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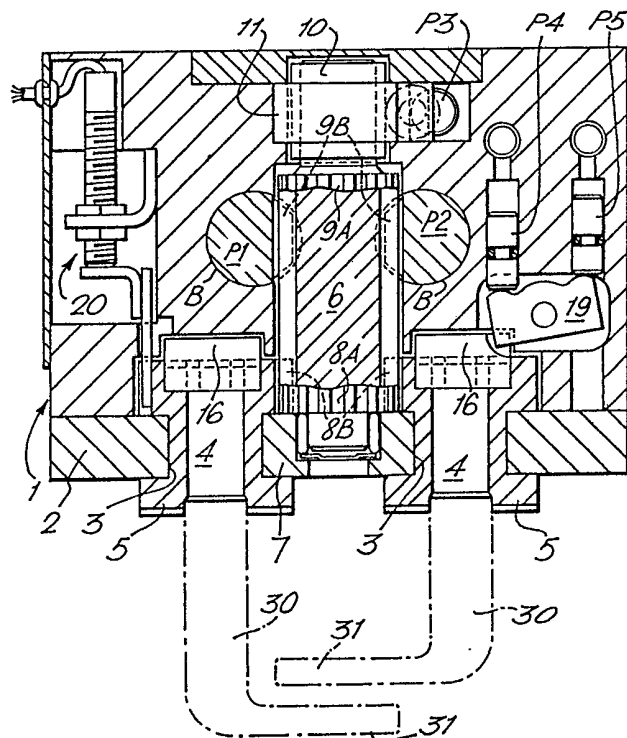
(54) Gripping device

(57) A gripping device for attachment to the end of a robot arm (not shown) whereby fingers (30) mounted on respective slides (4) will be held parallel while moving toward or away from one another instead of e.g. performing a scissor movement.

A drive member (6) rotatable centrally in the housing (1) has a spur gear (8A/9A) by which it engages gears or racks (8B) on the slides (4), and piston-driven racks (P1, P2) on opposite sides of the drive member (6) engage a pinion (8A/9A) thereon whereby opposite reciprocation of the racks (P1, P2) causes rotation of the drive member (6), which in turn causes opposite reciprocal movement of the slides (4).

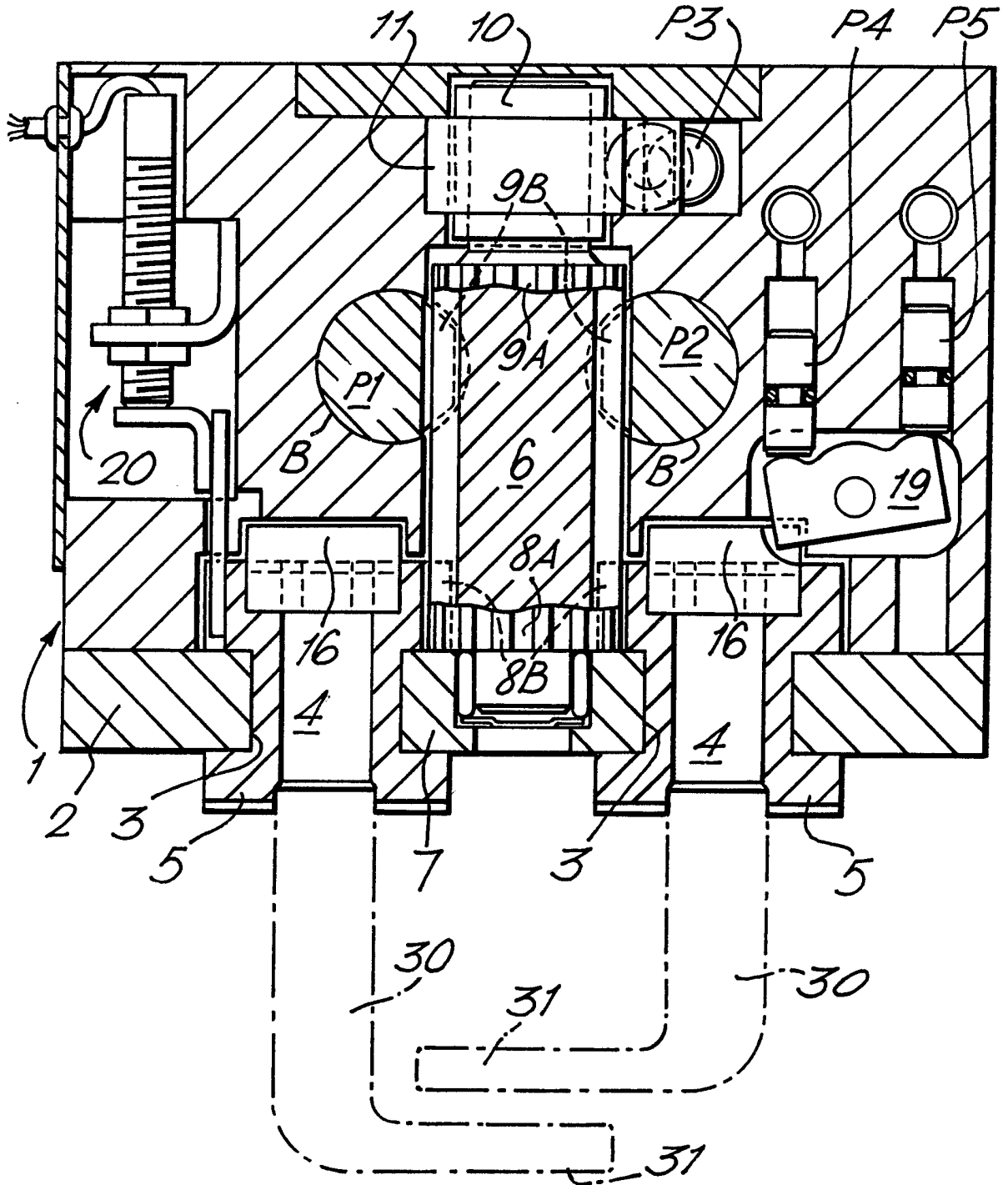
A friction clutch 11 operated by a piston P3 controls the angular position, at rest, of the drive member (6) and therefore the position of the fingers (30).

FIG.1.



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FIG. 1.



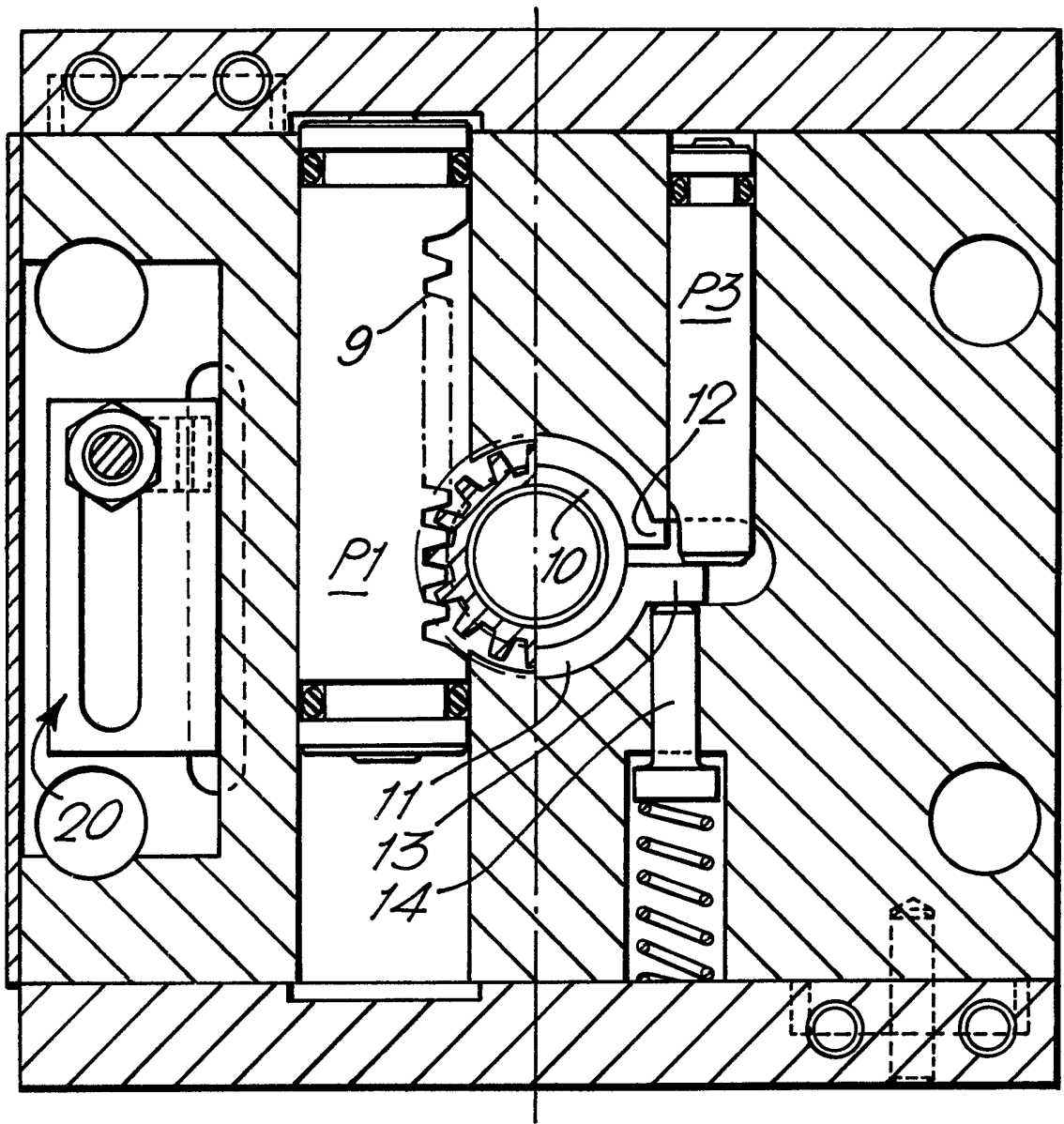


FIG. 2.

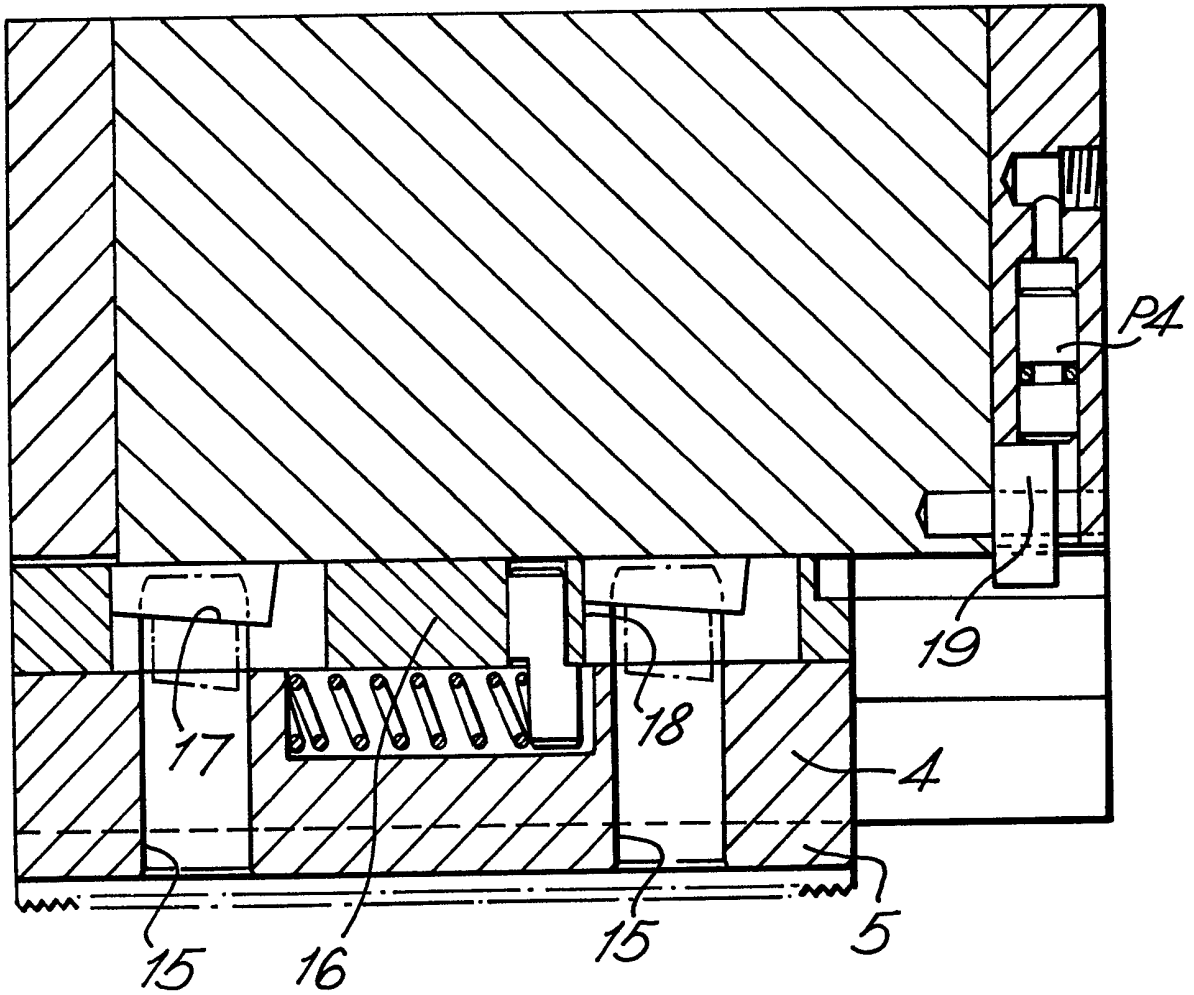


FIG. 3.

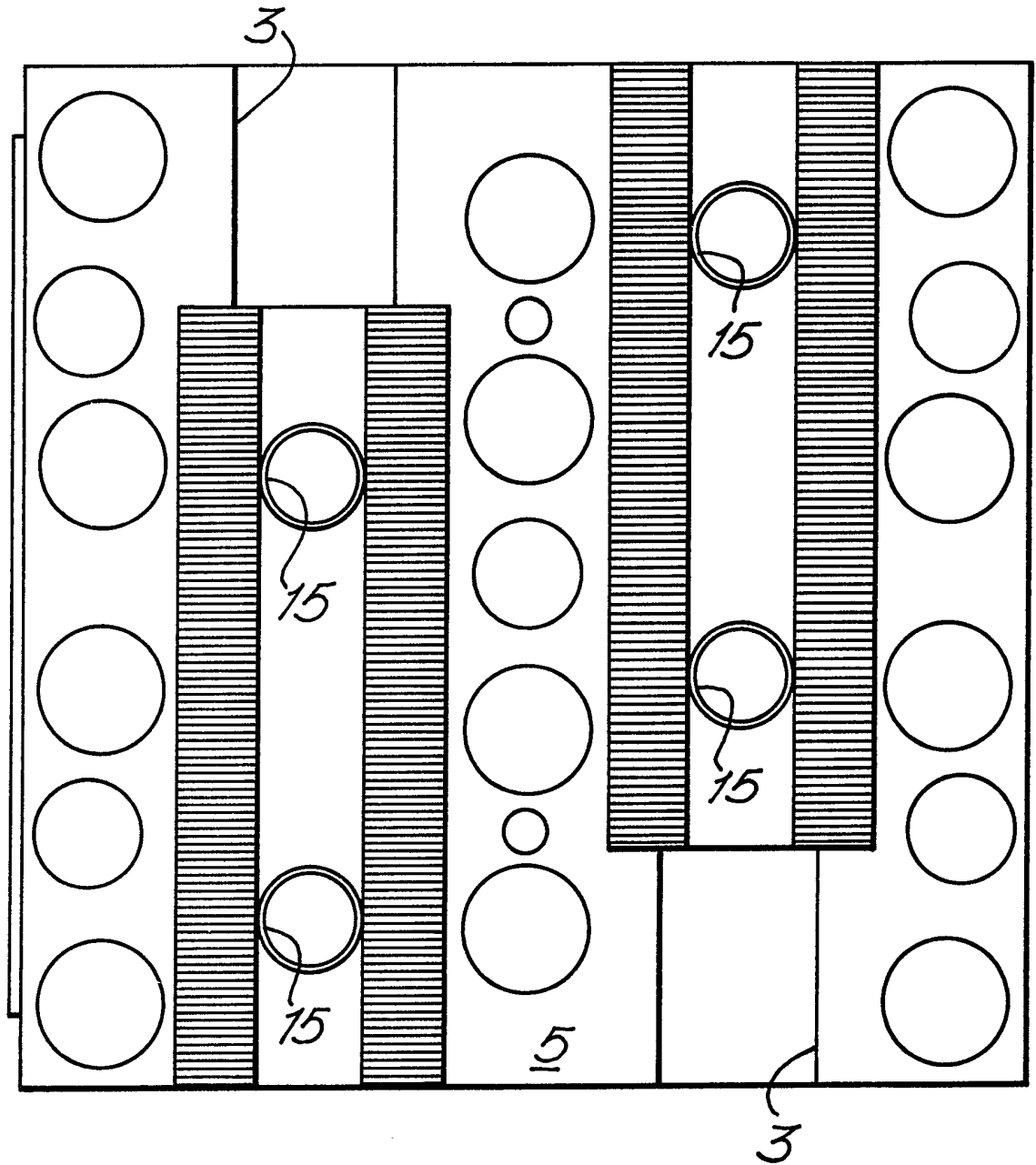


FIG. 4.

SPECIFICATION

Robot arm component

5 The invention relates to an improved robot arm component, and in particular to a gripping device to be located for example at the end of a robot arm.

10 It is usual to mount a mechanical hand or a grip- per module on to the wrist flange face at the end of a robot arm.

Usually such gripping means operate by a scis- sors action, two blades crossing each other and en- gaging an object. There are however many

15 industrial applications for which this mode of grip- ping is not possible or desirable, for example where there is limited working space or the object is not of suitable size or shape.

20 It is one object of this invention to provide a gripping device in which the gripping parts will move oppositely along substantially parallel paths.

According to the invention there is provided a gripping device for location on a robot arm, the device comprising a plurality of finger location

25 means linearly moveable in parallel paths in a housing and a common, rotatable drive means which is mechanically connected to the finger loca- tion means in such a way that rotation of the drive means causes opposite reciprocative movement of

30 the finger location means.

The drive means is preferably formed or pro- vided with a long spur gear which engages rack or gear surfaces of the finger location means.

35 The device means is preferably arranged to be rotated by reciprocative rack members on opposite sides thereof, the rack members engaging pinion teeth of the drive means. The rack members are preferably longitudinally displaceable by respective pressurised fluid actuators.

40 Releasable friction clutch means is preferably provided to prevent unintended rotation of the drive means. The clutch means may comprise a split bush surrounding the drive means and having radial flanges at its opposite ends one of which is

45 fixed and the other of which is biased so that the bush exerts a friction grip on the drive means, means being provided to displace said other flange against its bias so that the bush releases the drive means.

50 In order that the invention may be well under- stood an embodiment will now be described by way of example only with reference to the accom- panying diagrammatic drawings, in which

55 *Figure 1* is a side elevation partly in section of a gripping device in accordance with the invention; *Figure 2* is a plan view of the device of *Figure 1*, partly in section;

Figure 3 is a side elevation, partly in section; and *Figure 4* is an underneath plan view of the de-

60 vice of *Figure 1*.

The gripping device illustrated comprises a box like housing 1 having means, not shown, by which it may be attached to the wrist flange face at the end of a robot arm. The floor 2 of the box 1 has

65 channels 3 for receiving two generally parallel sec-

tion slides 4, the lower portions 5 of which extend below the floor 2. Interchangeable gripping parts 30 such as fingers are releasably connected to the slides 4 and extend therefrom, as will be explained later.

70 A rotary member 6 is mounted vertically on the land 7 between the channels 3 and a middle part thereof is formed with spur teeth 8A/9A. The inner sides of the slides 4 adjacent the rotary part 6 have

75 complementary geared or rack surfaces 8, ar- ranged so that rotation of the pinion imparts to the slides 4 equal and opposite movement in their re- spective channels 3. In this way the slides 4 move oppositely along parallel paths in the channels 3.

80 Two pistons P1, P2, have racks 9A which engage a pinion portion 9A of the rotary part 6 above the land 7 and reciprocate oppositely in bores B lo- cated above the slides 4. The pistons are arranged to reciprocate under pneumatic or hydraulic pres- sure, and selected movement of the pistons P1, P2 will rotate the rotary part 6 in one sense of rotation or the other.

85 A needle roller one-way clutch 10 is located at the top end of the rotary part 6. The clutch 10 is surrounded by a split bush 11 (*Figure 2*) having side extensions 12, 13, one of which (12) is shorter than the other and is fixed relative to the housing 1. A spring loaded plunger 14 projects from a wall of the housing towards a piston P3 extending from

90 the other side, and the bush extension 13 is dis- posed in between, the plunger 14 tending to urge the extension 13 toward the fixed extension 12 and so prevent accidental rotation of the rotary part 6 (if, for example, the pneumatic pressure fails).

95 When the clutch is to be released, movement of the piston P3 against the extension 13 causes the plunger 14 to retract as the split bush 11 is opened so allowing the rotary part 6 to rotate.

As shown in *Figure 3*, the slides 4 have spaced

100 apart anchor holes 15 to receive root parts of the gripping fingers, 30. When the root parts are re- ceived in the holes, a locking bar 16, present on the top of each slide 4, is moved across to engage the root parts by engagement of wedging surfaces

105 17 and keyhole slots 18. To release the locking bar 16 a rocking catch 19 (*Figure 1*) is pivoted out of the path of movement of the locking bar by move- ment of one of two small pistons P4, P5. At one side of the box a proximity switch 20 is present to

110 sense when a clamping or gripping position is reached and provide a signal to initiate further op- eration of the robot.

115 In operation, the required gripping fingers 30 are mounted on the slides 4. Pneumatic or hydraulic pressure is applied to the pistons P1, P2. The pis- tons P1 and P2 move oppositely so causing rotation of the rotary part 6 in one sense of rotation or the other. This in turn causes the slides 4 to move op- positely in the channels 3, carrying the gripping

120 fingers with them. At a predetermined limit of travel, e.g when an article has been gripped be- tween the cranked ends 31 of the fingers, the pis- tons P1 and P2 still have further travel to go and thus maintain a gripping force on the article for as

125 long as pneumatic or hydraulic pressure is main-

130

tained.

Should the pressure medium fail the one-way clutch 10, locked in the split bush 11, prevents return movement of the gripping fingers 30.

- 5 When the article is to be released pressure is diverted to the opposite ends of piston-racks P1 and P2 and to Piston P3. This forces the extension 13 of the split bush 11 back against the spring plunger 14 and allows the one-way clutch body and the rotary part 6 to rotate in the release direction. The box is then lifted or lowered, or indexed, as required, so displacing the gripped object.

The gripping forces will vary from 100 N at 6 Bar pneumatic to 8000 N at 100 Bar hydraulic, depending on the size of the gripping device.

The invention is capable of variation beyond the embodiment shown. Thus the slides in a box may be triangular or square and may have three or four sets of slides 4 according to the number of gripping fingers to be used in a given assembly.

It will also be understood that the gripping fingers 30 shown are exemplary only and are shown purely for purposes of clarifying how the device of the invention is intended to work. Known fingers of a great variety of shapes and dimension could be substituted for those shown.

CLAIMS

- 30 1. A gripping device for location on a robot arm, the device comprising a plurality of finger location means linearly moveable in parallel paths in a housing and a common, rotatable drive means which is mechanically connected to the finger location means in such a way that rotation of the drive means causes opposite reciprocative movement of the finger location means.
- 35 2. A device as claimed in Claim 1 wherein the drive means is formed or provided with a long spur gear which engages rack or gear surfaces of the finger location means.
- 40 3. A device as claimed in either preceding Claim wherein the device means is arranged to be rotated by reciprocative rack members on opposite sides thereof, the rack members engaging pinion teeth of the drive means.
- 45 4. A device as claimed in Claim 3 wherein the rack members are longitudinally displaceable by respective pressurised fluid actuators.
- 50 5. A device as claimed in any one of the preceding claims and comprising releasable one-way clutch means to prevent unintended rotation of the drive means.
- 55 6. A device as claimed in Claim 5 wherein the clutch means is situated in a split bush surrounding the drive means and having radial flanges at its opposite ends one of which is fixed and the other of which is biased so that the bush exerts a friction grip on the drive means, means being provided to displace said other flange against its bias until the bush releases the drive means.
- 60 7. A gripping device for location on a robot arm substantially as described and as shown in the accompanying drawings.