United States Patent

Baginski et al.

[15] **3,695,148**

[45] **Oct. 3, 1972**

[54] **FLUID-PRESSURE OPERATED THRUSTING AND ROTATING DEVICE**

[72] Inventors: **Albert R. Baginski,** Torrance, Calif.; **David T. Okada,** Piscataway, N.J.; **Edwin O. Stastny,** Hong Kong, United Kingdom

[73] Assignee: **Mattel, Inc.,** Hawthorne, Calif.

[22] Filed: **June 9, 1971**

[21] Appl. No.: **151,403**

Related U.S. Application Data

[62] Division of Ser. No. 780,154, Nov. 29, 1968, Pat. No. 3,599,363.

[52] **U.S. Cl.** **92/92,** 46/44, 60/62.5

[51] **Int. Cl.**.....**F01b 19/00**

[58] **Field of Search** 92/90, 91, 92; 73/410, 428; 46/41, 44, 175; 138/30; 222/206

[56] **References Cited**

UNITED STATES PATENTS

2,212,128	8/1940	Richter	92/90
1,790,659	2/1931	Gillen et al.	138/30
3,453,967	7/1969	Spurlock et al.	92/90 X
3,066,853	12/1962	Landenberger	92/90 X
3,490,733	1/1970	Berthaud	92/92 X
3,494,260	2/1970	Critcher	92/91
3,530,719	9/1970	Altfillisch	73/418

Primary Examiner—Martin P. Schwadron
Assistant Examiner—Ronald H. Lazarus
Attorney—Seymour A. Scholnick

[57] **ABSTRACT**

A thrust element mounted on the inner turn of a spirally-wound band, the spiral expanding lengthwise when pressured air is applied to it.

3 Claims, 4 Drawing Figures

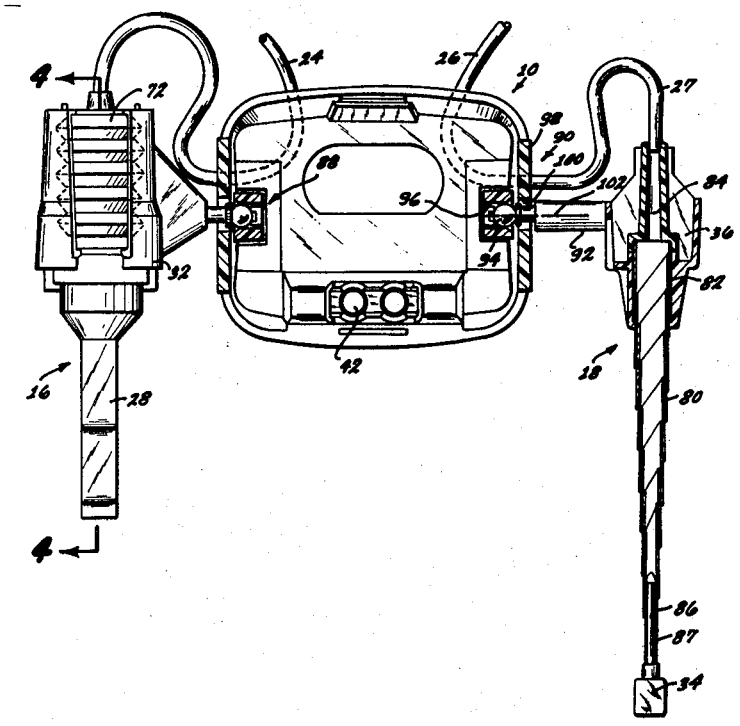


Fig. 3

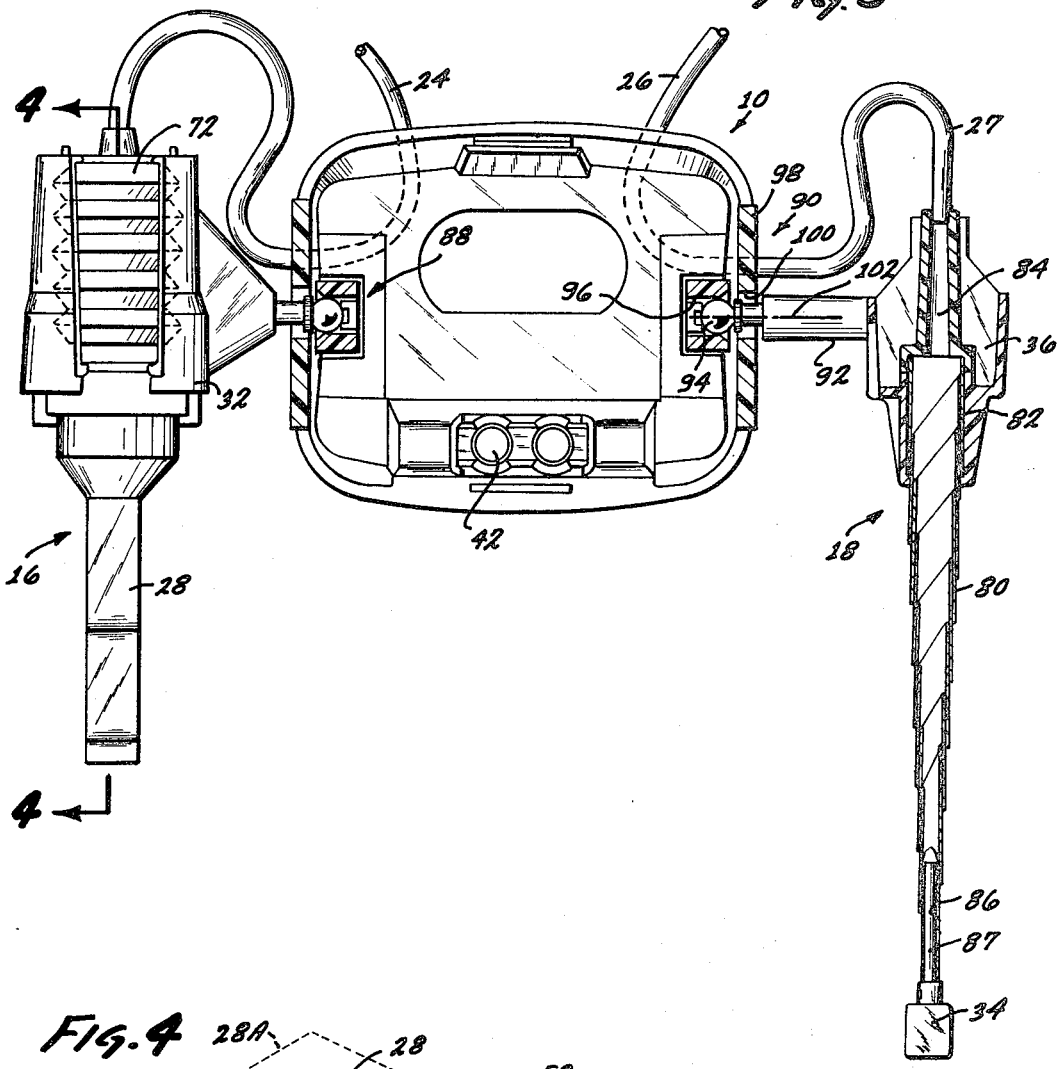
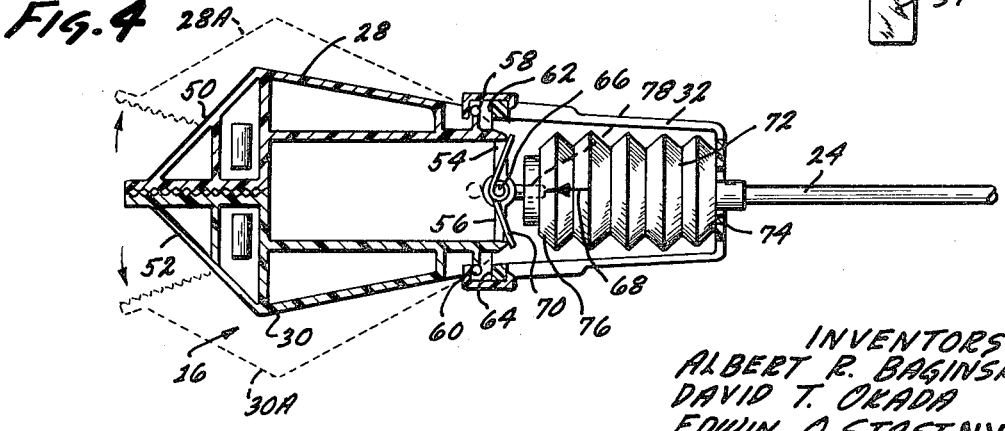


Fig. 4



INVENTORS
ALBERT R. BAGINSKI
DAVID T. OKADA
EDWIN Q STASTNY

BY Mark E. Shirk
ATTORNEY

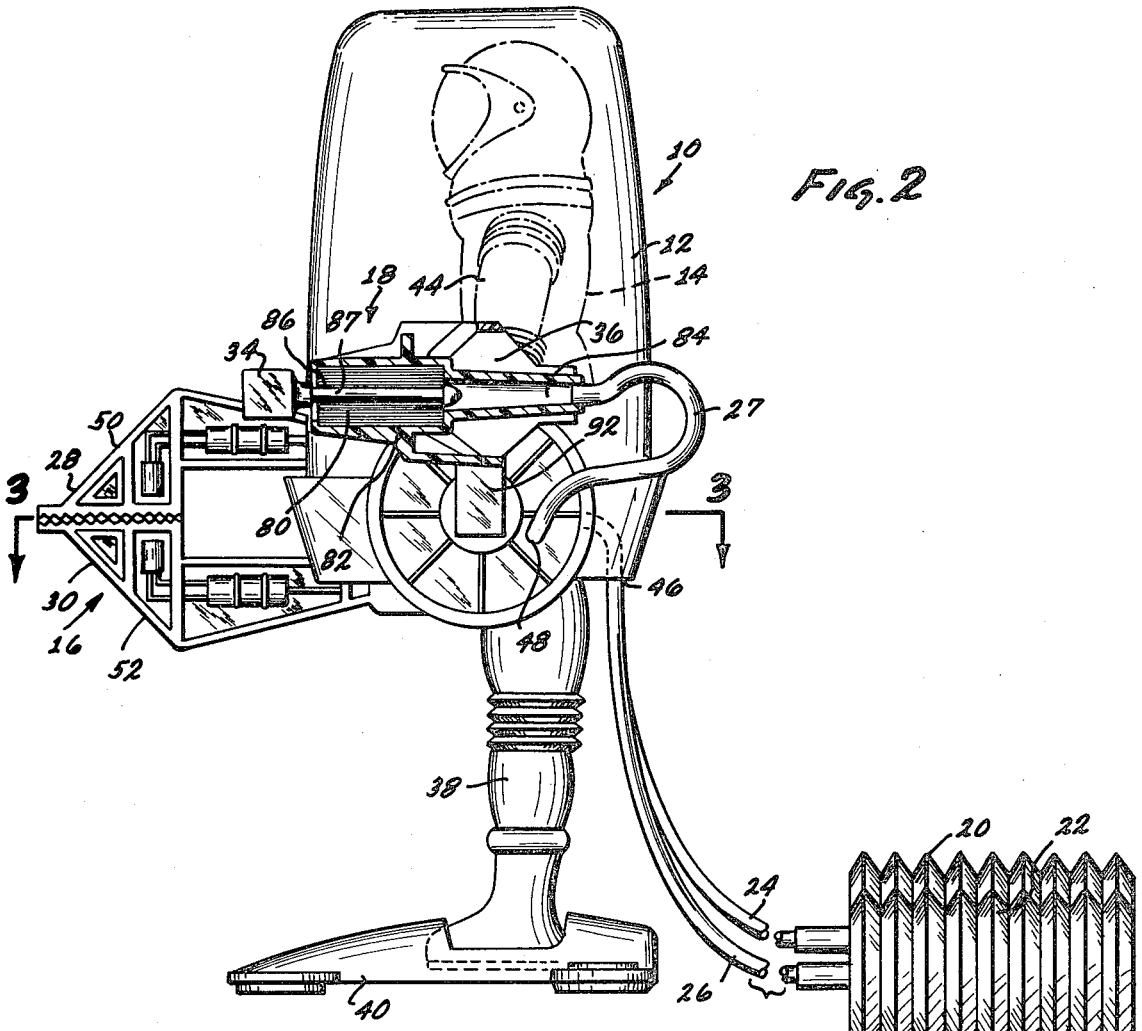


FIG. 2

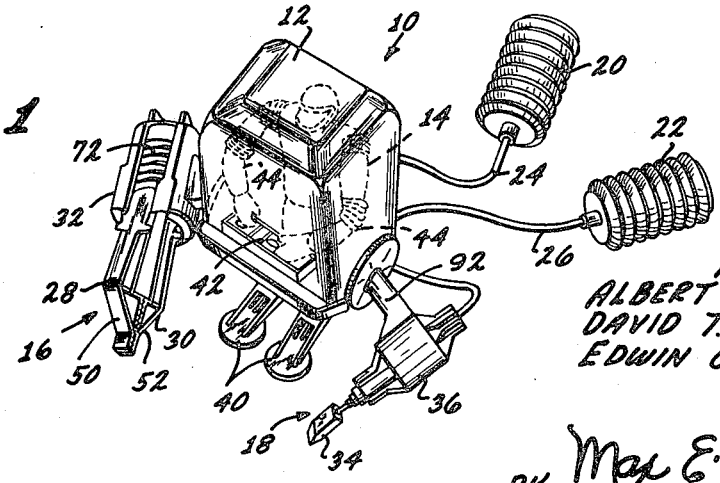


FIG. 1

INVENTORS
ALBERT R. BAGINSKI
DAVID T. OKADA
EDWIN O. STASTNY

BY Max E. Shirk
ATTORNEY

FLUID-PRESSURE OPERATED THRUSTING AND ROTATING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

This application is a division of application, Ser. No. 780,154, filed Nov. 29, 1968, now U.S. Pat. No. 3,599,363.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to pressure operated devices and more particularly to fluid-pressure operated thrusting and rotating devices.

2. Description of the Prior Art

Cylinder-enclosed pistons or bellows have been used as fluid-pressure operated thrusting devices. A simple device of this type which also has a rotating component is desirable.

OBJECTS AND SUMMARY OF THE INVENTION

An object of the present invention is to provide a new and useful fluid-pressure operated thrusting and rotating device.

Still another object is to provide a simple pneumatically powered thrusting apparatus.

For purposes of illustration, but not of limitation, the present invention will be shown and described in connection with an action space toy which includes a capsule for holding an astronaut figure, and tools mounted on the capsule for simulated control by the figure. One tool has a claw that can be opened and closed, while the tool of the present invention has a spade which can be rapidly thrust forward while it rotates. Each tool is pneumatically operated, and receives air pressure pulses from a tube that extends from the space capsule to the tool, to provide the appearance of control by the figure in the capsule. The tubes further extend to air pumps that can be operated by a child to create air pulses that power the tools.

The jaws of the claw tool are pivotally mounted, with ends engaged by a bellows-type cylinder that expands in response to air pulses. The thrusting tool is mounted on the inner turn of a spirally wound band of resilient material, whose outer turn is held by a tool frame. Air pulses applied to the inside of the spiral cause the inner turns to thrust forward and rotate. The thrusting tool is useful not only in toys, but in other applications where a pneumatically operated thrusting apparatus is required.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a prespective view of a toy incorporating a device of the present invention;

FIG. 2 is a side elevation view, partially in section, of the toy shown in FIG. 1;

FIG. 3 is a sectional plan view taken on the line 3—3 of FIG. 2; and

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1, the toy 10 comprises a transparent environmental space capsule 12 which surrounds the upper portion of an astronaut doll FIG. 14.

A pair of tools 16 and 18 are mounted on the space capsule, and a pair of hand pumps 20 and 22 are provided to operate the tools 16 and 18, respectively. The pumps 20 and 22 are connected by tubes 24 and 26, respectively, to the tools 16 and 18. Each tube extends through a portion of the space capsule 12 to provide the appearance that the tools are operated by the astronaut FIG. 14, and also to better support the tubes for strength and neatness.

The tool 16 is a clamping or claw tool which includes two clamping members or jaws 28 and 30 that can open and close to grasp objects. The jaws are pivotally mounted on a tool frame 32 that is mounted on the capsule 12 in a manner that permits it to face in a wide variety of directions.

The other tool 18 is the tool of the present invention and may be considered to be a thrusting tool, which has a spade-like thrusting element 34 that can be thrust forward while it rotates. A supporting thrusting tool frame 36 is also mounted on the capsule 12 in a manner that permits it to thrust out the element 34 in a wide variety of directions.

Also shown in FIG. 2, the astronaut FIG. 14 has legs 38 for supporting itself and the capsule 12, and pads 40 on its shoes for stability. A simulated tool control panel 42 is provided in the capsule, and arms 44 on the figure extend to the panel to indicate operation of the tools by manipulation of panel knobs. A control panel is not necessary, however, to provide the simulated astronaut control of the tools. The air tube 26, which couples the pump 22 to the thrusting tool 18, extends through apertures 46 and 48 in the capsule, so that it appears that the thrusting tool is controlled and powered from the space capsule by the portion 27 of the tube. Corresponding capsule apertures are provided for the other tube 24. Instead of actually projecting through the capsules, however, portions of the tubes could be tied to the outside of the capsule.

As shown in FIG. 4, the jaws 28 and 30 each have an outer jaw portion 50, 25 with serrations, an inner operating end portion 54, 56, and a pivot member 58, 60. The pivot members 58 and 60 are pivotally engaged with bearing slots 62 and 64 on the clamping tool frame 32. The jaws are also pivotally joined together, at a bearing 66 located at the extreme inner ends of the portions 54 and 56. When the bearing point 66 is moved forward in the direction of arrow 68, both jaws are swung open to the positions 28A and 30A. A torsion spring 70, which is looped about the bearing axis 66 and has ends engaged with the jaws, biases the tool to a closed configuration.

The clamping tool is operated by an expandable chamber member 72 of a bellows-like construction. The chamber member, which may be constructed of soft rubber or the like, has an inner end 74 abutting the tool frame. Its opposite end 76 is connected by a rod 78 to the bearing 66 to which the jaws are pivotally joined. When pressured air is received through the tube 24 to expand the chamber member, the bearing 66 is moved forward and the jaws open. When pressure is removed, the chamber member tends to collapse and the jaws close. The spring 70 increases the closing speed to provide a more positive action. The maximum angle of jaw opening is limited by the large-faced end 76 of the chamber member. The end 76 abuts the inner ends 54

and 56 of the jaws when the clamp is opened wide, to prevent further opening.

The thrusting tool 18, which is shown in greater detail in FIG. 3, includes an operating mechanism 80 in the form of a spirally wound band of resilient material such as a film of polyethylene terephthalate. The spiral has several turns, such as nine, and tends to assume a compressed configuration only as long as the width of the band. However, when pressured air is admitted through tube 26 to the inside of the spiral mechanism, the mechanism expands to the elongated configuration shown in FIG. 3. In addition to a thrusting motion, the thrusting element 34 makes several rotations as it moves out or back in.

The operating mechanism 80 has an outer turn 82 fastened to the tool frame 36, at a position about a passageway 84 in the frame that connects to the air tube 26. The inner turn 86 of the mechanism is connected to the thrusting element 34. When pressured air is delivered through the tube 26, the inner turn 86 and its element 34 are thrust forward. In order to reduce air leakage, the band of resilient material is wound into a tight spiral, so the turns are in contact or nearly so even in the elongated configuration. In addition, the thrusting element 34 has a plug 87 which plugs the inside of the inner spiral turn to further reduce air leakage, in addition to serving as the means for attaching the thrusting element to the spiral.

The frames of the clamping and thrusting tools 16 and 18 have couplings 88 and 90 for positioning them in a wide range of directions. For example, the thrusting tool 18 has a connecting member 92 with a ball joint 94 at its end that is engaged with a socket 96 on the capsule. A limit plate 98 on the capsule has a horizontal slot 100 that permits pivoting the tool to the rear and forward, but not up and down. However, the thrusting tool can be rotated about the axis 102 of the ball joint, which allows it to point in a wide range of directions. The thrusting element 34 can represent a digging tool, and it is desirable to allow it to be directed with a downward component so it hits the ground when operated. The coupling 88 of the clamping tool is constructed in a similar manner to allow the tool to face in a wide range of directions.

The thrusting mechanism of the thrusting tool is useful not only in toys but in a variety of applications where a simple pneumatically operated thrusting and rotating mechanism is useful. Among the applications are output devices for pneumatic logic circuits, and a wide range of applications where cylinder-enclosed pistons or bellows have been used. The spiral band has low mass and moves out and back very quickly. A variety of materials such as polyethylene terephthalate and spring steel can be used for constructing the spiral member, and a wide variety of thrusting elements can be mounted thereon for thrusting motion.

Although a particular embodiment of the invention has been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art, and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. Apparatus for converting fluid pressure pulses to mechanical motion comprising:
   - a thin ribbon-like resilient member of substantial width arranged in a closely wound spiral to form a generally cylindrical body;
   - thrust means mounted on the radially inner convolution of said resilient member;
   - means supporting the radially outer convolution of said resilient member; and
   - means for applying pressured air to one axial end of said body to cause the body to elongate axially with the convolutions thereof sliding axially along each other.

2. The apparatus described in claim 1 wherein: said thrust means includes a plug portion disposed in substantially sealing cooperation with the inner convolution of said spiral.

3. A fluid-pressure operated thrusting and rotating device, comprising:
   - an operating mechanism in the form of a spirally-wound band of thin ribbon-like resilient material, said band having a plurality of turns concentrically nested in repose to define a generally cylindrical body and including an inner turn and an outer turn;
   - thrust means mounted on said inner turn; means supporting said outer turn; and means for applying fluid pressure to one axial end of said body to cause the body to elongate axially with the turns thereof sliding axially along each other.

* * * * *