperating levers supported on the housing for pivotal movement about fixed pivot axes, and a reciprocable center drive member mounted in the housing and held captive between a pair of spaced opposed knife edge portions formed on the levers to effect line contact engagement therewith for providing a low friction drive for pivoting said levers.

This invention generally relates to motion conversion mechanisms and particularly concerns a mechanism usable, e.g., with automatic feeding equipment in handling articles.

A principal object of the invention is to provide an improved motion conversion mechanism particularly suited for high speed handling of small parts such as miniaturized electronic components that are difficult to handle.

Another object of the invention is to provide an improved mechanism which may be incorporated in both new and existing article handling equipment and which is useful in manipulaitng parts of varying size and shape in a high speed production operation.

A further object of the invention is to provide an improved mechanism of the above described type which is of compact construction having a minimum number of parts and which is fast and durable in operation for use over extended periods of time.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth, and the scope of the application which will be indicated in the appended claims.

In the drawing:

FIG. 1 is a front elevational view, partly in section and partly broken away, showing a preferred embodiment of a motion conversion mechanism constructed in accordance with this invention;

FIG. 2 is a side elevational view, partly in section and partly broken away, showing the mechanism of FIG. 1 on a reduced scale; and

FIG. 3 is a section view, partly broken away, taken generally along line 3—3 of FIG. 1.

Referring now to the drawing in detail, a motion conversion mechanism **10** is shown including a housing **12** having an upper base member **14** and a lower body member **16**, the base and body members **14**, **16** preferably being rectangular in shape and releasably secured by bolts such as at **18**.

A pair of levers **20** are supported on the lower body member **16** for pivotal movement in a bottom slot **22** defined by a pair of ribs **24**. Each lever **20** is of L-shape having perpendicular integral arm portions **26** and **28**. Arm portions **26** are each secured, adjacent the juncture with their respective arm portions **28**, by pivot pins **30** supported by the ribs **24** such that the levers **20** are spaced opposed with their arm portions **26** projecting in opposite directions in slot **22**. Arm portions **28** are positioned adjacent one another and project downwardly from the lower body member **16** of the housing **12**.

In the use of the mechanism **10**, the housing **12** is mounted on a supporting structure such as that of a power operated transfer unit of an automatic feeding system, e.g., which is not a part of this invention and is not illustrated. The arm portions **28** are desirably provided with threaded holes as at **31** whereby special fingers, not shown, may be attached for handling a workpiece.

Referring now more particularly to the housing **12**, centrally disposed coaxial passageways **32** and **34** are formed in the base and body members **14** and **16**. The lower end of passageway **32** and the upper end of passageway **34** are respectively provided with shallow cylindrical chambers **36**, **38** positioned in oppositely facing relation and forming an operating cylinder **40** within housing **12**. The lower end of the passageway **32** is enlarged to provide a radial shoulder **42** which assists in fixing a bushing **44** against axial movement upon insertion of the bushing **44** in the passageway **32**.

To operate the levers **20**, a drive member or actuator **46** is centrally mounted in the housing **12** and is shown supported by a diaphragm **48** fixed between the base and body members **14**, **16** to extend transversely across the operating cylinder **40** for flexural movement therein in opposite axial directions. The diaphragm **48** is formed preferably of urethane rubber or other durable resilient material.

A pair of disks **50** and **52** are provided at the head of the actuaotr **46** on opposite sides of the diaphragm **48**, and a rod **54** extends downwardly from the lower disk **52** through the passageway **34** of the lower body member **16**. The disks **50** and **52** each have a diameter slightly less than that of the operating cylinder **40** and are retained in axial alignment with the rod **54** by a screw, not shown, maintaining the actuator **46** in assembled relation as a single unit supported by the diaphragm **48**.

To provide a low friction driving connection between the unitary actuator **46** and the levers **20** which will be highly responsive to flexural movements of the diaphragm **48**, a reduced end portion **56** of rod **54** is provided with a radial end flange **58** held captive by opposing knife edge portions **60** and **62** on an inside edge surface **64** of each lever **20**. The knife edge portions **60**, **62** are formed by a pair of apertures **66** which extend parallel to the pivot axes of the levers **20** and provide oppositely facing slots across their inside edge surfaces **64**. The slots are suitably dimensioned to receive the radial end flange **58** whereby the knife edge portions **60**, **62** provide line contact engagement with the opposite surfaces of the radial end flange **58** and effect a low friction driving connection. The radial end flange **58** extends into the apertures **66** with sufficient clearance to permit a limited reciprocating movement of the rod **54** without binding or interfering with the levers **20**. The levers **20** are shown with their inside edge surfaces **64** closely spaced opposed to one another and having their upper portions relieved at **67** to accommodate the reduced end portion **56** of rod **54** which projects downwardly between the levers **20** from the body member **16**.

The housing **12** includes passages **68** and **70** respectively formed in the base and body members **14** and **16** for communicating with the upper and lower chambers **36**, **38** of the operating cylinder **40**. Passages **68**, **70** both extend radially outwardly from the operating cylinder **40** in the same direction. Such an arrangement permits either passage **68** or **70** to be conveniently connected in a well known manner to a source of pressurized fluid such as compressed air.

In the operation of the specific illustrated embodiment, compressed air is introduced through passage 68 into the upper chamber 36 of the operating cylinder 40 to cause the diaphragm 48 to be thrust downwardly, forcing air under the diaphragm 48 to vent from the lower chamber 38 to atmosphere through the passage 70 as the rod 54 of the actuator 46 forces the levers 20 to pivot into an open position. Upon release of the air pressure in the upper chamber 36, the diaphragm 48 will flex upwardly into the position shown in the drawing under the biasing force of a pair of compression or return springs 72 to pivot the levers 20 into their illustrated closed position and condition the mechanism 10 for a repeat operation. The return springs 72 are seated in compartments 74 formed in body member 16 and extend axially of rod 54 into engagement with the lower disk 52 of the actuator 46.

To handle workpieces of varying size and shape, the mechanism 10 is provided with adjustable stops for selectively limiting the pivotal movement of the levers 20 in opposite angular directions. For this reason, the outer extremities of the arm portions 26 are shown having threaded bores 76 for receiving stop screw 78. The stop screws 78 are engageable with a pair of steel balls 80 staked to the bottom of the body member 16 intermediate the ribs 24 whereby the extent of lever movement in an opening direction may be selectively limited by adjusting the screws 78. The closed position of the levers 20 is adjusted by a stop screw 82 threadably mounted in the opening through the bushing 44 to extend into the upper chamber 36 of the operating cylinder 40 and engage the upper disk 50 of the actuator 46, positively stopping the pivotal movement of the levers 20 toward one another.

To ensure a mechanism 10 of maximum versatility, the base portion 14 of the housing 12 is also provided with compartments 84, similar in structure and function to the above-described compartments 74, such that the separable base and body members 14, 16 of the housing 12 may be disassembled to reverse the position of the return springs 72 relative to the diaphragm 48. Upon reassembly, the pickup device 10 will be adapted for applications wherein the levers 20 are normally open as distinguished from their normally closed condition in the illustrated embodiment. Accordingly, compressed air would then be introduced through passage 70 into the lower chamber 38 of the operating cylinder 40 in opposition to the biasing force of the return springs 72 to cause the actuator 46 to be thrust upwardly to close the levers 20, and the air in the upper chamber will be vented to atmosphere through passage 68. To prevent leakage of compressed air from the lower chamber of the operating cylinder 40 through the bore 34, rod 54 is shown having a necked-down intermediate segments 86 with a surrounding O-ring 88 engaging the wall of the passageway 34 for sealing off the operating cylinder 40 from atmosphere.

It is to be noted that in addition to providing the necessary force for returning the actuator 46, the return springs 72 may be preselected to provide a cushioning effect to counter-balance the driving force of a predetermined operating air pressure. A workpiece may be grasped, e.g., either externally or internally depending on whether the levers 20 are adapted for normally open or normally closed applications, and the force effected by the levers 20 will be acceptable for the intended purpose despite a high speed of operation.

By virtue of the above-described structure, a motion conversion mechanism of maximum utility is provided in a compact durable unit incorporating a minimum number of parts. Moreover, the described mechanism is highly responsive to actuation so as to be capable of completing a large number of accurate operations in a short period of time. In addition to being of notable use in a variety of high speed production operations, the described invention is particularly suited for transferring small parts that are normally difficult to handle.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above-described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. A motion conversion mechanism comprising a housing, a pair of opposed cooperating levers supported on said housing for pivotal movement toward and away from one another, said levers each being contoured to provide a pair of spaced opposed knife edge portions, and a reciprocable center drive member mounted in said housing and positioned between said levers, said center drive member being connected to each of said levers intermediate their pivot axes and being held captive between said knife edge portions on each of said levers in line contact engagement therewith for providing a low friction drive for pivoting said levers toward and away from one another.

2. The mechanism of claim 1 wherein said housing includes an operating cylinder and a passageway extending axially therefrom, and a resilient diaphragm mounted in said housing and extending transversely across said operating cylinder for flexural movement therein, and wherein said center drive member is suported by said diaphragm for reciprocable movement in said passageway in response to flexural movement of said diaphragm for operating said levers.

3. The mechanism of claim 2 further including adjustable stops for selectively limiting the extent of pivotal movement of said levers toward and away from one another.

4. The mechanism of claim 2 wherein said diaphragm divides said operating cylinder into first and second chambers, and wherein said housing includes a supply and exhaust passage formed therein in communication wiith said first chamber for selectively supplying fluid to and exhausting it from the same for controlling flexural movement of said diaphragm in said operating cylinder.

5. The mechanism of claim 2 wherein said housing includes separable base and body portions each having a cylindrical compartment therein disposed in oppositely facing relation and defining said operating cylinder, said diaphragm being mounted between said base and body portions and dividing said operating cylinder into first and second chambers, and wherein a fluid passage is formed in each of said base and body portions in communication with its respective cylindrical compartment for supplying fluid to and exhausting it from said first and second chambers of said operating cylinder alternatively.

6. The mechanism of claim 4 further including a spring received in said second chamber for continuously exerting a spring force on said diaphragm in opposition to the force of fluid pressure acting thereon in said first chamber.

7. The mechanism of claim 5 further including a spring received in one of said first and second chambers for continuously exerting a spring force on said diaphragm in opposition to the force of fluid pressure acting thereon in the other of said first and second chambers.

8. A motion conversion mechanism comprising a housing, a pair of opposed cooperating levers supported on said housing for pivotal movement toward and away from one another, and a reciprocable center drive member mounted in said housing and positioned between said levers, said center drive member being connected to each of said levers intermediate their pivot axes for operating said levers, said levers each being L-shaped and having first and second arm portions, said first arm portions projecting outwardly of said housing for cooperative action, and said second arm portions each having a stop mounted thereon and engageable with said housing, each said stop being adjustable for selectively limiting the extent of pivotal movement of its respective lever away from the other of said levers.

9. A motion conversion mechanism comprising a housing, a pair of opposed cooperating levers each having a pivot pin secured to the housing and providing a fixed pivot axis for supporting said levers on said housing for pivotal movement toward and away from one another about fixed centers, and a reciprocable center drive member mounted in said housing and positioned between said levers, said center drive member being connected to each of said levers intermediate their pivot axes for operating said levers.

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Disclaimer

3,386,297.—*Grant N. Willis*, Bristol, Conn. MOTION CONVERSION MECHANISM. Patent dated June 4, 1968. Disclaimer filed Nov. 13, 1972, by the assignee, *The Arthur G. Russell Company, Incorporated.*

Hereby enters this disclaimer to claim 9 of said patent.

[*Official Gazette February 19, 1974.*]