Sept. 27, 1966 H. R. FISCHER ETAL 3,274,903

PISTON MOTOR

Original Filed Oct. 26, 1961 2 Sheets-Sheet 1

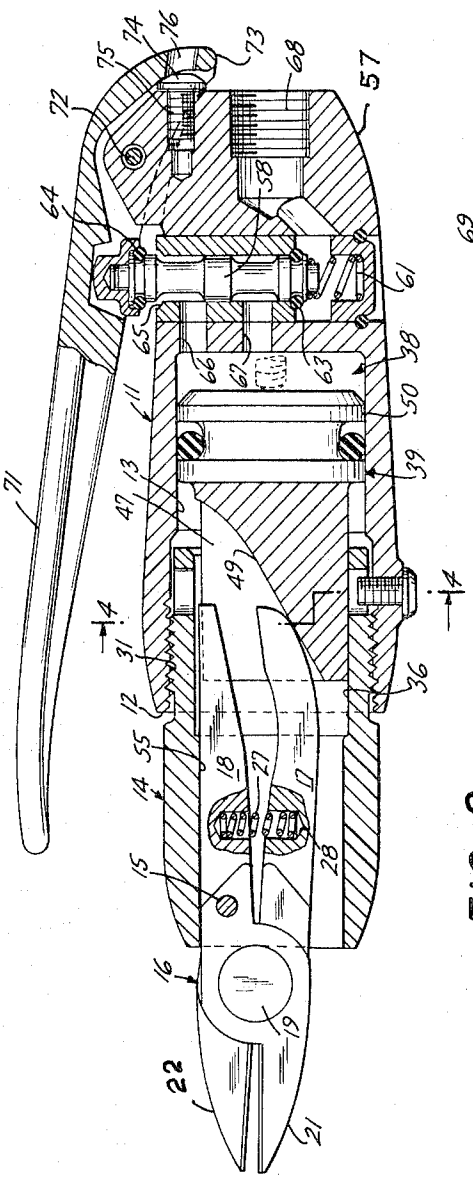


FIG. 1

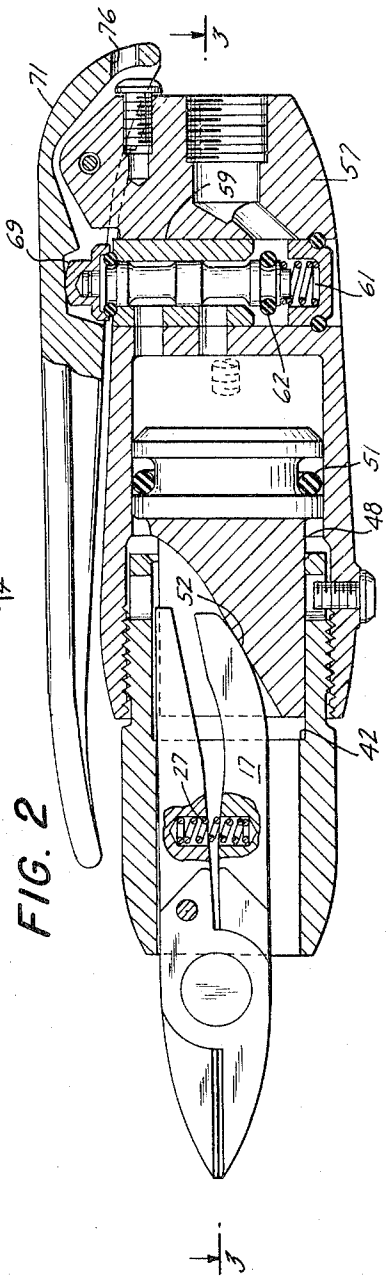


FIG. 2

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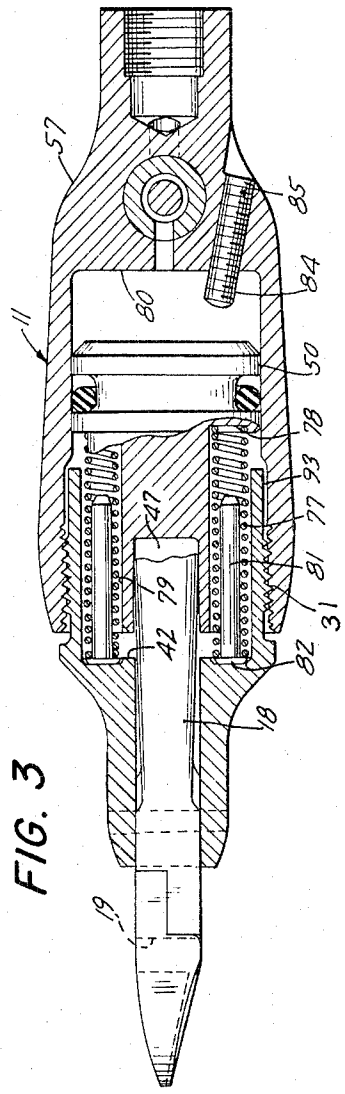


FIG. 3

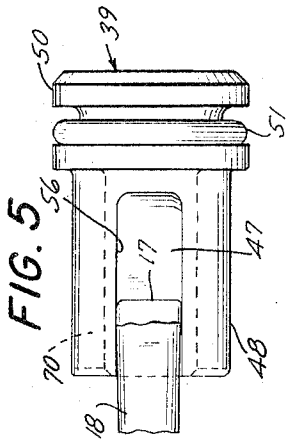


FIG. 5

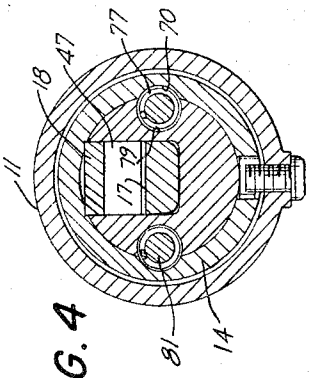


FIG. 4

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3,274,903

PISTON MOTOR

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Original application Oct. 26, 1961, Ser. No. 147,956, now Patent No. 3,177,583, dated Apr. 13, 1965. Divided and this application Feb. 2, 1965, Ser. No. 429,768
2 Claims. (Cl. 92—13)

This application is a division of our pending application bearing Serial Number 147,956, filed October 26, 1961 for a Wire Lead Nipping Tool now Patent No. 3,177,583.

This invention is directed to a piston motor.

The general object of the invention is to provide an improved piston motor which is suitable for use in drawing the jaws of an associated tool together.

A feature of the invention is means for adjusting the length of the piston chamber whereby the length of the piston stroke may be predetermined.

Another feature of the invention is a desirable arrangement of spring means for returning the piston following a work stroke.

A still further feature of the invention lies in the particular construction of the piston motor as having a cam surface, in an arrangement for adjusting the piston stroke, and in means for driving and automatically return the piston whereby the piston motor is subject to a wide variety of applications.

The invention further lies in the particular construction of the components thereof and also in their cooperative association with one another whereby the results intended herein are accomplished.

The foregoing and other objects and advantages of this invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein an embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawings are for purposes of illustration and description, and they are not to be construed as defining the limits of the invention.

The invention is illustrated in association with a nipping wire tool; it is, however, subject to application with other tools such as fastener drivers, connector crimpers, and others.

In the accompanying drawings:

FIG. 1 is a longitudinal section through a nipping tool in which the invention is incorporated and disclosing the piston motor in its normal or returned condition;

FIG. 2 is a view similar to FIG. 1, but showing the tool in operated condition;

FIG. 3 is a plan section taken on line 3—3 of FIG. 2, showing the piston motor in its forward position at the end of a piston stroke;

FIG. 4 is a section taken on line 4—4 of FIG. 1; and

FIG. 5 is a detail in plan of the piston, showing the relation of the terminal portions of the levers of the nipping tool to the piston slot.

Reference is now directed to the accompanying drawings to provide a more detailed understanding of the invention.

The tool shown in the drawings includes a main housing body 11 having a piston chamber 13 in which a cam piston motor 39 works. The chamber 13 is closed at its rear by means of a back head 57; and has an open front end 12 in which is threadedly screwed an open ended cylinder head 14. The cylinder head serves to support a pair of nippers or a nipping element 16. The latter includes a pair of crossed levers 17 and 18 pivotally interconnected intermediately of their ends by means of a pivot pin 19. Each lever terminates at its forward end

in a cutting jaw one of which is designated 21 and the other 22. Rearwardly of the pivot pin 19 the levers 17 and 18 extend rearwardly into the interior of the cylinder head. The nipping element is restrained against endwise movement in the cylinder head by means of a pivot pin 15 extending transversely of the cylinder head and passing through the lever 18. A compression spring 27 seated at its ends in a pair of opposed pockets 28 formed in the levers normally biases the levers apart so that the jaws 21 are normally in open condition as in FIG. 1. The tension of the spring presses the lever 18 against the inner wall 55 of the cylinder head. The other lever 17 has a cam 52 at its terminal end with which the cam piston 39 cooperates in effecting a closing action of the jaws 21 and 22.

The piston 39 includes a cylindrical piston head 50 at its rear which reciprocates in the piston chamber. An O-ring 51 fitted in a peripheral groove of the piston head provides a peripheral seal for the latter in the piston cylinder. The piston further has an elongated cylindrical portion 48 extending forwardly of its head 50 which is provided with a cam slot 47 formed centrally and longitudinally thereof. The terminal ends of both levers 17 and 18 extend into the cam slot. The cam end 52 of the lever 17 extends rearwardly into the cam slot and is held pressed by the tension of the spring 27 upon the lower end of a cam slide 49 defining the bottom of the cam slot. The cam slot has a pair of opposed parallel flat side walls 56 in bearing contact with corresponding sides of the terminal portions of the levers. The cam slot 47 declines downwardly and forwardly of the extension and opens through the forward end of the latter.

It can be seen by reference to FIG. 1 that as the piston moves forwardly, the cam end 51 of lever 17 will ride up the cam slide to pivot lever 17 relative to lever 18 and cause its jaw 22 to fully close upon the jaw 21 of the lever 18; and that the reverse action occurs as the piston moves rearwardly.

The piston is pneumatically driven on its work stroke; and it is spring driven on its return stroke. Manipulative throttle control means arranged in the back head portion 57 of the housing is provided to control flow of pneumatic operating air to the rear of the piston cylinder. This control means includes a throttle slide valve 58 movable in a bushing 59 to control pneumatic flow into and out of the piston cylinder. The throttle valve has a normal condition as in FIG. 1, wherein it is loaded by a spring 61 so that an O-ring 62 seals over an inlet port 63, and an O-ring 64 is clear of a vent port 65; whereby an exhaust orifice 66 of the piston cylinder is vented to atmosphere, and an inlet orifice 67 is sealed off from a pneumatic pressure supply inlet 68. In this normal condition of the throttle valve, the spring 61 acts through the throttle valve and a nosed cap 69 on an external end of the throttle valve to press a manipulative lever 71 clockwise (FIG. 1) about a pivot support 72 so that a curved tail end 73 of the lever 71 abuts against the head 74 of a screw 75 threaded into the back head 57 of the housing.

Manually pressing the lever 71 counter-clockwise (FIG. 2) down upon the cap 69 of the throttle valve will shift the latter to its operative condition wherein the O-ring 64 seals over the vent 65 and the O-ring 62 is clear of the inlet 63. Pressure air will then flow through ports 68 and 67 to the piston chamber to drive the piston forwardly on its work stroke.

The screw 75 may be adjusted as desired outwardly relatively to the back head of the housing. A hole 76 in the tail end of the manually operable lever 71 enables a screw driving tool, such as a hex key, to be applied to a socket in the head of the screw to permit adjustment of the screw. It is clear that as the head of the screw is threaded outwardly it will pivot the lever 71 counter-

clockwise against the throttle valve to cause the latter to move inwardly to a corresponding degree. This arrangement avoids lost motion between the lever **71** and the throttle valve and holds the lever in abutment with the latter.

Spring power provided by a pair of coil spring elements **77** (FIGS. 3 and 4) serves to return the piston to its inoperative position as the throttle valve is released and as the piston cylinder is vented. The spring elements are disposed in parallel relation to each other at diametrically opposite areas of the piston. They are seated at their rear ends on the flat bottoms **78** of a pair of parallel grooves **79** formed longitudinally of opposite areas of the piston extension **48**. The forward ends of the springs extend beyond the front end of the grooves **79**. A guide pin **81** slidably inserted in the forward end of each spring has a flat head **82** which is pressed by the spring against the flat bottom of the shoulder **42** of the cylinder head. Slight peripheral portions of the springs project from the grooves of the cylinder head into shallow complementary guide grooves **70** in the cylinder head **14**. The springs, which are compressed on the work stroke of the piston, act to return the piston as the pressure of air trapped at the rear of the piston cylinder is vented when manual pressure on the lever **71** is relaxed.

At times, it may be desired that the piston have a short stroke. A piston stroke regulating screw **84** is provided. The latter is threadable through an elongated tapped hole **85** of the back head into the rear of the piston cylinder. When the screw is extended into the piston cylinder, it cooperates with the rear end of the piston **39** to limit the extent of the return movement of the latter. The screw bore **85** opens to the outside of the back head whereby access to it may be had by a suitable screw driving tool.

A further advantage is provided by the adjusting screw in that as the screw is extended into the piston chamber it moves the piston forwardly and causes it to cooperate with the cam **52** of lever **17** to draw jaw **22** closer to jaw **21**; and as the screw is backed away or out of the piston chamber it causes the piston to move rearwardly to allow the jaw **22** of lever **17** to move apart from jaw **21**. The further the screw is extended into the piston chamber, the closer will the jaws be drawn to one another; and the further the screw is backed out, the wider apart will the jaws be spread. The limit to which the jaws may be spread apart will be reached when the screw is backed fully out of the piston chamber and the piston is pressed under the load of the return springs against the bottom wall **80** of the piston chamber. This feature enables the jaws to be narrowed by being drawn close together for cutting thin wires or to permit the jaws to be moved between closely spaced wires without interferences; and yet this feature also permits the jaws selectively to be opened wide under different conditions for cutting thicker wires.

A further feature of the invention is provided by a plain extension **93** of the cylindrical portion of the cylinder head beyond the threaded surface **31** of the latter. This facilitates threaded assembly of the cylinder head in the housing **11** relative to the piston without twisting or damaging the return springs **77**. In assembling the cylinder head into the housing, the piston is first inserted through the open end **13** of the housing. The adjusting screw **84** is then threadedly extended into the piston cylinder so as to move the piston forwardly until the front end of the latter is even with the end wall **12**. It is then backed away from the piston head a distance corresponding to one or two of the threads **31**. Next, the headed ends **82** of the spring guide pins **81** are aligned for entry into the guide grooves **70** of the cylinder head; the tail ends of the levers **17** and **18** are aligned with the cam slot **47** of the piston and entered therein as the cylinder head is inserted into the housing to the extent of the plain extension **93** at the rear of the cylinder head. The cylinder head is then rotated a turn or two to engage its threads with those of the housing; the piston is carried about by the tail ends of the levers as this is done. The adjusting screw may then be backed further out to permit the cylinder head to be threaded further into the housing to the extent desired.

What is claimed is:

1. A pneumatic reciprocating motor comprising a housing providing a piston chamber open in its front end, a piston reciprocable therein, a cylinder head screwable to a selective distance into the said front end, compression spring means carried in part by the cylinder head and in part by the piston yieldably urging the piston rearward relative to the cylinder head and housing, fluid pressure means for moving the piston forward with sufficient force to overcome the opposition of said compression spring means, adjustable screw means limiting the rearward position of the piston relative to the cylinder head, and means in the cylinder head engageable with the piston in said limited position enabling rotation of the cylinder head together with the piston as a unit relative to the housing.

2. A pneumatic reciprocating motor comprising a cylinder providing a piston chamber opening through the front end of the cylinder, a cylinder head screwable into the front end of the cylinder for a selective distance, the piston having an extension projecting forwardly and being axially slidable within the cylinder head, the piston extension having a plurality of longitudinal grooves in its outer surface, the cylinder head having in its interior surface a plurality of longitudinal grooves, each registering with and complementing an associated groove on the piston extension, a plurality of helical compression springs, each disposed in a pair of said complementary grooves and interposed between the piston and cylinder head to urge the piston rearwardly, fluid pressure means for moving the piston forward with sufficient force to overcome the opposition of said compression springs, a slot in the piston extension, and means carried by the cylinder head removably engageable with the slot to enable rotation of the cylinder head together with the compression springs and piston as a unit relative to the cylinder.

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