Aug. 8, 1950 K. F. RICHARDS 2,518,375

AUTOMATIC FEEDER

Filed April 24, 1947 6 Sheets-Sheet 1

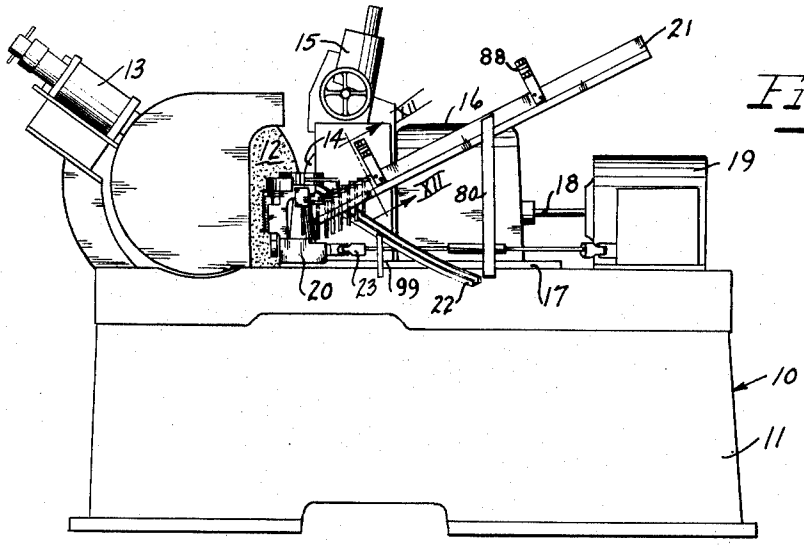


Fig. 1

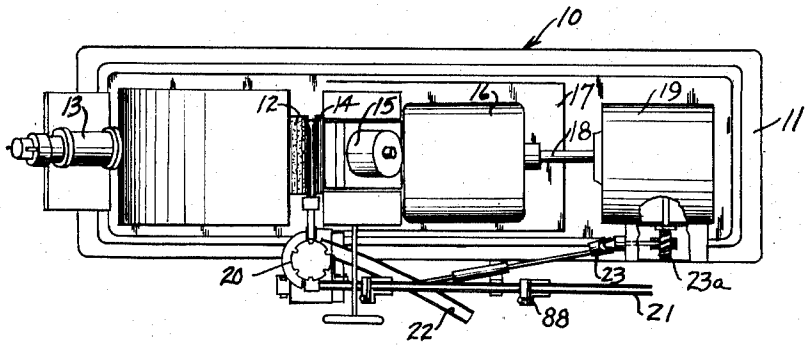


Fig. 2

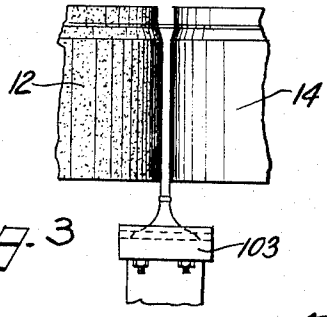


Fig. 3

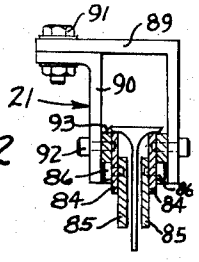


Fig. 12

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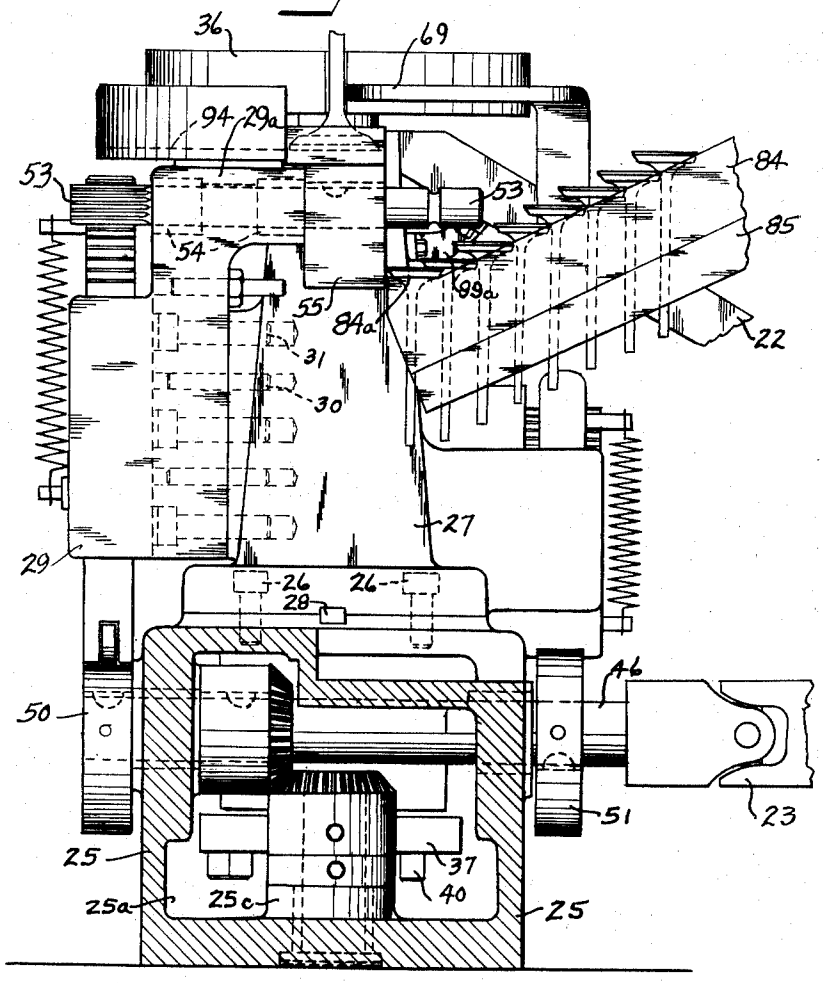
by Their Attys.

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AUTOMATIC FEEDER

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Fig. 4



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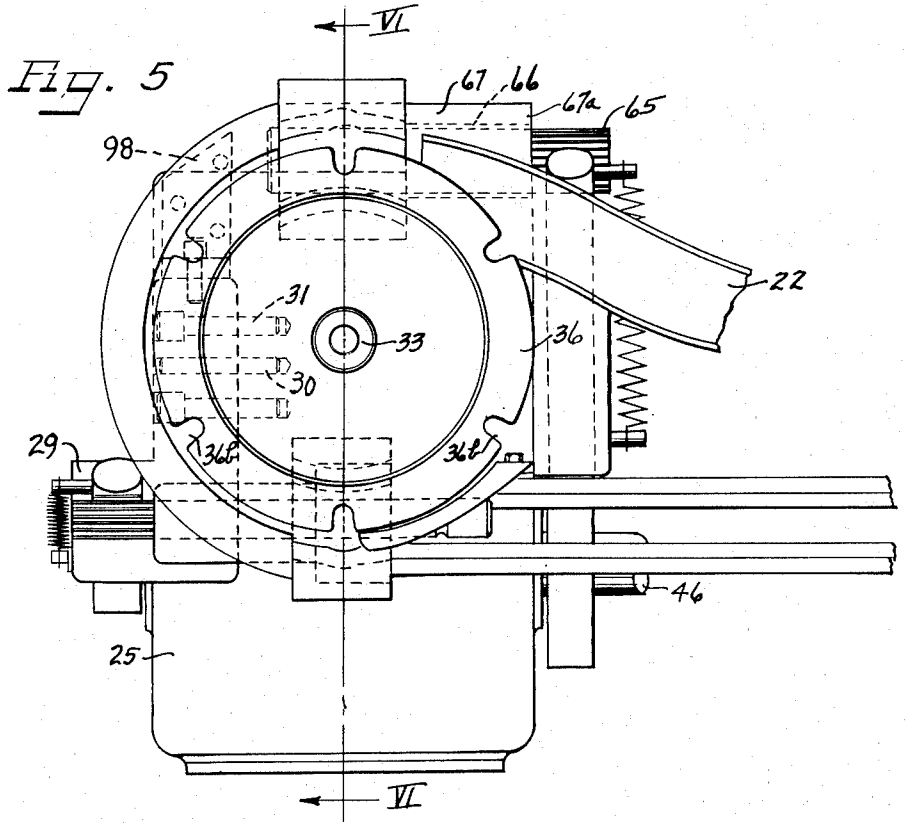
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Fig. 5



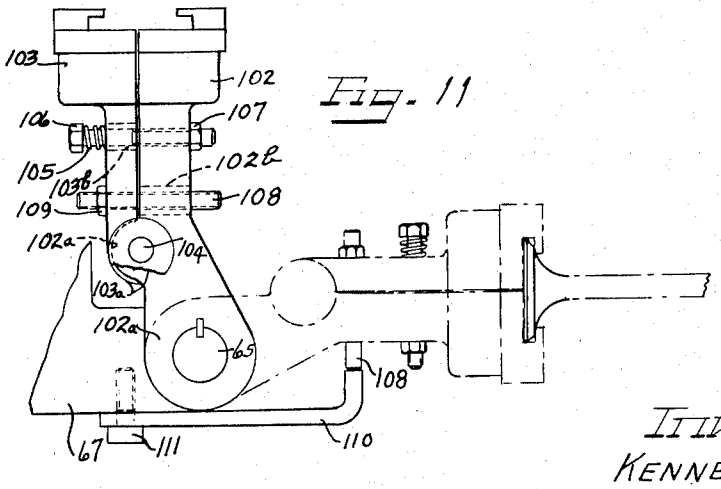


Fig. 11

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AUTOMATIC FEEDER

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Fig. 6

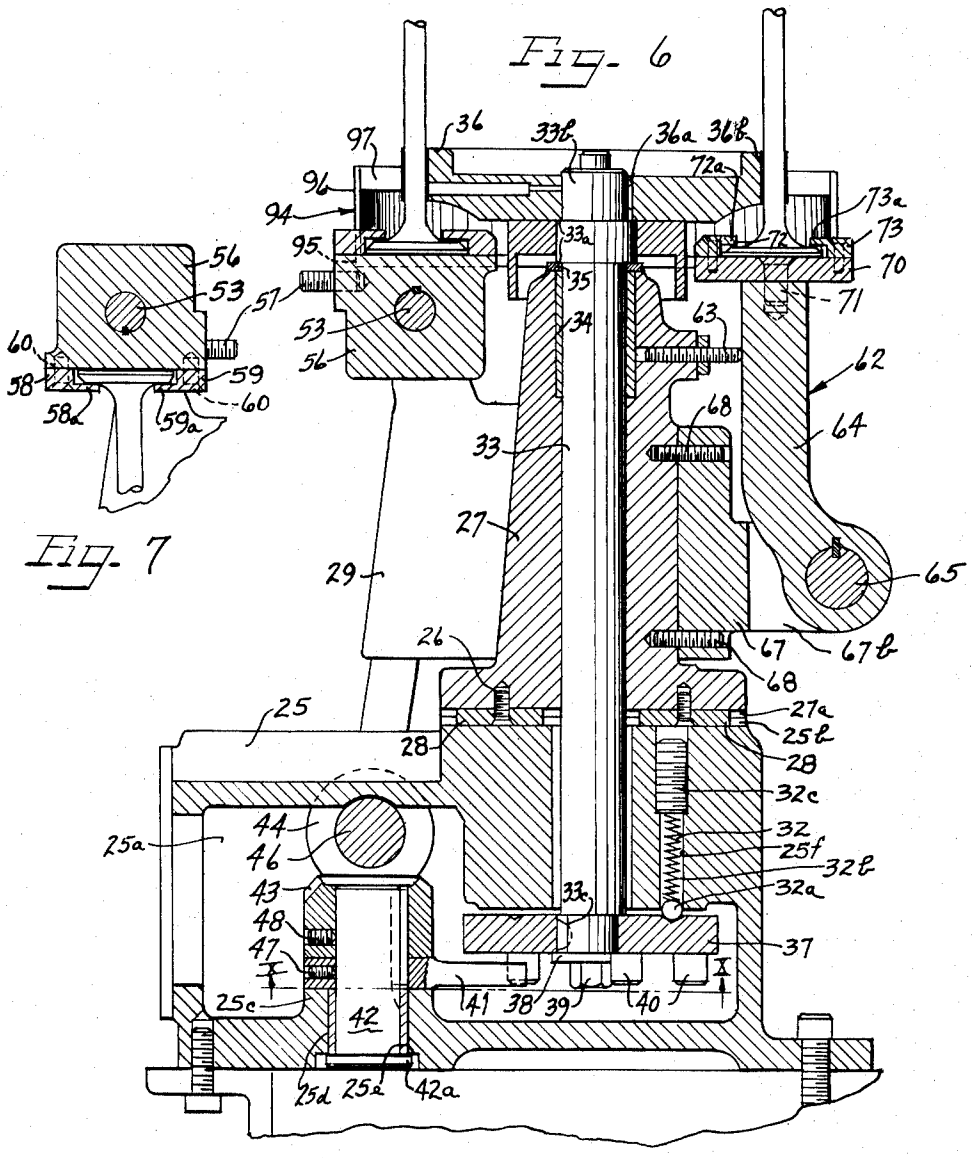
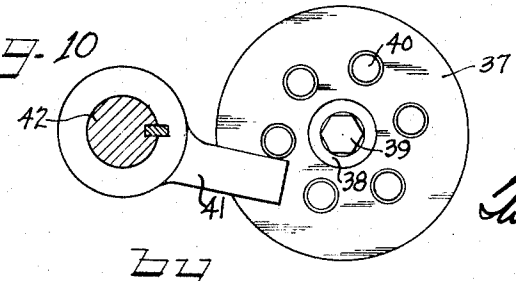


Fig. 7

Fig. 10



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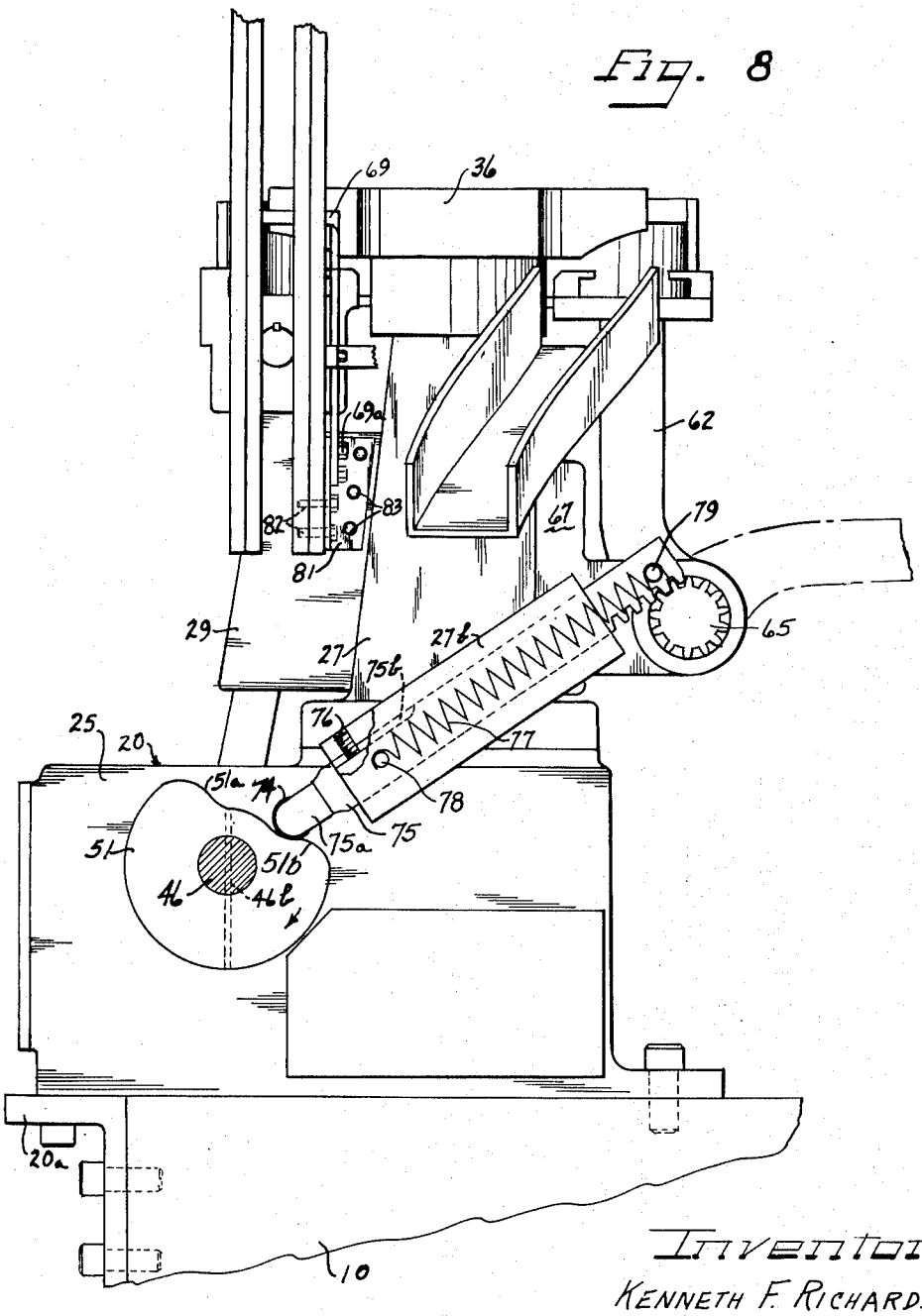
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AUTOMATIC FEEDER

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Fig. 8



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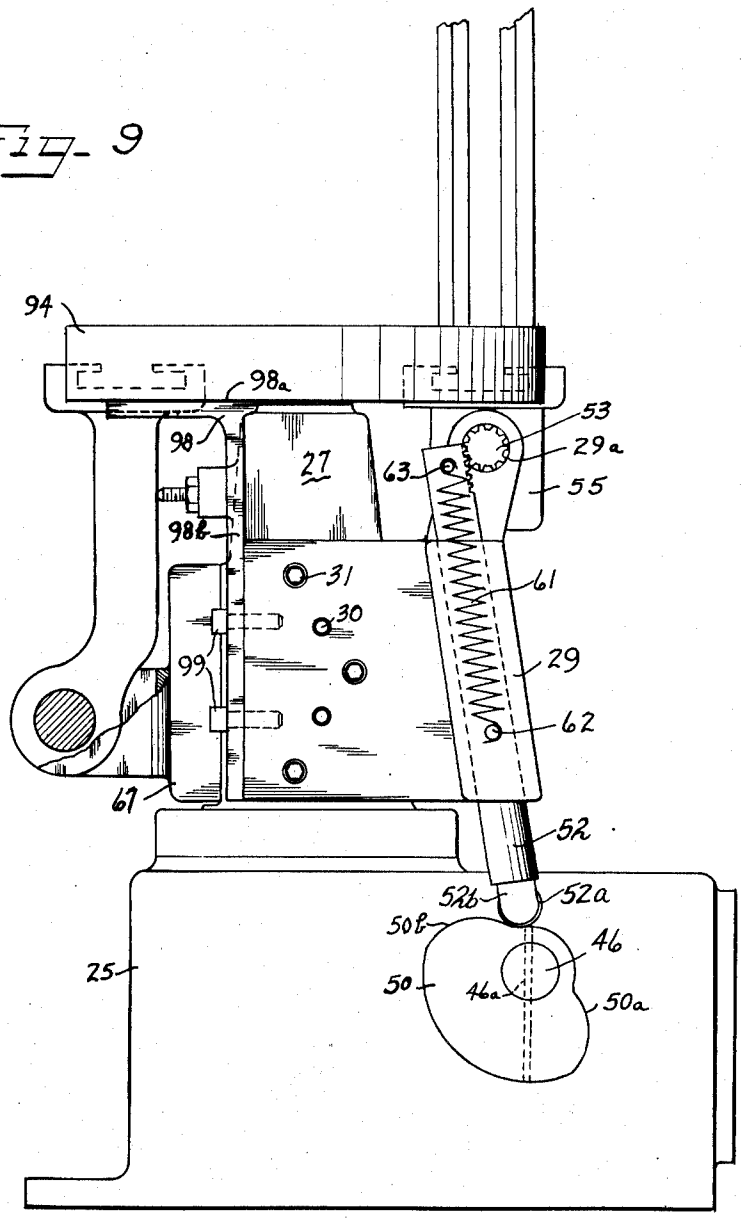
By Atty's.

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AUTOMATIC FEEDER

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Fig. 9



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Patented Aug. 8, 1950

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UNITED STATES PATENT OFFICE

2,518,375

AUTOMATIC FEEDER

Kenneth F. Richards, Willoughby, Ohio, assignor to Thompson Products, Inc., Cleveland, Ohio, a corporation of Ohio

Application April 24, 1947, Serial No. 743,514

21 Claims. (Cl. 51—215)

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This invention relates to improvements in apparatus for automatically feeding materials to a processing or work station.

Specifically, this invention deals with the automatic feeding of a valve stem to the throat of a centerless grinder and positioning it therein for machining to size.

According to this invention there is provided an automatic feeder for successively supplying work to the grinding throat of a grinding machine, holding the work in proper position in the throat and for removing the work after completion of the grinding operation. The feeder will hereinafter be specifically described in connection with the feeding of poppet valves to the grinding throat of a centerless type grinder, but it should be understood that the invention is not limited to such embodiments, being generally useful in the feeding of work pieces to any type of machine.

The feeder of this invention includes an inclined supply track having spaced rails receiving freely therebetween the stems of valves to be ground. The heads of the valves span the rails and rest thereon. Succeeding valve heads overlie preceding heads on the track, and the track is manually filled with valves from its upper end to provide a stepped series of valves. The valves as they reach the lower end of the track are successively fed by gravity into a loader arm which receives the valve head and tilts the valve to position it uppermost in a slot of a turret while its head rests on an arcuate track. The turret holds several valves and is intermittently driven to convey the valves from the loader arm to a work holder arm. This holder arm has a slotted head into which the valve head is pushed as the turret rotates. The holder arm is then swung outwardly to tilt the valve and swing the stem thereof into the grinding throat. After a predetermined grinding period, the holder arm is automatically swung upwardly to remove the valve stem from the grinder and return it to its slot in the turret, which is then indexed one position and the machined valve is permitted to drop by gravity into a chute which directs it to a suitable receptacle. Meanwhile, the turret has pushed the next valve into the slotted head of the holder arm for the subsequent grinding operation.

In grinding an article such as a standard type of poppet valve that has either a shoulder, a head, or other enlarged portion at one end, the operations of feeding the article into the throat of the grinder and removing it therefrom are most advantageously carried out from the same side of

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the grinder. It is evident therefore, that these two operations must be performed separately in order that they do not interfere with each other and delay the production of finished articles. In the present invention both the operations of positioning the valve in the grinder and removing it therefrom are carried out by the same pivoting work holder arm, thereby preventing interference. Moreover, valves are fed to the holder arm by the turret with a minimum amount of lost time between the removal of one valve and the positioning of the next in the grinder. The production capacity of the grinder is thus greatly increased by the use of the apparatus of this invention.

In any grinding operation where only a relatively small amount of material is removed, such as a finish grind on a valve stem, the time required for grinding the valve is so short that the operator could not efficiently operate more than one machine. He would be required to shift back and forth from one machine to the other at an exhausting rate. The apparatus of the present invention provides a method for efficiently carrying out the grinding operation, in which the operator is only required to keep the supply track filled with valves. By the use of this invention one operator can easily keep two or more machines operating at a relatively high production. Further, the services of a skilled grinder operator are not required where the apparatus of this invention is employed.

An important feature of this invention resides in the provision of a loader arm, swingable by a cam-actuated mechanism from a lower receiving position to an upper discharge position and having a slotted head portion adapted in its lower position to receive therein the head of a valve and arranged in its upper position to allow a rotating turret to slide the valve head out of the slotted head portion.

Another feature of this invention is the provision of a rotatable turret having a plurality of slots in the periphery thereof for moving valves or other work from a receiving to a releasing position, and being rotated by a peg-type intermittent drive mechanism.

A further feature of this invention is the provision of a work holder arm swingable by a cam-actuated mechanism from a vertical receiving position to a horizontal working position and then to a vertical releasing position, said holding arm having a slotted head arranged in its vertical position to permit a rotating turret to insert a valve head therein or remove one therefrom, and

in the horizontal position to hold the work in position in the grinding machine.

A special feature of this invention resides in the provision of a work holding arm which has two arm portions, one of which is pivotally mounted on the other. A spring loaded member passes through both arm portions and tends to clamp the work piece between a pair of jaws at the outer end of the arms while the work piece is being moved to grinding position. A spreader pin operates on the pivoting member and loosens the grip of the jaws when the valve is moved into position for grinding to permit the valve to spin during the grinding operation.

It is, then, an object of this invention to provide a compact feed mechanism suitable for installation on a standard grinding machine and adaptable to be driven from the power take-off of the machine.

A further object of this invention is to provide a feed mechanism capable of automatically taking articles to be machined from a supply source, positioning each article in the working zone of a machine tool, holding it in this position during machining and then directing it to a storage container, the operations being performed successively and so coordinated as to allow a minimum of lost time between each operation.

A further object of this invention is to provide an improved apparatus for holding a poppet valve during grinding of the stem to permit rotation of the entire valve during the operation.

Other objects, features and advantages of this invention will be readily apparent to one skilled in the art from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a front elevational view of the novel feeder mechanism of this invention mounted on a standard type centerless grinder;

Figure 2 is a plan view of the feeder mechanism mounted on the centerless grinder illustrated in Figure 1, particularly showing a work piece positioned by the feeder mechanism in the throat of the grinder;

Figure 3 is an enlarged fragmentary plan view of that portion of Figure 2 which shows the work piece in the throat of the grinder;

Figure 4 is a front elevational view, partly in section, of the feeder mechanism of this invention;

Figure 5 is a plan view partly broken away of the feeder mechanism of this invention;

Figure 6 is a vertical sectional view of the feeder mechanism taken substantially on line VI—VI of Figure 5;

Figure 7 is a fragmentary vertical sectional view showing a revolved position of a portion of the mechanism of Figure 6;

Figure 8 is a side elevational view, partly broken away, of the feeder mechanism;

Figure 9 is a side elevational view, partly broken away, of the feeder mechanism of this invention;

Figure 10 is a horizontal sectional view taken substantially along line X—X of Figure 6 looking in the direction indicated by the arrows;

Figure 11 is a vertical elevational view of a modified form of the valve holder arm of the feeder mechanism of this invention, showing in dot-dash lines the revolved position of the holding arm when the valve is being held between the grinder wheels; and

Figure 12 is a vertical sectional view on line XII—XII of Figure 1.

In Figure 1 the reference numeral **10** designates a typical centerless grinder comprising a base portion **11** on which is mounted a grinding wheel **12** including a trueing attachment **13** and an adjustable regulating wheel **14**, with a trueing attachment **15**. The regulating wheel **14** is conveniently driven by a motor and a suitable mechanism enclosed in a housing **16**.

To permit the regulating wheel **14** to move toward the grinding wheel **12** at the beginning of the grinding operation, the regulating wheel and the housing **16** are mounted on a platform **17** which is suitably disposed on the bed of the grinder for back and forth movement. An in-feed mechanism, indicated by the reference numeral **18**, is motivated from a power unit **19** to provide the reciprocating movement to the platform **17**.

The automatic feed device of this invention is generally indicated by the reference numeral **20** in Figures 1 and 2. It is mounted on the side of the grinder on a bracket **20***a* (Fig. 8) and is adapted to take valves from an inclined track **21**, position them in the throat area of the grinder for machining and then direct the finished valves to a chute **22** which conveys the valves to a suitable receptacle. This automatic feeder is driven through a universal drive mechanism **23** and through spiral gears **23***a* from the power unit **19** (Fig. 2).

As best shown in Figures 4, 5, 6, 8, and 9, the frame of the automatic feeder **20** of this invention comprises a substantially box-shaped base **25**, which is partially hollowed out to afford a chamber **25***a*. On the upper surface of the base **25** is secured, by means of cap screws **26**, an upright body member **27** the central portion of which has a circular cross section which progressively decreases in area from bottom to top. The body member **27** may be located on the base **25** by means of a pair of keys **28**, Figure 6, which are fastened by countersunk screws onto the under side of the member **27** and are arranged to seat in cross grooves **27***a* and **25***b* of the members **27** and **25** respectively. A side body member **29** is secured by a plurality of dowels **30** and cap screws **31** to the central body member **27**.

The automatic feeding device of this invention includes three drive mechanisms all driven from the same power source and coordinated with each other. These mechanisms include driving means for rotating a conveyor for moving valves from a work receiving station to a work processing station, driving means for actuating a loader arm to deliver work to the work-receiving station of the conveyor and drive means for actuating a work holder arm for removing work at the work-processing station.

Means for driving the conveyor of this invention is provided by a drive shaft **33**, Figure 6, which is suitably journaled in a bearing **34** recessed in the vertical body member **27** and which has an enlarged shoulder portion **33***a* adapted to rest on a washer **35** positioned on the uppermost surface of the vertical member **27**. The shaft **33** is thus arranged to be supported by the vertical member **27** for rotation therein.

A rotatable turret-type conveyor **36** has a vertical central aperture **36***a* adapted to be positioned over a reduced portion **33***b* of the drive shaft **33**. The turret **36** is thus supported on the upper portion of the shoulder **33***a* of the drive shaft and may be conveniently keyed to the upper portion **33***b* of the shaft, for rotation with said shaft.

The turret **36** is circular in form and has a plurality of work-receiving slots **36***b* disposed

around the periphery thereof. The slots are arranged in diametrically opposed pairs in order that the loading and unloading operations may be carried on contemporaneously by swinging arms located on opposite sides of the turret.

The lower portion of the shaft **33** projects through a central aperture in the base member **25** and has secured to a lower reduced portion **33c** an indexing plate **37**, which may be keyed to the shaft and held between the lower shoulder of the shaft **33** and a washer **38** by means of a cap screw **39** which is threaded into the lower end of the shaft.

As illustrated in Figures 6 and 10, the indexing plate **37** has a plurality of downwardly projecting pegs **40** secured therein. An indexing arm **41**, which is keyed to an idler shaft **42** for drive thereby, is arranged to contact one of the pegs **40** of the index plate each revolution and thus index the shaft **33** one position for each revolution of the idler shaft. In Figure 6 an indexing plate having six pegs is illustrated. By using this type of drive the speed of the drive shaft **33** is reduced to one-sixth of that of the idler shaft **42**.

A resilient stop assembly **32**, comprising a ball check **32a**, a spring **32b** mounted above the ball check in an aperture **25f** of the base **25** and a set screw **32c**, hold the indexing plate in the indexed position. After the indexing arm **41** completes the movement of the plate, the spring **32b** will urge the ball check down into one of a series of spaced indentations on the upper surface of the indexing plate.

To afford a support for the indexing arm **41**, a built-up shoulder portion **25c** is provided extending upwardly from the lower wall of the base **25** into the chamber **25a**. An opening **25d** is cut in the shoulder portion **25c** and is adapted to receive therein the idler shaft **42**. In order to drive the indexing arm **41**, a bevel gear **43** is positioned on the idler shaft **42** just above the indexing arm **41** and is keyed thereto. The bevel gear **43** is in mesh with a second bevel gear **44** which is secured to a drive shaft **46** extending across the chamber **25a** and driven by the universal drive **23**. A set screw **47** on the indexing arm **41** and a set screw **48** on the bevel gear **43** are arranged to contact the idler shaft **42** and hold it against up and down movement, with a lower shoulder portion **42a** abutting a recessed shoulder member **25e** of the base. Thus the indexing plate, and consequently the drive shaft **33** and turret **36**, are arranged to be driven intermittently by a drive shaft **46** through an idler shaft **42** and a pair of miter bevel gears.

As previously mentioned, the rotation of the turret **36** must be coordinated with the movement of the loader arm which receives the valve from the supply track and with the movement of the work holder arm which takes the valves from the turret and positions them in the throat of the grinding machine. This is accomplished in this invention by connecting the shaft **46** which drives the turret **36** to a pair of cams **50** and **51**, as seen in Figure 4.

The cam **50**, Figure 9, is keyed on the shaft **46** and is arranged to actuate a rack **52** through a roller follower **52a** freely journaled in the lower bifurcated end **52b** of the rack **52**. The teeth at the upper end of the rack are in mesh with teeth at the outer end of a pinion shaft **53** which is journaled for rotation in a pair of bearings **54**, Figure 4, disposed in an upwardly extending portion **29a** of the side body member **29**. Near

the inner end of the pinion shaft **53** and aligned vertically with the drive shaft **33**, a loader arm **55** is keyed to the pinion shaft **53**. For convenience, the portion **29a** in which the pinion shaft is journaled may be made of such a length that the loader arm will be in alignment with the shaft **33** when it is positioned abutting the side face of the portion **29a** of the body member **29**.

The loader arm **55**, Figures 6 and 7, includes a block-shaped journal member **56** which is adapted to receive the pinion shaft **53** in a centrally located aperture. A pair of guides **58** and **59** are secured by countersunk set screws **60** to the member **56**. For the purpose of gripping the head of the poppet valve, the guides **58** and **59** have inwardly extending arms **58a** and **59a**, respectively. The recess formed by the arms **58a** and **59a** provide an arcuate shaped path from which the turret **36** moves each valve.

In Figure 7 is shown the position of the lower arm **55** when it is ready to receive a poppet valve from the supply track. The loader arm **55** is aligned with the supply track **21** by means of an adjustable stop screw **57** which is arranged in the arm **55** for limiting counterclockwise movement by contacting the body member **27**. In Figure 6, the loader arm **55** has been rotated approximately 180° and has positioned the valve in a slot **36b** in the turret **35**. It is to be noted that, as the valve approaches the slot **36b**, a guide arm **69**, Figures 4 and 8, directs the valve into the slot. This arm is secured at its lower end onto the supply track **21** by cap screws **69a**. This latter position of the loader arm corresponds to the position of the cam **50**, shown in Figure 9, wherein the roller follower **52a** rests on the low portion of the cam. As the cam begins to rotate counterclockwise due to the driving of the shaft **46**, the roller follower will remain for a predetermined time on the low portion of the cam. When it begins to ride up the inclined surface **50a** of the cam, the follower **52a** and consequently the rack **51** will move upwardly causing the teeth at the upper end of the rack to rotate the pinion shaft **53** clockwise and thus rotate the loader arm **55** clockwise to a position where the valve holding guides **58** and **59** are down. When the follower **52a** has reached the high side of the cam it will remain thereon for approximately 120° of rotation of the shaft **46** and will then be forced downwardly along the downwardly inclined surface **50b** of the cam due to the action of a spring **61** which has one end anchored about a pin **62** secured in the body member **23** and the other end anchored around a pin **63** secured in the upper end of the rack. When the cam follower **52a** is on the downwardly sloped surface **50b** of the cam **50**, the cam **50** no longer exerts an upward force on the rack **52** and the spring **61** will pull the rack downwardly as the follower **52a** moves along the cam surface. It is to be noted that as the cam follower moves down the surface **50b** the loader arm **55** will be rotated counterclockwise into the position indicated in Figure 9. Therefore, there is provided means for rotating the loader arm from a downward receiving position to an upward discharging position. In the embodiment of the invention shown in Figure 9, the cam **50** has a lower dwell of approximately 120°, a high dwell of approximately 120° and a cam rise of 60° and a cam fall of 60°.

For the purpose of removing the valves from the turret **36** there is provided a pivotable work holder **62** which is actuated by the cam **51**, and which, in the upper position shown in Figure 6,

is arranged to abut against adjustable stop screw 63 threaded into the body member 27, and thus align itself directly under a slot 35b of the turret 36. The work holder includes an arm 64 keyed to a pinion shaft 65 which is journaled in a bearing 66, Figure 5, in a bracket 67 secured by set screw 68 to the central body member 27. This bracket 67 has a rearwardly extending portion 67a which is disposed horizontally across the back of the feeder. A recess portion 67b, Figure 6, directly in line with the axis of the drive shaft 33, affords a pivoting chamber in which the arm 64 is keyed on the pinion shaft 65 for rotation therewith.

Besides the arm 64, the work holder 62 includes a wear plate 70 secured to the upper end of the arm 64 by a set screw 71. The wear plate 70 is made of a particularly wear-resistant material such as steel since, during the grinding operation, the head of the spinning valve will tend to rub thereagainst. A pair of oppositely disposed guides 72 and 73 are secured by set screws to the wear plate. The guides 72 and 73 have overhanging lip portions 72a and 73a, respectively, which form arcuate shaped channels for receiving the head of the valve as the turret 36 swings the valve toward the holder arm 62.

As previously mentioned, the cam 51 controls the pivoting movement of the work holder 62. This is accomplished by a roller follower 74, Figure 8, which actuates a rack 75, being mounted for rotation in the lower bifurcated ends 75a thereof. The rack is conveniently disposed in a guide portion 27b of the central body member 27 and is guided therein by a set screw 76 which is arranged to project downwardly into a keyway 75b in the rack 75.

The teeth at the upper end of the rack 75 are in mesh with the teeth on the pinion shaft 65. When the follower 74 is riding on the lower dwell portion of the cam 51, the work holder 62 is held in a vertical position, illustrated in Figure 8, through the action of a spring 77. This spring 77 has its lower end disposed over a peg 78 secured in the body member 27b and its upper end anchored over a peg 79 secured in the upper end of the rack 75 and this is thus adapted to exert a downward pressure on the rack 75. When the cam follower rides up the inclined surface 51a of the cam, the work holder will be swung downwardly to the substantially horizontal position shown in the dot-dash lines in Figure 8. In this position the valve stem is held in the throat of the grinder. After a predetermined period the follower will reach the surface 51b and the spring 77 will return the arm 62 to a vertical position for unloading the finished valve.

To supply valves to the loader arm 56 there is provided a supply track 21, Figures 1, 8, and 12, which is mounted on the side of the machine, being supported by a support arm 80 secured as by welding to the track and to the frame of the grinder. At its lower end the track is supported by an angle plate 81, Figure 8, one leg of which is fastened to the track by cap screws 82 and the other leg of which is fastened to the central body member 27 by cap screws 83.

As best seen in Figure 12, the track comprises a pair of upper plates 84 and a pair of lower plates 85. Each upper plate 84 is secured to a lower plate 85 by a plurality of cap screws 86 which are spaced along the entire length of the track. The valve head rests on the upper plates while the valve stem hangs free between the lower plates. To hold the track assemblies apart there are provided two spacer brackets 88, each of which comprises two angle members 89 and 90 secured together by a bolt 91. The downwardly extending arms of the angle members 89 and 90 are fastened to the upper plates 84 by cap screws 92 with a spacer plate 93 between each uppeer plate and each arm.

At the end of the track adjacent the feeder each upper plate 84 is provided with a substantially horizontal portion 84a, shown in Figure 4, which is adapted to hold the lowest valve in the line in a susbtantially horizontal position preparatory to being pushed into the groove of the loader arm 56 by the weight of the valve immediately behind it. When one valve is positioned in the guide slot in the loader head 56, the valve immediately behind it comes to rest against the loader arm and is held from further downward movement as the loader arm rotates by the side of the loader arm which is in contact with the edge of the valve.

After a valve has been swung upwardly by the loader arm 56 and positioned in a slot in the turret 36, the valve will be slid out of the arcuate recess formed by the guides 58 and 59 on the loader arm 56 and onto the lower surface of an arcuate-shaped track assembly 94, Figure 6, which extends in a substantially semi-circular path around the side of the feeder. The track assembly 94 comprises a lower plate 95 which is enclosed by an arcuate-shaped housing member 96 and which may be welded thereto. At the upper end of the housing 96 and extending inwardly therefrom, an arcuate-shaped member 97 provides a guide surface for preventing the valve stem from moving out of the slot in the turret 36 as it rotates from the loader arm 56 to the work holder arm 62. The upper surface of the lower plate 95 is in the same plane as the upper surface of the wear plate of the work holder 62 in order that the valve may be easily slid into the upper guide portion of the work holder. As is best shown in Figures 5 and 9, the track assembly 94 may be conveniently supported by a bracket 98 which has a flat upper support surface 98a and a downwardly extending arm 98b which is secured by cap screws 99 to the body 29.

After the valve has been machined in the grinder and returned to the slot in the turret 36, the turret will be rotated clockwise as seen in Figure 5 and the valve will be allowed to drop by gravity into a chute 22 which is disposed under the turret. This chute is a substantially U-shaped member which may be conveniently made from sheet metal and which is suitably supported by a brace 99, Figure 1, welded to the chute and to the frame of the grinder. An additional brace 99a, Figure 4, may be disposed under the upper end of the chute between the upper body member 27 and the chute. The chute may, of course be extended downwardly as far as desired and may be made to discharge into a receptacle or on to a work table.

From the foregoing description it is seen that there is provided in this invention a supply track for delivering valves to a loader arm which is adapted to swing the valve upwardly into a slot in a rotary turret. The turret is intermittently driven by an indexing plate and arranged to slide the valve out of the guide head of the loader arm onto a track and then by intermittent pushes to propel the valve around the track and slide it into the guide head of a work holder. The work holder is actuated to swing the valve downwardly for positioning the stem thereof in the throat of a grinder. When the valve is returned to a slot in the turret, further rotation of the turret permits the valve to drop into a chute in which it is directed to a suitable receptacle.

In Figure 11 is shown a modified form of the work holder arm. This work holder comprises an upright arm 102 which has a lower portion 102a keyed to the pinion shaft 65 for rotation therewith. A second arm member 103 is pivotally disposed on the arm 102 having its lower bifurcated end 103a disposed over a projecting portion 102a of the arm 102 and secured for pivoting thereon by a pin 104. These two arm members 102 and 103 are yieldably held together by means of a spring 105 disposed over a bolt 106 which passes through an opening 103b in the arm 103 and is threaded into the arm 102 and locked therein by a lock nut 107. When the turret slides a valve into the opening at the upper end of the arm the spring 105 permits the two arms to separate slightly to allow the valve head to be positioned therein and then maintains a pressure on the two arms tending to close them and thus hold the valve relatively tightly in the upper portion of the arms. When the valve is inserted in the throat of the grinding machine it is desirable that the valve head be allowed to spin while the grinding operation is being performed. To accomplish this, there is provided a spreader pin 108 which passes through an opening 102b in the arm 102 and is threaded into the arm 103 and held therein by an adjustable nut 109. A stop plate 110 may be conveniently secured by a cap screw 111 into the bracket 67.

When the work holder is swung down, the stop pin 108 will contact the stop plate 110 and cause the pivoting arm 103 to swing away from the arm 102 against the action of the spring 105. It is apparent that the amount of opening can be easily controlled by adjusting the position of the stop pin 108. When the work holder is swung back into its upright position the stop pin upon leaving the stop plate 110 will permit the spring 105 to once more swing the arm 103 toward the arm 102 and firmly grip the valve in the upper guide portion thereof.

In operation, the drive mechanism of this invention is arranged to rotate the turret only when both the loader arm 56 and the work holder 62 are in the upright position, both valves being swung into slots in the turret. This coordination is effected by setting the cams 51 and 50, as shown by Figures 8 and 9, respectively, with the cam followers on the low dwell portion of the cam. It is to be noted that in this position the loader arm 56 and the work holder 62 are in their upright positions. The loader arm will remain in this position for approximately 120° of rotation of the drive shaft 46 while the work holder will remain upright for approximately 60°. For ease in coordinating the cams on the shaft 46, locating holes 46a and 46b may be drilled parallel in the shaft 46 one at each cam station. If then holes are drilled in the cams, one beginning at the start of the low dwell portion of the cam 50 and the other beginning at the end of the low dwell portion of the cam 51, the cams 50 and 51 will always be coordinated with each other when these holes are aligned by any convenient pin or dowel. To coordinate the mechanism so that the turret 36 will be indexed while the loader arm and the work holder are in their upright position it is necessary only to adjust the indexing arm 41 on the idler shaft 42 by loosening the set screw 47 and put it in the position indicated in Figure 10. In this position the turret is just beginning to be indexed.

It is further necessary that the back and forth movement of the regulating wheel 14 on the grinder be synchronized with the movement of the work holder so that the regulating wheel will be moved against the valve just after the valve is positioned in the throat of the machine. This may be readily accomplished by coordinating the speed of the shaft 46 which is driven from a standard power take-off of the in-feed drive attachment 19 of the grinder through the universal drive and the spiral gear 23 with the feed of the in-feed mechanism 19. Since the in-feed attachment and mechanism is not a part of this invention it will not be described in detail.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. An automatic feeder for a machine having a work treating station which comprises a work supply receptacle, a swingable loader receiving work successively from said receptacle, a conveyor having a plurality of work-receiving portions successively positioned adjacent said loader to successively receive work therefrom, a swingable work holder adjacent the work-treating station of said machine for successively receiving work from the conveyor, and mechanism driven by said machine for swinging the loader, for driving the conveyor to advance the work on the conveyor to the holder, to swing the holder in one direction to move the work to the treating station, to swing the holder in the other direction to return the treated work to the conveyor, and to further advance the conveyor to discharge the work away from the treating station.

2. An automatic feeder for a machine having a work-treating station which comprises an inclined feeder track having a gravity discharge, a swingable loader receiving work successively from said feeder track, a rotary conveyor having a plurality of work-receiving portions successively positioned adjacent said loader to successively receive work therefrom, a swingable work holder adjacent the treating station of said machine for successively receiving work from the conveyor, mechanism to actuate said loader between the discharge end of said track and said rotary conveyor for charging the conveyor with work, mechanism for rotating the conveyor intermittently to advance work to the holder, and mechanism to actuate said holder to move work from said conveyor to the treating station of the machine and to return treated work to said conveyor for discharge.

3. An automatic feeder for a machine having a work-treating station which comprises a frame, an inclined feeder track having a gravity discharge adjacent said frame, a loader arm pivotally mounted on said frame, a rotary turret journaled in said frame and having a plurality of work-receiving slots in the periphery thereof successively positioned adjacent said loader to receive work therefrom, a swingable holder positionable under said turret for receiving said work therefrom, mechanism driven by said machine to actuate said loader arm between the discharge end of said feeder track and said turret for charging said turret with work, mechanism for rotating said turret intermittently to advance work to said holder, and mechanism to actuate said holder to move work from said turret to the

treating station of the machine and to return treated work to said conveyor.

4. An automatic feeder for a machine having a work-treating station which comprises a work supply receptacle, a swingable loader receiving work successively from said receptacle, a conveyor having a plurality of work-receiving portions successively positioned adjacent said loader to successively receive work therefrom, a swingable work holder adjacent the treating station of said machine for successively receiving work from the conveyor, a cam-actuated rack and pinion mechanism to actuate said loader between the discharge end of said supply receptacle and said conveyor for charging said conveyor with work, a peg-type intermittent drive mechanism for rotating said conveyor intermittently to advance work to said work holder, and a cam-actuated rack and pinion mechanism to actuate said holder to move work from said conveyor to the treating station of the machine and to return treated work to said conveyor for discharge.

5. An automatic feeder for a machine having a work-treating station which comprises an inclined supply track having a gravity discharge, a loader arm having a work-receiving head positioned adjacent the discharge end of said supply track, a rotary conveyor driven by said machine having a plurality of work-receiving slots, a work holder pivotally mounted adjacent the treating station of said machine having a work-receiving head for cooperation with said conveyor, mechanism for moving said loader arm between the discharge end of said supply track and said conveyor for positioning a work piece in a slot in said conveyor, and mechanism for rotating said conveyor, the work-receiving heads of said loader and said work holder having work-receiving recesses alignable with work in the slots of said conveyor whereby the conveyor will move work out of said loader into the conveyor while it ejects a treated work piece out of said work holder.

6. An automatic feeder for a machine having a work-treating station which comprises an inclined track having a gravity discharge, a swingable loader positioned to receive work from said track, a swingable work holder disposed near the throat of the machine for positioning work therein, a conveyor for receiving work from said loader and delivering it to said work holder comprising a rotatable member having work-receiving slots and a stationary plate member disposed beneath said rotatable member, and mechanism driven by said machine for actuating the loader, for driving the conveyor and for swinging the holder to feed the work from the conveyor to the treating station and to swing the holder in the other direction to return the treated work to the conveyor and to further advance the conveyor to discharge the work away from the treating station.

7. An automatic feeder for a machine having a work-treating station which comprises a work supply track having a gravity discharge, a conveyor having a circular conveying member and having a plurality of work-receiving stations in the periphery thereof, a loading member arranged to receive work from said supply track and swing it upwardly to a work-receiving station in said conveyor, guide means for directing the work into the work-receiving station, a work holder disposed on the opposite side of said conveyor from said loader member for receiving work from said conveyor, said work holder being swingable downwardly to position the work in the work-treating station of the machine, and mechanism driven by the machine for rotating said conveyor, for actuating said loader member and for swinging said work holder in one direction to move the work into the treating station and for swinging the work in the other direction to return the work to the conveyor for discharge.

8. An automatic feeder for a machine having a work-treating station which comprises a housing, a conveyor supported by said housing, a drive shaft journaled in said housing and arranged to drive said conveyor, an inclined supply track having a gravity discharge, a loader arm disposed for pivoting on said housing to move work from said supply track to said conveyor for loading the same, a work holder arm arranged in one position to receive work from said conveyor and arranged in a second position to hold the work in the work-treating station of the machine, and mechanism driven from the machine for rotating said drive shaft, for pivoting said loader arm and for swinging said work holder between its two operating positions.

9. An automatic feeder for a machine having a work-treating station which comprises a housing, a conveyor supported by said housing comprising a stationary work support and a rotary member for moving work along the stationary support and having a plurality of work-receiving stations, a drive shaft journaled in said housing for rotating said rotary member, a loader arm pivotally mounted on said housing for moving work to said conveyor for loading the work-receiving stations therein, a cam-actuated rack and pinion drive mechanism for pivoting said loader arm, a swingable work holder disposed in a first position to receive work from said conveyor and in a second position to swing the work into the work-treating station of the machine, a cam-actuated rack and pinion drive mechanism for swinging said holder from the first to the second position, and a drive associated with said drive shaft, with said drive mechanism for said loader arm and with said drive mechanism for said holder to drive these mechanisms.

10. An automatic feeder for a machine having a work-treating station which comprises a housing, a rotary conveyor including a conveying member having a plurality of work-receiving stations therein, a drive shaft journaled in said housing and associated with said conveyor for rotation thereof, a loader arm pivotally mounted on said housing for moving work from a supply station to the work-receiving stations of said conveyor, a work holder for moving work from said conveyor to the work treating station of the machine, said work holder comprising a holder arm pivotally mounted on said housing, a clamping arm pivotally mounted on said holder arm, oppositely disposed jaw members on said holder arm and on said clamping arm, a resilient means for holding the work between said jaw members when said work holder is moving the work between the conveyor and the work-treating station of the machine, a spreader device for opening said jaws to permit spinning of said work therein during the machining operation, and mechanism for driving said drive shaft, for pivoting said loader arm, and for moving said work holder between said conveyor and said work-treating station of the machine.

11. An automatic feeder for a machine having a work-treating station which comprises a housing, a loader pivotally mounted on said housing, a work supply track having a gravity discharge

and being disposed to supply work to said loader, a conveyor having a plurality of work-receiving stations therein for receiving work from said loader, said loader being arranged to deliver each work piece separately to a work-receiving station in said conveyor while holding the remaining work pieces in said supply track, a holder having a spring-urged jaw member for clamping said work piece during movement of the holder and movable to a release position for permitting spinning of the work piece during machining, and mechanism driven by said machine for swinging the loader, for driving the conveyor, for swinging the holder to feed the work from the conveyor into the work-treating station of the machine, to swing the holder in the opposite direction to return the treated work to the conveyor, and for further advancing the conveyor to discharge the work.

12. An automatic feeder for a machine having a work-treating station which comprises a work supply receptacle having a gravity discharge, a swingable loader receiving work successively from said receptacle, a conveyor comprising a stationary conveyor surface and a rotary conveying member for moving the work along said conveyor surface, said rotary member having a plurality of pairs of diametrically opposed work-receiving stations in the periphery thereof, a swingable work holder adjacent the treating station of said machine for successively receiving work from the conveyor, said swingable loader being movable into one of a pair of diametrically opposed work-receiving stations for loading the station while said conveyor is inoperative and contemporaneously with the movement of said work holder into the other diametrically opposed work-receiving station whereby subsequent rotation of said conveyor will remove a work piece from said loader and will remove a machined work piece from said holder arm and position an unmachined piece therein, and mechanism driven by said machine for swinging the loader, for driving the conveyor and for swinging the holder to feed the work from the conveyor to the work-treating station of the machine, and to swing the holder in the opposite direction to return the machined work to the conveyor and to further advance the conveyor to discharge the work from the treating station.

13. In a feeder for a machine having a work-treating station, a feeder arm comprising a holder arm pivotally mounted adjacent said work-treating station, a clamping arm pivotally mounted on said holder arm, oppositely disposed jaw members on said holder arm and on said clamping arm, a resilient means urging said jaw members together for holding the work between said jaw members when said feeder arm is moving the work toward said work-treating station, and a spreader device for opening said jaws slightly against the action of said resilient means to permit spinning of said work therein during the treating operation.

14. A device for feeding headed stem articles such as poppet valves or the like to a grinding throat of a grinding machine which comprises a pair of spaced inclined rails mounted on said machine and arranged for supporting the heads of said articles thereon in stepped inclined relation while receiving the stems of said articles between the rails, a turret mounted on said machine and having a plurality of stations for receiving the stems of said articles, a work loader shiftably mounted on said machine for transferring the end article at the bottom of said rails to a station of said turret, a work holder shiftably mounted on said machine for moving said article out of its station of the turret into the grinding throat and for returning the article to the turret, said loader and said holder each having an undercut recess for receiving the head of an article therein, said recess of the loader being alternately aligned with the lower ends of said rails to receive an article by gravity flow from said rails and aligned with said turret to position the stem of the article in a station of the turret, means for rotating the turret to remove the article from said loader, said loader having an abutment face holding the articles in the rails whenever the recess of the loader is misaligned with the rails, said recess of the holder being aligned with the turret to receive an article therefrom and to return the ground article thereto, and said turret being arranged for ejecting the ground article from the holder when the holder returns the article to the turret.

15. A device for feeding poppet valves or the like to the grinding throat of a grinding machine which comprises a pair of spaced inclined rails mounted on said machine and arranged for supporting the heads of said valves thereon in stepped inclined relation while receiving the stems of said valves between the rails, a turret rotatably mounted on said machine at a level above the lower ends of said rails and having a plurality of stations for receiving the stems of said valves, a work loader tiltably mounted on said machine and having an undercut recess alternately alignable with the lower ends of said rails to receive a valve by gravity flow therefrom and with said turret to deposit the stem of said valve in the turret, said recess releasably retaining said valve head, a loader tiltably mounted on said machine having an undercut valve head-receiving recess alternately alignable with said turret and with said grinding throat of the machine, said holder being arranged for moving a valve from the turret into the grinding throat and for returning the ground valve to the turret, and means for rotating the turret to eject the ground valve out of the holder.

16. A device for feeding poppet valves or the like to the grinding throat of a centerless-type grinding machine which comprises track means arranged for supporting a row of valves for gravity flow, a loader arm shiftable from a receiving position adjacent the lower end of said track means to a discharge position remote from said lower end, a turret shiftably mounted adjacent the discharge position of said loader and having a plurality of valve stem-receiving stations, means for shifting said turret to move the valves in said stations, a work holder arm tiltably mounted on said machine to transfer a valve from said turret to said grinding throat and back to said turret, and mechanism timing the operations of said loader arm, said turret, and said holder arm for simultaneously inserting a valve into the turret and ejecting a ground valve from the turret.

17. Automatic apparatus for feeding poppet valve stems to the grinding throat of a grinding machine which comprises a valve receptacle, a loader arranged for removing valves in succession from said receptacle, a turret arranged to convey valves from said loader to a position adjacent the grinding throat, a work holder tiltably mounted adjacent said grinding throat to remove valves from the turret and position the stems

thereof in the grinding throat, and mechanism for ejecting ground valves from the work holder.

18. In a valve-feeding mechanism for a grinding machine the improvements of an inclined track adapted to support a row of poppet valves in stepped superimposed relation, a loader having a valve head-receiving recess adapted to be aligned with the lower end of said track to receive the end valve by gravity flow from the track, and an abutment face on said loader arranged to close the open bottom of said track whenever said recess of the loader is misaligned relative to the bottom of said track.

19. In combination in a machine for processing poppet valves or the like, a frame structure, a work holding member having a longitudinal slot and flange portions partially closing said slot, said slot having open ends through which a valve may be inserted or withdrawn, said work holder being pivotable from a work-receiving position with said slot in a position for holding the valve with the shank extending downwardly to a work discharge position with the shank extending upwardly from the head, a turret rotatable about an axis in the plane of pivoting of said work holder and having recess portions overlying the discharge position of said work holder for receiving the work piece as said holder is pivoted to said work discharge position, and means for rotating said turret to slide the valve out of said slot for conveying the valve to the machine.

20. In a machine having a station for processing poppet valves or the like, a rotatable conveyor having work engaging portions on its peripheral portion receiving valves at a loading station and sliding them on a platform through substantially 180° to a processing station, a swingable work holder at said processing station

having a slot movable into the path of travel of said work engaging portions of said conveyor and underlying the peripheral portion of said conveyor with the base of said slot aligned with the surface of the platform whereby the valve is slid into said slot as said conveyor is rotated, and means for swinging said work holder to deliver the valve to the processing station.

21. In a machine having a work processing station, a work feeder comprising a first arm member pivotally mounted on the frame of said machine, a second arm member pivotally mounted on said first arm member for swinging therewith between a work receiving and a work treating station and arranged to lie close thereagainst, confronting slotted portions at the end of each arm defining a jaw assembly for receiving said work piece, spring means urging said arm members toward each other for gripping the work member between said jaws, and an adjustable member secured to one of said arms movable against a portion of the frame of the machine as said feeder approaches the work processing station for separating said jaws to relax the grip of the jaws in the work piece during treating thereof.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,834,158	Johnston	Dec. 1, 1931
1,892,364	Raule	Dec. 27, 1932
1,981,260	Yager	Nov. 20, 1934
2,117,917	Silven	May 17, 1938