March 25, 1958 A. S. CHARLAT 2,827,808

POSITIONING TABLE

Filed Jan. 16, 1957 3 Sheets-Sheet 1

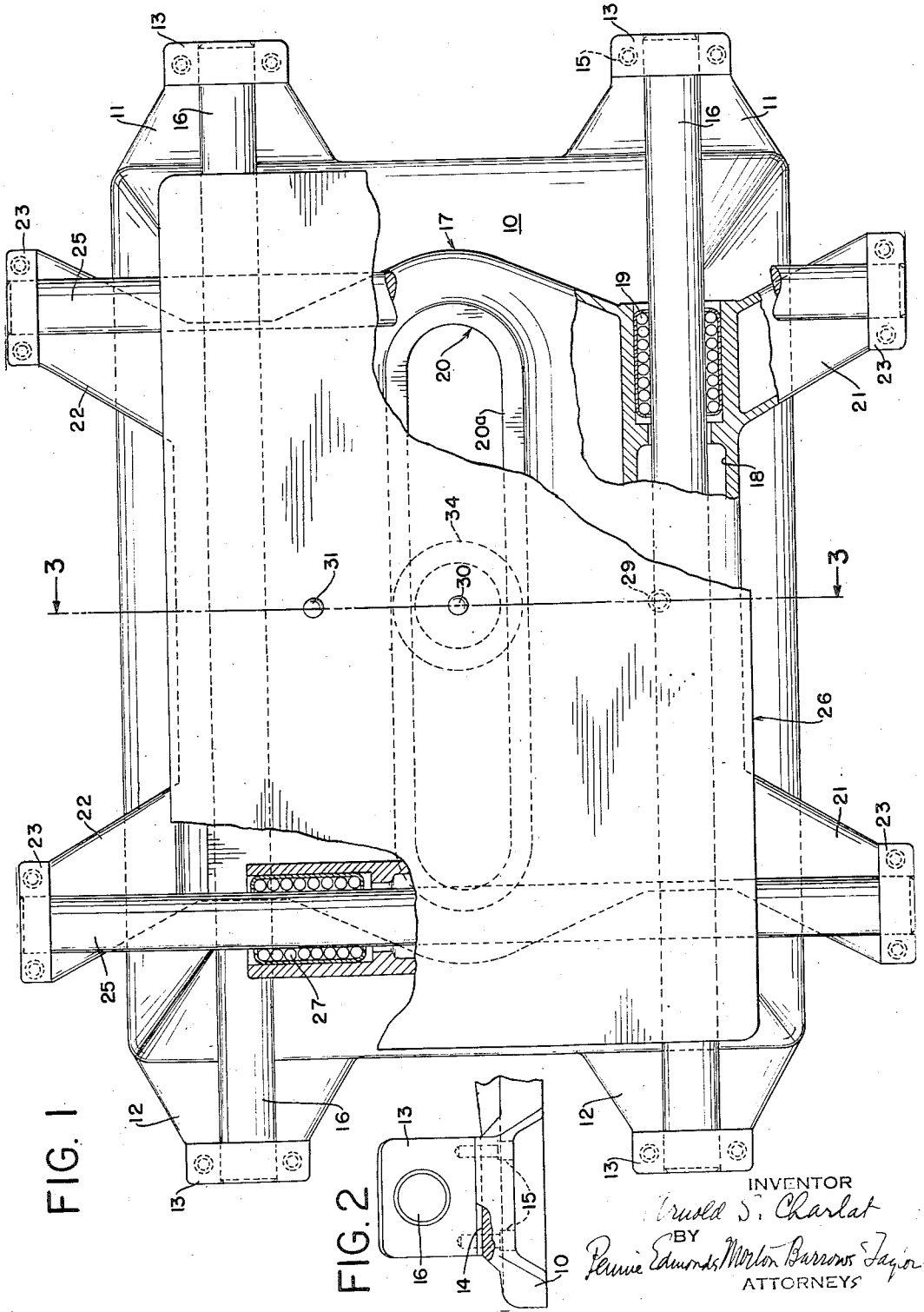

FIG. 1

FIG. 2

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FIG. 3

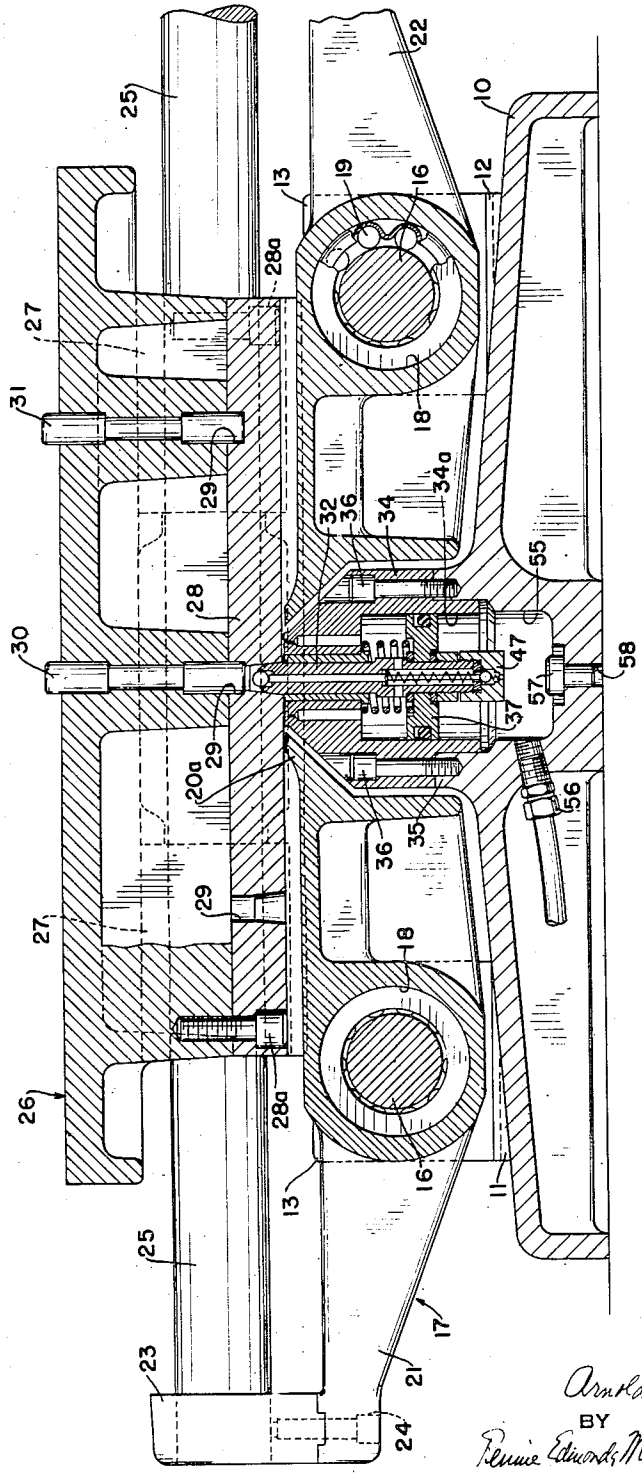

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FIG. 4

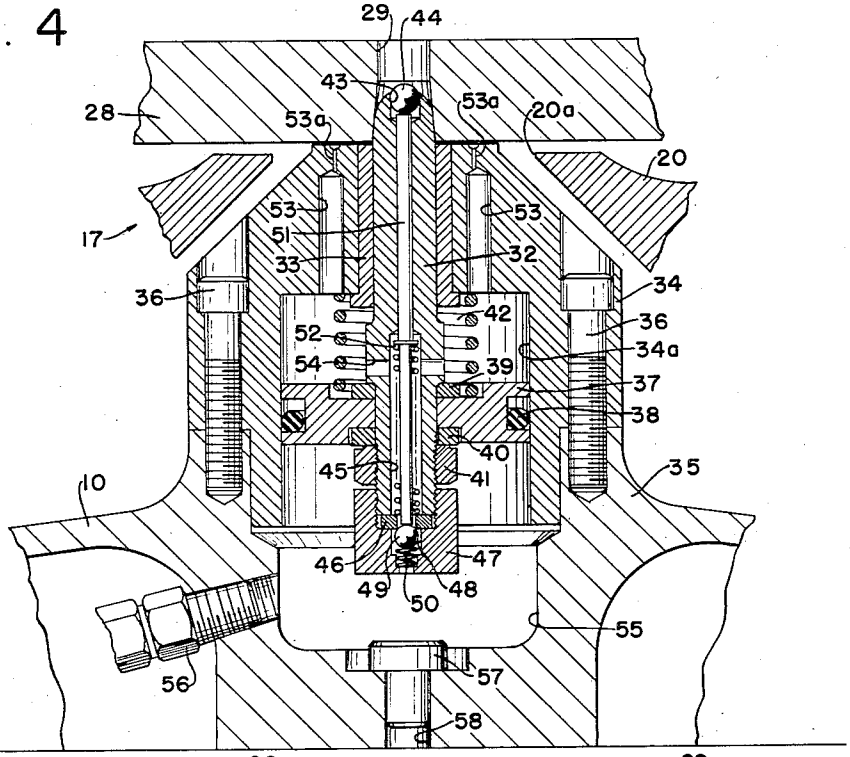
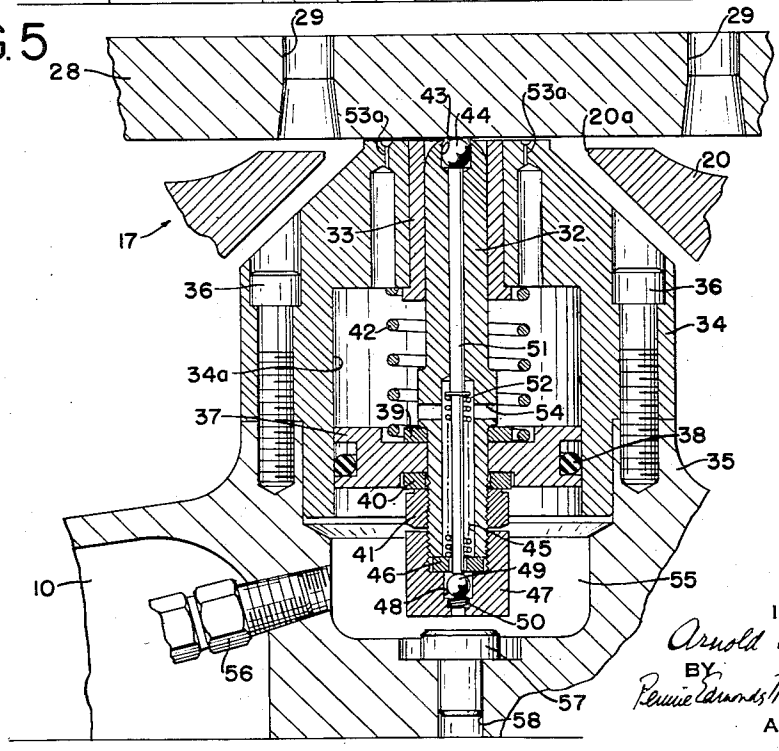


FIG. 5



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2,827,808

POSITIONING TABLE

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Application January 16, 1957, Serial No. 634,482

8 Claims. (Cl. 77—64)

This invention relates to tables for positioning a workpiece beneath and in different relations to the tool of a machine, such as the drill of a drilling machine or the cutter of a milling machine, so that operations can be performed on the workpiece at desired locations. More particularly, the invention is concerned with a novel positioning table for the purpose stated, which includes a workpiece support having a free translational movement within limits in all directions in a plane and locking means for holding the support in any of a number of predetermined positions in relation to the tool and engaging the support from beneath and preventing it from becoming distorted by the pressure applied by the tool to the workpiece in the machine operation. The new table has features in common with that of the table of my pending application, Ser. No. 612,545, filed September 27, 1956, but differs from the prior table in a number of respects, which will be pointed out hereafter.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a plan view of one form of the new table;

Fig. 2 is a fragmentary end elevational view of the base;

Fig. 3 is a vertical sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary vertical sectional view on the line 3—3 of Fig. 1, but on a larger scale than that of Fig. 3; and

Fig. 5 is a view similar to Fig. 4 but showing the workpiece support in a different relation to the locking means.

The new table in the form shown in the drawings includes a base 10, which may be a metal casting of generally rectangular shape having pairs of spaced parallel extensions 11, 12 from its opposite ends. Each extension carries a block 13 having a tongue and groove connection 14 with the extension and secured thereto by bolts 15. Each block has an opening for receiving the end of a rod 16 and each rod extends between and is supported in blocks 13 on aligned extensions 11, 12 at opposite ends of base 10. The two rods lie parallel above the top of the base and are unsupported between their ends.

A carriage generally designated 17 is mounted for movement along the guide rods 16 and comprises a casting having a pair of parallel passages 18 each containing a pair of ball bearing assemblies 19, through which one of the rods extends. The carriage has a central slot 20 lying midway between the rods 16 and parallel thereto and the slot is defined by a lip 20*a* rising above the level of the top of the carriage and having a flat top. The carriage is provided with pairs of spaced extensions 21, 22 from its opposite ends lying at right angles to the axis of slot 20. Each of the extensions 21, 22 carries a block 23 secured to the extension by screws 24 and having an opening for the end of a guide rod 25. The two guide rods 25 extending between blocks 23 on aligned extensions 21, 22 lie parallel at right angles to rods 16. The

rods 25 lie above the top of the carriage 17 and are unsupported between their ends.

A workpiece support generally designated 26 is mounted for movement on the guide rods 25 and comprises a casting having a flat top and aligned pairs of openings below the top and containing ball bearing assemblies 27. A guide rod extends through each pair of bearing assemblies and the carriage extends down between the rods 25 and carries on its lower end a location plate 28 provided with a plurality of openings 29 extending through the plate and of tapering form at their lower ends and of cylindrical form at their upper. The location plate is secured to the workpiece support by bolts 28*a* and is oriented in relation to the support by pins 30, 31, which extend through the support and project above and below it. The lower ends of pins 30, 31 enter a pair of openings 29 in the plate 28 and the upper ends serve as means for orienting a workpiece holder on the support 26.

The openings 29 in the location plate 28 receive means for locking the plate and support in different positions relative to the tool and such means include a pin 32 extending through a bushing 33 in an opening through the top of a cap 34, which rests upon the top of a central boss 35 extending upward from the base and is secured in place by screws 36. The upper end of the cap extends through the slot 20 in the carriage 17 and lies in approximately the plane of the top of the lip 20*a* on the carriage. Also, the top of the cap normally lies spaced from the under surface of the plate 28 by a clearance of a few thousandths of an inch. The cap 34 is hollow and provides cylinder 34*a* containing a piston 37 having a peripheral groove containing a rubber O-ring 38 engaging the inner wall of the cylinder and acting as a piston ring. The piston has a central opening, through which the lower end of pin 32 extends, and bears against the under side of a washer 39 seated against a shoulder on the pin. A washer 40 on the pin engages the under surface of the piston and the assembly of piston and washers is held together and against the shoulder on the pin by a nut 41 threaded on the lower end of the pin. A spring 42 seated at its upper end against the top of cylinder 34*a* bears against the top of piston 37 and urges it downwardly.

The pin 32 has a lengthwise bore with a chamber 43 at its upper end containing a ball 44, which is movable into and partly out the chamber and is held in place by the inturned outer edge of the pin surrounding the chamber. The bore through the pin leads to a chamber 45, which opens through the lower end of the pin and contains a valve disc 46 held in place against the lower end of the pin by a nut 47 threaded on the pin 32 and formed with a chamber 48 open through the lower end of the nut. A ball 49 within the chamber is urged by a spring 50 to seat against and close the opening through valve disc 46. A rod 51 extends through the bore through the pin 32 and into the chambers 43 and 45 and the length of the rod is such that, when the ball 49 is seated on the valve disc 46 and the lower end of the rod rests upon the top of the ball, the upper end of the rod forces the ball 44 to project out of chamber 43. Whenever the ball 44 is forced into chamber 43, the ball moves the rod 51 downward to force the ball 49 away from the valve disc 46. A spring 52 encircling the rod 51 within chamber 45 engages a collar on the rod and urges the rod upward.

A pair of chambers 53 lead upward from the top of the cylinder 34*a* and small bleeder passages 53*a* lead from the upper ends of the respective chambers through the top of the cap 34. Passages 54 lead through the pin from chamber 45 into cylinder 34*a* above the piston 37. The boss 35 is formed with a chamber 55 open to cylin-

der 34*a* below the piston and air under pressure is supplied to the chamber through a fitting 56 threaded into an opening through the wall of the chamber. The downward movement of the piston and rod effected by spring 42, when the air pressure is off, is arrested by a bumper in the form of a plug 57 seated in a bore 58 through the bottom of chamber 55.

In the use of the table described, a location plate 28 is first prepared by forming a number of openings 29 corresponding in number and relative position to the locations, where operations are to be performed on a workpiece in a holder resting on the support 26 and oriented by means of pins 30 and 31. The plate is mounted on the under side of the support 26 and oriented by pins 30 and 31 and, when the plate is in place, air under pressure is admitted to chamber 55. Ordinarily at this time, the upper ball 44 is in contact with the under surface of the plate 28 and is forced partially into the chamber 43, as shown in Fig. 5, so that the rod 51 holds the lower ball 49 free of the valve disc 46. As a result, air from the chamber 55 flows up through the valve disc 46, the chamber 45, and the passages 54 into the cylinder 34*a* above the piston 37 and air escapes from the cylinder through chambers 53 and the bleeder passages 53*a*. The size of the passages 53*a*, the air pressure used, and the strength of spring 42 are such that, when the ball 44 is in contact with the under surface of plate 28, the pressure of the air acting on top of the piston and the force of the spring 42 are slightly overbalanced by the air pressure beneath the piston, so that the piston and pin are urged upwardly by a light force. At the same time, the ball 44 is held against the under surface of the plate 28 by the force of the light spring 52 only and the upper end of the pin is out of contact with the plate.

When an operation is to be performed on the workpiece, the support 26 is moved with the ball 44 rolling over the surface of plate 28, until the desired opening on the plate lies above the pin 32. As soon as this occurs, the pin is moved upwardly into the opening and the ball 44 is free to move outwardly from its chamber 43, so that the rod 51 is moved up by the spring 52 and the ball 49 is seated on the disc 46 by the spring 50. The closing of the passage through the disc 46 cuts off the supply of air to the cylinder 34*a* above the piston, whereupon the air pressure below the piston causes the piston to rise and the pin 32 is seated in the opening in the plate 28 by the full air pressure and positively locks the support in proper relation to the tool. When the operation on the workpiece is completed, the air supply to chamber 55 is momentarily cut off, so that the pin 32 is withdrawn from the opening in the plate by the action of spring 42. As soon as the support 26 has been moved so that the pin and opening are out of register, the air pressure is restored and the ball 40 bears lightly against the under surface of the plate 28. The support 26 is then moved to bring the next opening 29 into line with the pin 32 and the sequence of operations above described is repeated.

As above described, the guide rods 16 on the base and the guide rods 25 on the carriage are supported only at their ends and, when pressure is applied in a drilling operation to the workpiece in a holder on the support 26, the rods would bend downward, if nothing were done to prevent. Any substantial distortion of the rods under pressure during drilling would result in errors in the work but, in the construction described, the cap 34 lies directly beneath the tool and the top of the cap is spaced by only a few thousandths of an inch from the under surface of the plate 28. Accordingly, only a slight distortion of the rods under drilling pressure applied to the workpiece causes the cap to be engaged by the plate 28 and the cap and the boss 35 on the base act as an abutment preventing any further downward movement of the plate and the support 26. The air issuing through the bleeder pipes 53*a*, when the pin 32 is not in an opening 29 in the plate 28, escapes through the clearance between the top of the cap and the under side of the plate and keeps the opposed surfaces of the plate and cap clean and free of small bits of metal, etc.

With the ball 44 making only light contact with the under surface of the location plate 28 as the workpiece support is shifted about to bring a new location on the workpiece into position, there is substantially no wear on the plate and the plate may be made of relatively soft steel. This simplifies the operations involved in the formation of the plate and substantially reduces the cost.

I claim:

1. A table for positioning a workpiece beneath the tool of a machine, which comprises a base, a pair of parallel guides mounted on the base, a carriage mounted on the guides on the base for movement lengthwise of the guides, the carriage having an opening lying between the guides on the base, a pair of parallel guides mounted on the carriage and lying at right angles to the guides on the base, a workpiece support mounted on the carriage guides for movement lengthwise thereof, means on the support for holding a workpiece fixed on the support in position to be acted on by the tool, the guides on the carriage being supported only at their ends and subject to downward distortion under pressure, a location plate attached to the under surface of the support in fixed relation to the holding means and having at least one hole in a position corresponding to a location on a workpiece held by the holding means, an abutment on the base having a top opposed to the under surface of the location plate through the carriage and engageable by the plate to arrest downward movement of the support tending to distort the guides, and means, including a pin projectable out of the abutment and adapted to enter the hole in the plate, for locking the support with the workpiece thereon in a desired position relative to the tool.

2. The table of claim 1, in which the locking means is provided with pneumatic operating means urging the pin out of the abutment with a pressure controllable by an element movably mounted at the outer end of the pin.

3. The table of claim 2, in which the element is a ball in a chamber at the outer end of the pin, the ball being movable into the chamber by contact with the surface of the location plate and acting upon such movement to cause the operating means to urge the pin out of the abutment with light pressure.

4. The table of claim 3, in which the ball is urged out of its chamber by a spring and acts upon such movement to cause the operating means to urge the pin out of the abutment with full pressure.

5. The table of claim 1, in which the abutment contains a cylinder and piston, the pin is connected to the piston, a spring urges the piston to draw the pin into the abutment, and the abutment is provided with means for supplying air beneath the piston to raise the piston and move the pin out of the abutment.

6. The table of chain 5, in which the pin is provided with a passage leading from below the piston to the space in the cylinder above the piston, a valve at the lower end of the passage controls flow through the passage and is biased toward closed position, and means for opening the valve extend through the pin and are operable at the upper end of the pin.

7. The table of claim 6, in which the valve opening means comprise a rod having its lower end in engagement with the movable member of the valve and a ball engaging the upper end of the rod and mounted movably in a chamber in the upper end of the pin, movement of the ball into the chamber causing the rod to unseat the movable member of the valve and permit air to flow.

8. In a table for positioning a workpiece beneath the tool of a machine, the combination of a base, a workpiece support, means for mounting the support on the base for limited horizontal movement in all directions,

means on the support for holding a workpiece fixed on the support in position to be acted on by the tool, a location plate attached to the under surface of the support in fixed relation to the holding means and having at least one hole in a position corresponding to a location on a workpiece held by the holding means, a pin adapted to enter the hole in the plate for locking the support with the workpiece thereon in a desired position relative to the tool, a mounting for the pin, pneumatic means acting on the pin and urging it into contact with the location plate, means for controlling the pressure with which the pneumatic means acts on

the pin, and an element mounted at the outer end of the pin in position to engage the location plate and movable to regulate the control means.

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