

United States Patent

Hori

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[54] FEEDING DEVICE FOR MACHINE TOOLS

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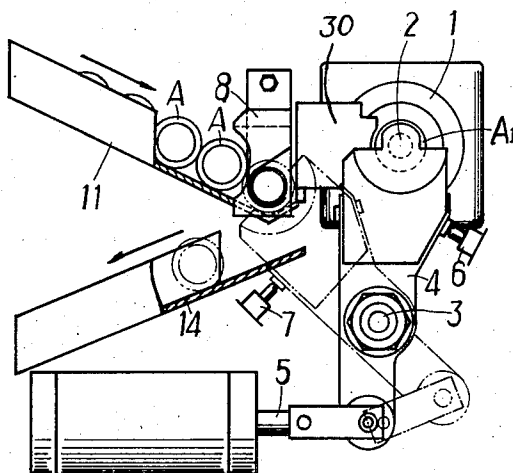
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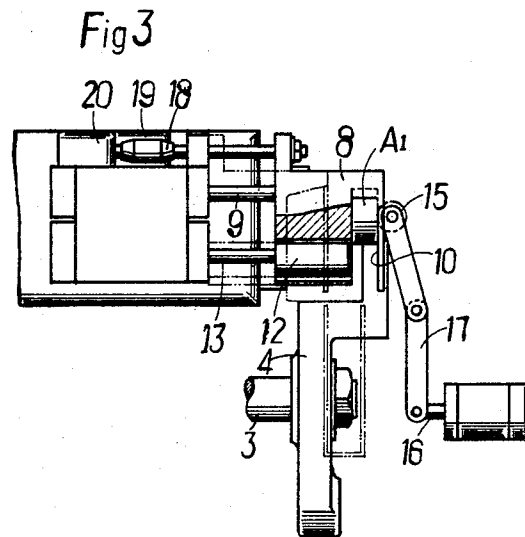
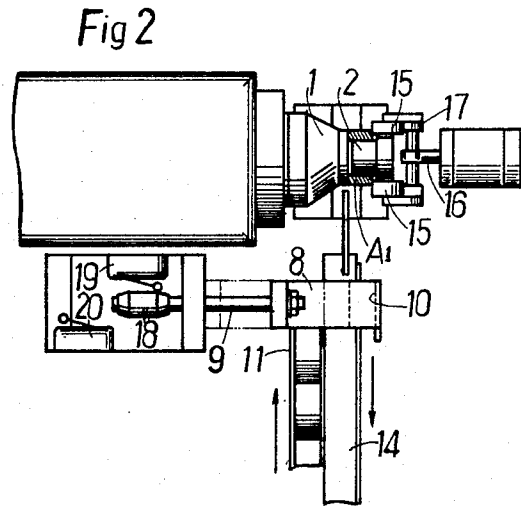
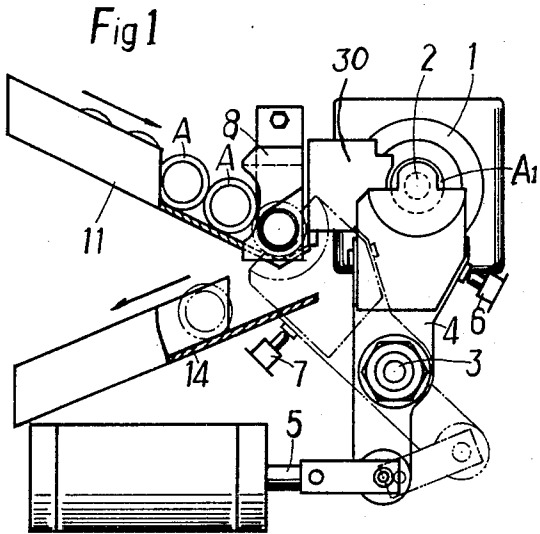
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[57] ABSTRACT

This invention is to provide a simple and accurate device for automatically feeding workpieces one by one in order in a systematic manner to an operating part on one of the various kinds of machine tools, such as, the grinding machine, the super-finishing machine, the honing machine, lapping machine and so forth, and for delivering the finished workpieces to a predetermined place.

6 Claims, 6 Drawing Figures





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Fig 4

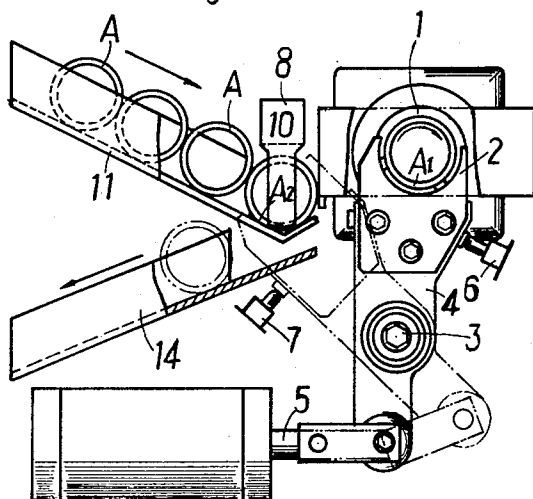


Fig 5

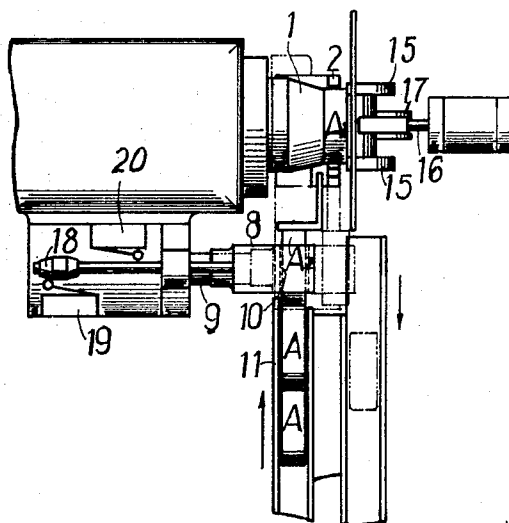
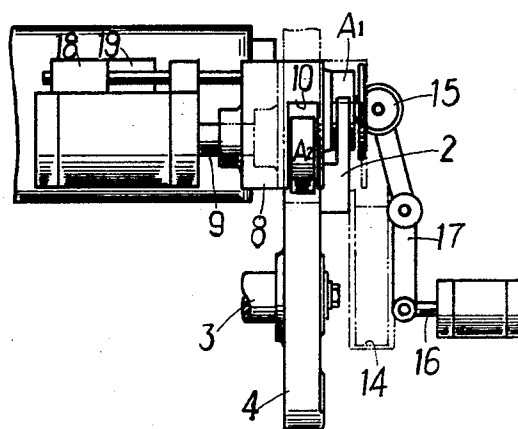


Fig 6



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FEEDING DEVICE FOR MACHINE TOOLS

An object of this invention is to provide a simple and accurate device for automatically feeding workpieces one by one in order in a systematic manner to an operating part on one of the various kinds of machine tools, such as, the grinding machine, the super finishing machine, the honing machine, lapping machine and so forth, and for delivering the finished workpieces to a predetermined place.

Another object of this invention is to provide a device for automatically feeding circular workpieces whose outer diameters are to be finished and for delivering them at a constant speed.

Still another object is to provide a device for automatically feeding ring-form workpieces whose inner diameters are to be finished and for delivering them at a constant speed.

The attached drawing shows an example of the working of this invention.

FIG. 1 is a front elevation of a device for automatically feeding circular workpieces whose outer diameters are to be finished, with a portion thereof cut vertically;

FIG. 2 a plan view of the device in FIG. 1;

FIG. 3 a side elevation of the device in FIG. 1.

FIG. 4 is a front elevation of a device for automatically feeding ring-form workpieces whose inner diameters are to be finished, with a portion thereof cut vertically;

FIG. 5 is a plan view of the device in FIG. 4; and

FIG. 6 is a side elevation of the device in FIG. 4.

In FIG. 1 to 3, the numeral 1 represents a driving shaft on one of the various kinds of machine tools such as the grinding machine, the super finishing machine, the honing machine, the lapping machine and so forth.

A circular workpiece A, is supported and rotated at the front side of the driving shaft 1 by the centerless system. The numeral 2 represents a shoe into which the lower portion of the workpiece A, is fitted and supported. The shoe 2 is attached at its central portion to the upper portion of an oscillation lever pivotally attached to a machine frame by means of a supporting shaft 3. A piston rod 5 is connected to the lower portion of the oscillation lever 4. By moving the piston 5 back and forth, the oscillation lever 4 and the shoe 2 are oscillated left and right until they collide with stoppers 6 and 7 alternately.

The numeral 8 represents a pushing out member attached to a piston rod 9 reciprocating on one side of the driving shaft 1 in parallel with the center line of said driving shaft 1. The front side of the pushing out member 8 is provided with a concave member 10 into which the workpiece A is fitted. This device is so constructed that when the pushing out member 8 stops at its forward position, the concave member 10 is aligned with the oscillation locus of the shoe 2; and that when the pushing out member 8 stops at its backward position, the concave member 10 is aligned with the lower portion of a feeding pail 11.

The numeral 12 represents a guide plate located at the lower portion of the feeding pail 11. The numeral 14 represents a delivery pail provided at a proper distance at the front side of the feeding pail 11. The numeral 15 is a pressure roller moving back and forth through a lever 17 by means of the reciprocating motion of a piston rod 16. The back and forth movement of the roller 15 pushes the front side of the working piece A against the driving shaft 1 and so allows the workpiece A, to rotate with the rotation of the driving shaft 1. In place of the pressure roller, a conventional pressure plate or driving shaft with a magnet may be used to support the workpiece on a driving shaft by the centerless system.

In accordance with this invention, it is provided that a series of the workpiece A which are fed to the feeding pail 11 fall one after another in order. The oscillation lever 4 supporting shoe 2 oscillates by the advance of the piston rod 5 until stopped by a stopper 7. The workpiece A in the forefront of the series fits in the concave member 10 of the pushing out member 8 in a condition in which said workpiece A contacts the guide plate 12 and is supported by it.

If at this time the workpiece A1, which rotates with the driving shaft 1 while being supported by the shoe 2, is released from pushing by the presser roller 15, after going through a predetermined finishing, the finished workpiece A1 is held on the same center line with the workpiece A which is in the forefront of the series of the feeding pail. When the piston rod 9 moves forward, the pushing out member 8 moves forward with the workpiece A fitted into its concave member 10, and pushes out the workpiece A1 on the shoe 2 with its front face and allows the workpiece A1 to fall on the delivery pail 14, and at the same time places the workpiece A on the shoe 2.

In this case, the workpiece which is in the forefront of a series of workpieces following on the feeding pail is supported without falling. Next, when the pushing out member 8, together with the piston rod 9, retreats, said workpiece fits into the concave member 10, and at the same time is supported by the guide plate 12 and held in the forefront of the feeding pail, and so it is ready for the next feeding. At the same time when the piston rod 5 retreats and the oscillation lever 4 oscillates until it is stopped by the stopper 6, the workpiece which is replaced on the shoe 2 will stop at the front face of the driving shaft 1, and while being pressed by the pressure roller said workpiece will rotate with the driving shaft and will be finished.

Thus, it is possible to automatically replace the workpiece which has gone through a predetermined finishing at a finishing section of a machine tool with an unfinished workpiece by moving each of the piston rods 5, 9 and 16 synchronously at a proper timing while feeding workpieces to the feeding pail 11, and so it is possible to perform operations continuously. In order to insure the replacement of a workpiece and also to direct the next operation, a cam 18 is provided to actuate limit switches 20 and 19 alternately when the pushing out member moves forward or retreats by means of the piston rod 9. Such an arrangement makes this operation smoothly and accurately.

The numeral 8 represents pushing out member attached to a piston rod 9 reciprocating on one side of the driving shaft 1 in parallel with its center line. The pushing out member 8 is provided at its front side with the concave member 10 into which a workpiece A is fitted.

The device of this invention is so constructed that when the pushing out member stops at its forward position, the concave member 10 will align with the oscillation end point of the shoe 2, and that when the pushing out member stops at its retreated position, the concave member 10 will align with the lower portion of a feeding pail 11. The numeral 12 represents a guide plate oscillated by a piston rod 13 in the inside of the concave member 10 of the pushing out member 8. The rod 12 or guide plate fits into the center hole of the workpiece A and allows it to maintain its central position.

The numeral 14 represents a delivery pail obliquely provided at the front lower portion of the feeding pail 11 in a direction opposite to the direction thereof. The numeral 15 represents a presser roller reciprocating through a lever 17 by means of a piston rod 16. The reciprocating motion of the presser roller 15 presses the front face of a workpiece A, and by pressing it against the driving shaft 1, the workpiece A, rotates with the rotation of the driving shaft 1.

The device shown in FIGS. 4 to 6, wherein elements similar to those shown in FIGS. 1 to 3 are similarly numerically designated, is also provided in such a way that a series of workpieces A fed on the feeding pail 11 will fall one after another in a line, and the workpiece A in the forefront is supported by the feeding pail 11 in such a way as to engage with the outer side of the pushing out member 8. Then, the workpiece A, which is supported by the shoe 2 and is rotated by the driving shaft 1, is released from the pressure of the presser roller 15 after going through a predetermined finishing.

If the oscillation lever 4, which supports shoe 2, starts to oscillate simultaneously with such release by the advance of the piston rod 5 and continues to oscillate until it is stopped by the stopper 7, the finished workpiece A1 with the shoe 2 fitted

in its center line will stop in such a condition that the finished workpiece A1 is fitted into the concave member 10 of the pushing out member 8. Then, when the pushing out member 8 retreats by means of a piston rod 9, the workpiece A1, which is at that time held between the concave member 10, is gradually pulled out of the shoe 2, and as soon as it is completely pulled out, it falls on the delivery pail 14 and is conveyed to a predetermined place. Then, when the pushing out member 8 retreats further so that its concave member 10 aligns with workpiece A in the forefront of the feeding pail 11, the workpiece A falls and fits into the concave member 10.

At the same time the rod or guide 12 moves forward by means of a piston rod 13, and fits into the center hole of a workpiece A and allows it to maintain its central position. The rod 12 also stops in a condition in which it faces the front side of the shoe 2. If the pushing out member 8 moves forward by the advancement of the piston rod 9 in this condition, the workpiece as it is being fitted into the concave member 10 also moves forward with the pushing out member 8, leaves out of the rod 12 and fits in and is supported by the shoe 2. In this case, the next workpiece A on the feeding pail is supported by the side of the pushing out member 8, is held in the forefront thereof, and is ready for the next feeding. At the same time, when the oscillation lever 4 oscillates by the retreat of the piston rod 5 until it is stopped by the stopper 6, the unfinished workpiece which has replaced the other on the shoe 2 stops at the front side of the driving shaft 1, is pressed by the pressure roller, and is finished, while rotating with the driving shaft.

Thus, it is possible to automatically replace the workpiece which has gone through a predetermined finishing at a finishing section of a machine tool with an unfinished work by moving each of the piston rods 5, 9, 13 and 16 synchronously at a proper timing while feeding workpieces to the feeding pail 11, and so it is possible to perform operations continuously. In order to insure the replacement of a ring-form workpiece and also to direct the next operation, a cam 18 is provided to actuate limit switches 19 and 20 alternately when the pushing out member moves forward or retreats by means of the piston rod 9. Such an arrangement makes this operation run smoothly and accurately.

As has been described above, a device in accordance with this invention has a very simple mechanism, holds a circular or ring-form workpiece on a feeding pail accurately on a center line, automatically feeds one by one in order to a finishing section of a machine tool, and delivers the finished workpiece to a delivery pail. Thus, the device of this invention do not injure a circular or ring form workpiece at all, always performs a very accurate finishing on the center line, and improves operating efficiency.

What is claimed is:

1. A device for automatically feeding work pieces to a machine tool having a rotating driving shaft which comprises in combination; (1) a sloped workpiece feed pail or channel the lower end terminating adjacent; (2) a pushing out member adapted to thrust a first unmachined work piece from said

feed pail onto the top of; (3) oscillation lever, said top of said oscillation lever being positioned between said lower end of said feed pail and the upper end of; (4) a sloped workpiece delivery pail or channel, whereby as said unmachined first work piece is thrust onto the top of said oscillation lever a second machined workpiece will be forced from the top of said oscillation lever onto the upper end of said work piece delivery pail, said top of said oscillation lever being adapted to oscillate between said pails and the front of said driving shaft and; (5) pressure means for forcing said unmachined first work piece against said rotating shaft, thereby causing said first work piece to rotate and; (6) machining means on said machine tool to machine said first work piece.

2. Device as defined by claim 1 wherein said oscillation lever is supported by; (7) an oscillation lever shaft mounted on said machine tool.

3. Device as defined by claim 2 wherein said pushing out member comprises; (8) a concave member activated by; (9) a piston rod reciprocating on one side of said driving shaft in parallel with the center line of said driving shaft, said piston rod adapted to position said concave member in its forward position in alignment with said oscillation lever and its rearward position in alignment with the lower end of said feeding pail.

4. Device as defined by claim 3 wherein; (1) timing means are adapted to activate said pressure means when the top of said oscillation lever is in front of said driving shaft and to activate said pushing out member when the top of said oscillation lever is intermediate said pails.

5. Device as defined by claim 1 wherein said pressure means for forcing said unmachined workpiece against said rotating shaft consists of a pair of rollers activated by levers, and a pressure means piston.

6. A device for automatically feeding circular work pieces to a machine tool having a rotating driving shaft which comprises in combination; (1) a sloped workpiece feed pair or channel the lower end terminating adjacent and abutting; (2) a pushing out member being in a plane parallel but spaced apart from the perpendicular plane passing through said driving shaft, said pushing out member activated by; (3) a timed first piston and adapted to thrust a first unmachined work piece from said feed pail onto a; (4) shoe positioned on the top of a; (5) oscillation lever, said shoe being positioned and oscillating in a perpendicular plane between said lower end of said feed pail and the upper end of; (6) a sloped workpiece delivery pail or channel, said pails being in planes perpendicular to the longitudinal axis of said driving shaft, said shoe adapted to oscillate between said pails and the front end of said driving shaft and; (7) pressure rollers for forcing a work piece in said shoe against said rotating shaft causing said work piece to rotate, said pressure rollers being activated by; (8) a timed second piston coordinated with said timed first piston and; (9) machining means on said machine tool for machining said circular work pieces.

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