June 14, 1966 G. W. ARMSTRONG ET AL 3,255,857

ROTARY TURNHEAD

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FIG-1

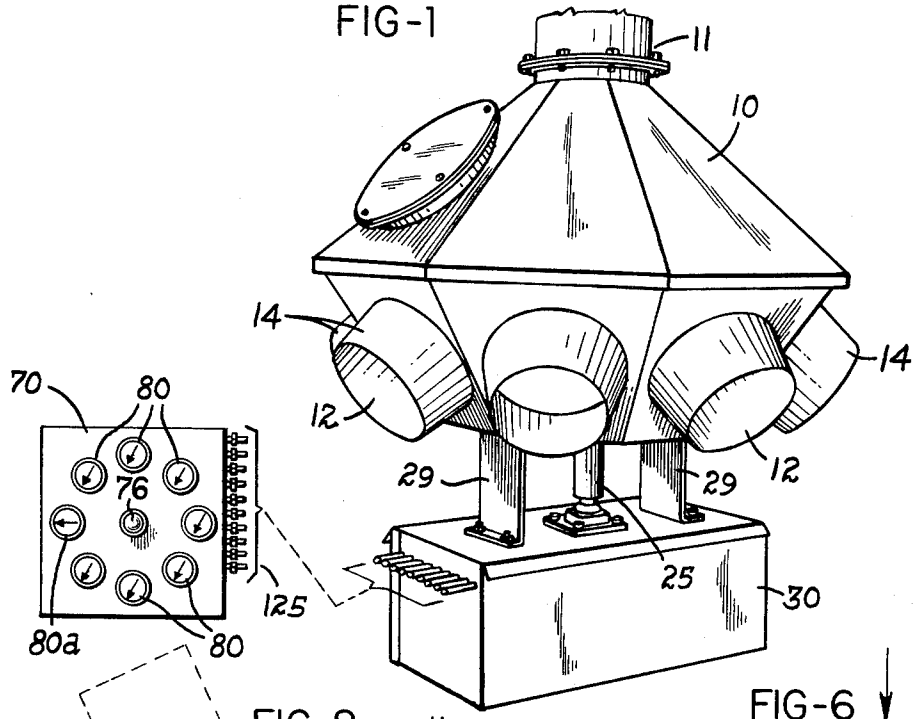


FIG-2

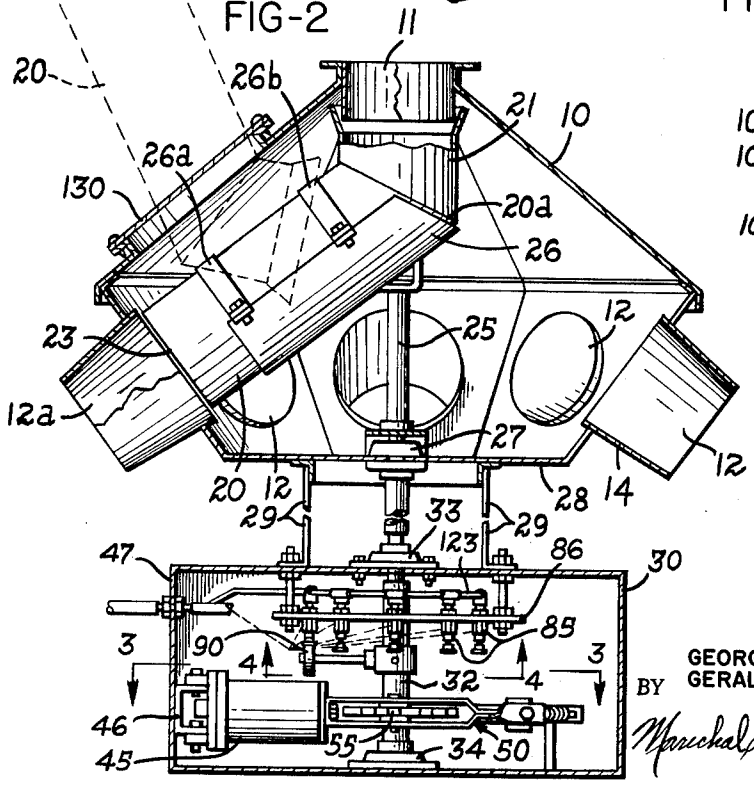
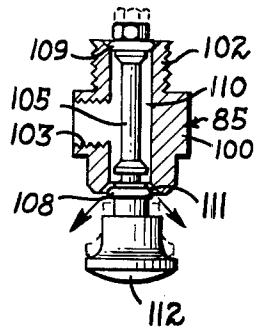


FIG-6



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FIG-3

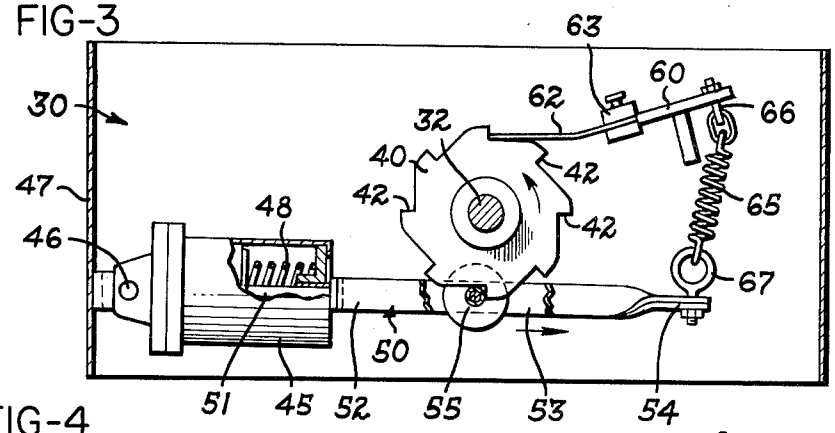


FIG-4

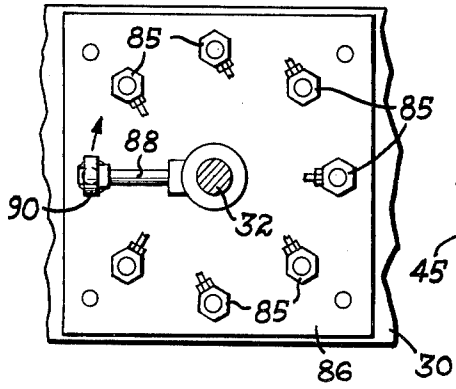


FIG-3A

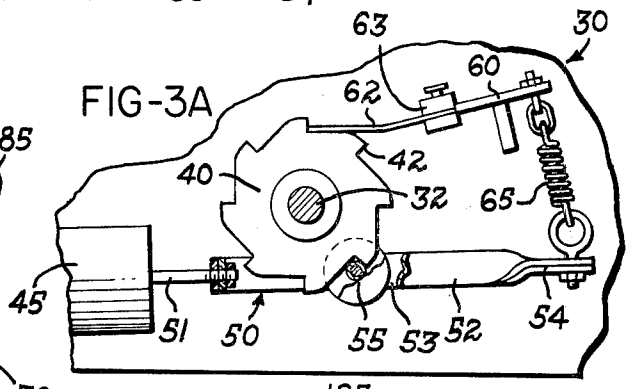
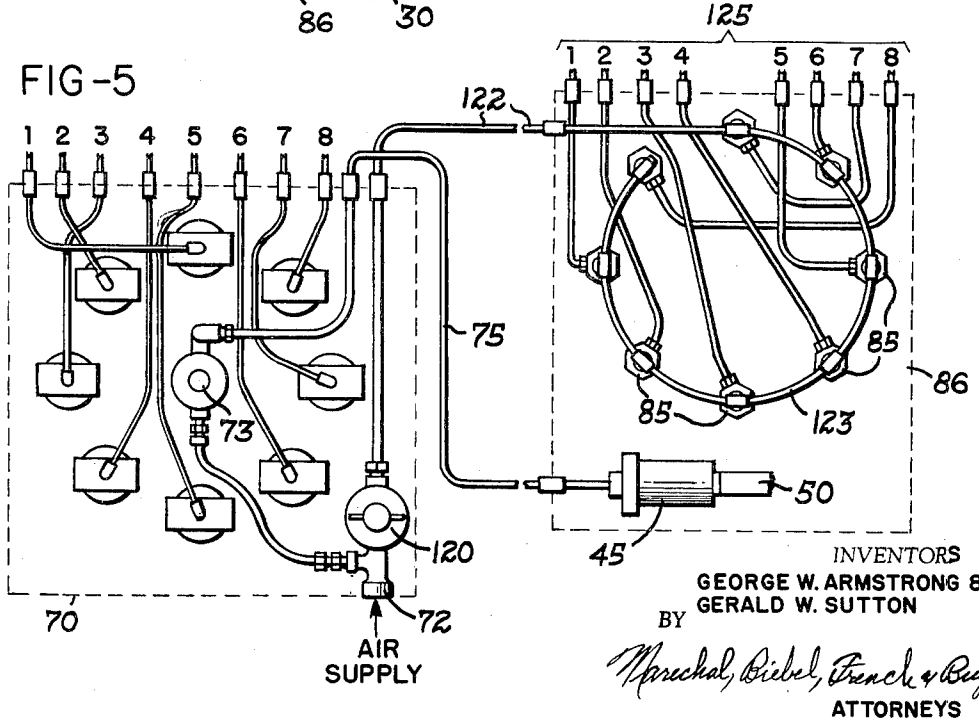


FIG-5



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ROTARY TURNHEAD

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8 Claims. (Cl. 193—23)

This invention pertains to rotary turnheads and more particularly to an improved rotary turnhead operating and control mechanism.

Rotary turnheads are devices which convey grain or other stored particulate matter from a common or central conduit and direct this material into any one of a plurality of different conduits or paths. Thus, a rotary turnhead may be used in a grain elevator for directing grain into any one of a plurality of bins.

By the nature of the use to which these devices are employed, the rotary turnheads are generally inaccessible for inspection during operation. However, it is necessary for the operator to assure that the rotary turnhead has properly operated to select the desired bin prior to opening of the flow control valve. Due to experience with erratic operation, it has frequently become the practice of the operator to make a visual inspection of the head prior to opening the valve, and this often involves climbing to inspect the valve.

A further disadvantage of many rotary turnheads now in use is that they utilize electric motors and associated wiring for positioning the internal selector conduit. Underwriters' requirements in most installations are such as to require completely explosion proof electrical equipment, thereby substantially increasing the initial cost of the installation.

It is a primary object of this invention to provide a rotary turnhead which is positioned by compressed air.

A further object of this invention is the provision of a rotary turnhead which provides a positive indication of the position of the head.

Another object of this invention is the provision, in a rotary turnhead, of a pneumatic positioning motor which is positive in operation to select fixed incremental positions corresponding to the individual selectable outlets.

A still further object of this invention is the provision of a rotary turnhead including a pneumatic control system which is positive in operation and which indicates at all times the position of the head.

A still further object of this invention is the provision of a rotary turnhead and control system which provides a remote display of the position of the head, and which eliminates hazardous electrical components and connections.

These and other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

FIG. 1 is a perspective view of a rotary turnhead constructed according to the invention, with the remote control panel being shown in elevation;

FIG. 2 is a vertical section through the rotary turnhead of FIG. 1;

FIG. 3 is a transverse section through the drive unit taken generally along the line 3—3 of FIG. 2, and showing the details of the pneumatic drive, with a portion of the air motor being broken away;

FIG. 3*a* is a fragmentary portion of the drive mechanism corresponding to FIG. 3, with the parts being shown in the moved position;

FIG. 4 is a fragmentary transverse section taken along the line 4—4 of FIG. 2, showing the arrangement of the indicator valves on the valve panel and the operator for the valve;

FIG. 5 is a somewhat diagrammatic view of the pneumatic control and indicator system of this invention; and

FIG. 6 is a transverse section through one of the three-way normally closed control valves.

Referring to the figures of the drawings which illustrate a preferred embodiment of the invention, a rotary turnhead is shown in FIG. 1 as having a sheet metal housing **10**. The housing **10** is formed with an inlet opening **11** at the top thereof to receive grain or other flowable particulate matter from a conduit and for distribution of the mater into any one of a plurality of circumferentially arranged, selectable outlets **12**. The turnhead shown has eight outlets **12** at 45°. More or less outlets may be provided at different angles, such as at 60°, without departing from the scope of this invention. The outlets **12** are each formed with a spout portion **14** extending generally outwardly and downwardly therefrom providing means for the connection of a suitable conduit thereto.

Reference may be had to FIG. 2 in which the turnhead is shown as including a duct or conduit **20**. The conduit **20** is contained wholly within the housing **10** and is formed with a vertically aligned inlet end **21** positioned in continuous communication with the housing inlet **11**, an intermediate 45° bend **20***a*, and a downwardly and outwardly directed outlet end **23** positionable in alignment with one of the outlets **12**. The conduit **20** is rotatably mounted on a support shaft **25** on a support plate **26** and is removably secured by a pair of straps **26***a* and *b*. The shaft **25** is supported for rotation on a suitable bearing **27** which is received in the bottom or floor **28** of the housing **10**. As shown in FIG. 2, the outlet end **23** is positioned immediately opposite a housing outlet **12***a* for the discharge of particulate matter into the associated spout **14**. By suitably positioning the conduit **20**, any one of the outlets **12** may be selected.

Dependently supported from the housing on straps **29** is a container forming an enclosed driver unit **30**. The shaft **25** extends downwardly through the bottom **28** and into driven engagement with an axially aligned and cooperating shaft **32** which is received between upper and lower bearings **33** and **34** respectively on the top and lower bottom of the container **30**, and which extends through the upper bearing **33** and into driving engagement with the shaft **25**. The purpose of the control unit **30** is to index and position the conduit **20** accurately and free of ambiguity into any one of the discharge stations defined by the outlets **12**.

One of the important features of this invention is the provision of drive means for the turnhead which is positive in operation. This drive means includes a ratchet plate **40** which is connected in driven relation to the shaft **32**, as best seen in FIGS. 3 and 3*a*. The ratchet plate **40** is formed with a plurality of teeth **42**, and these teeth correspond both in number and in relative angular position to the number and angular positions of the outlets **12** in the housing **10**. In the example shown, there are eight teeth **42** equally spaced about the periphery of the ratchet plate **40**.

Pneumatic motor means for advancing the turnhead sequentially through the selectable positions corresponding to the outlets **12** includes an air motor **45** which is pivotally mounted at **46** on one side wall **47** of the unit **30**. The air motor **45** is preferably of the rolling diaphragm type free of relatively sliding components. The motor **45** is also provided with an internal return spring **48**, although an external return spring or double-acting motor may be used.

The air actuator **45** includes an operator rod indicated generally at **50** for reciprocal movement adjacent the ratchet plate **40**. The operator rod **50** is suitably connected to, and forms an extension of, the motor plunger

51 and is formed throughout a major portion of its length by a pair of spaced apart straps 52 and 53 joined together at the end 54. A spool-shaped roller 55 is carried between the straps 52 and 53 and engages the teeth of the ratchet plate 40. The rod 50 is held in vertical alignment on the plate 40 by a pair of spaced ends of the roller 55 which receive the peripheral edge of the ratchet plate 40 therebetween.

Index means for the ratchet plate 40 includes a bracket 60 upon which is mounted a leaf spring 62. The spring 62 is held by the bracket 60 in engagement with the teeth 42 and permits rotation of the ratchet plate 40 in one direction only. The terminal end of the leaf spring 62 cooperates with the abrupt rise of the teeth 42 to define the indexed positions of the conduit 20 within the housing 10. A clamp 63 holds the spring 62 in predetermined adjusted position with respect to the plate 40 and provides the means for making fine adjustments in the indexing position.

The bracket 60 also provides a support for a tension spring 65, which is held at one end by a threaded eye bolt 66 on the bracket 60, and which is connected at its opposite end by a further eye bolt 67 to the extended end 54 of the operator rod 50. The spring 65 provides the means for maintaining the roller 55 in engagement with one of the teeth 42 during a forward stroke. In the event that, for some reason, a forward stroke of the air motor 45 is not completed, the spring 65 also assists in assuring that the plate 40 is returned to its original position.

The relationship between the spring 65 and the rod 50 can perhaps best be seen by reference to FIG. 3*a* in which the rod 50 is shown as having been moved to its full extended position. When the air pressure is now released in the motor 45, the retraction spring 48 begins to retract the rod 50 to its initial or reset position. This initial movement is aided and assisted by the spring 65. Also, this spring initially retains the roller 55 tightly seated within one of the teeth 42 until the ratchet plate 40 is firmly indexed at the end of the leaf spring 62, at which time the roller 55 proceeds up the inclined slope of the tooth and into its retracted position, in engagement with the next adjacent tooth. In the event that a full stroke has not been completed, such as by premature termination of the air supply to the motor 45, the spring 65, together with the spring 48 assures the return of the ratchet plate 40 to its previously indexed position.

The invention provides a positive pneumatic indicator system for indicating to the operator at all times the indexed position of the conduit 20. The apparatus also includes a remote control station or panel indicated generally at 70 in FIG. 1, in which the individual indicators are arranged.

The air suply connection to the air actuator 45 will be described first. All that is required is a suitable source of compressed air, which may provide air in the range of 40 p.s.i. for instance. This air is brought into the control panel 70 at an inlet fitting 72, shown in FIG. 5, and is applied to a push button air control valve 73. The valve 73 is preferably a normally closed three-way valve which, in the closed position, blocks the passage of air therethrough from the inlet 72 and which provides an air vent for the motor 45. When the valve 73 is operated or opened, such as by the depression of the push button 76 (FIG. 1), air is applied directly from the inlet 72 to the diaphragm of the air actuator 45 through an air supply line 75 leading between the control panel 70 and the drive unit 30. When the button 76 is released, the air supply is terminated and the motor 45 is vented through the valve 73 to permit the return of the rod 50 by the spring 48.

Remote indicating means in the panel 70 consists of a plurality of air pressure indicators 80, there being one indicator 80 for each of the selectable outlets 12. The indicators 80 may be of any suitable type, such as a pressure-operated light or a small gage, as shown. Gages rather than lamps are preferably employed in order to eliminate the employment of electrical components. The indicators 80 provide a continuous indication of the position of the conduit 20 and therefore indicate the selected outlet 12.

For each of the indicators 80 there is provided a separate valve 85. The valves 85 are positioned within the unit 30 on a valve supporting plate 86 and are arranged annularly about this plate. The spacing and number of the valves 85 correspond generally to the spacing and number of the outlets 12 in the rotary turnhead.

A valve operator movable with the turnhead spout and engageable with one of the valves 85 at each of the selectable positions includes an arm 88 which is clamped to the shaft 32 and which supports a roller 90 on the extended end thereof. The roller 90 is positioned to engage the plunger of one of the valves to move this valve into an operated position corresponding to the position of the conduit 20.

A typical valve which may be used for the valves 85, and which may also be used for the valve 73, is shown in section in FIG. 6. This is a three-way valve which has a valve body 100 formed with a first threaded port 102 opening at the top of the valve, and a second tapped port 103 opening at the side of the valve. The valve body 100 contains a reciprocatively mounted spool 105 which is of reduced section intermediate its ends, and which carries a pair of spaced O-rings 108 and 109 adjacent the ends thereof for cooperating with the longitudinal bore 110 formed through the valve. The O-rings 108 and 109 are engageable respectively with the bore 110 at the opposite ends of the valve. In the closed position of the valve, as shown in full lines in FIG. 6, the O-ring 109 seals and blocks the air at the inlet or first port 102. At the same time, the O-ring 108 is positioned just outwardly of the bore 110 and provides a bleed passageway 111 for the second port 103. In this manner, the individual indicators 80 are bled to atmospheric pressure.

When the enlarged end 112 of the spool 105 is moved by the roller 90 to the position shown in dotted lines, the O-ring 108 forms a seal to block the bleed passageway 111 and, at the same time, the O-ring 109 is carried by the spool 105 outwardly of the bore and thereby establishes communication between the ports 102 and 103. In this position, air pressure is applied directly to the associated indicators 80. However, just as soon as a roller 90 leaves the valve, the air pressure within the valve bore 110 operating on the ring 108 causes the spool 105 to shift to the closed position. Therefore, the valve is self-closing with air pressure applied in the inlet port 102. When this valve is used for the motor control valve 73, it is preferably of larger dimensions than the valve required for the operation of the indicators 80.

The air supply to the valves 85 is applied through a regulator 120 in the panel 70. The air pressure to the valves 85 may thus be regulated conveniently at a value lower than that employed in the air motor 45. A conduit 122 applies regulated air pressure to the valve inlet ports through a manifold tubing 123 connecting the inlet ports 102 in common. Each of the valve outlet ports is in turn, connected to one of the indicators 80 in the control head 70 through means forming individual lines such as the tubes 125. Low pressure tubing may conveniently be used, such as small plastic tubing which may be cut and trimmed to length by a pocket knife thereby facilitating ease of installation. In any given position of the conduit no air pressure is being consumed by the system either to the motor 45 or to any of the indicators 80. One of the indicators 80 will indicate a constant pressure as shown at 80*a* in FIG. 1, while the remaining indicators will be vented to atmosphere through the bleed opening 111 formed at the O-ring 108.

When the turnhead is used over a period of time with certain kinds of particulate material, a considerable amount of wear may occur at the bend **20***a*, and it may become necessary to replace the spout or conduit **20**. This is particularly true in the handling of certain grains such as soy beans, which are usually abrasive. To this end, the exterior of the housing **10** is provided with a removable hatch **130** through which access may be had for the removal of the straps **26***a* and *b* and the withdrawal of the conduit **20**, as shown by the broken lines of FIG. 2. The worn conduit may then be suitably replaced with a new conduit, the straps replaced, and the hatch closed.

In the operation of this invention, when it is desired to position the rotary turnhead, the operator depresses the push button **76** while observing the indicators **80**. As soon as the next adjacent indicator has moved, signalling that the conduit **20** has assumed its next adjacent position, the push button **76** may be released. If a further position is immediately required, such as in turning the head through several positions, the button **76** may be shortly thereafter depressed. The positioning operation is both positive in moving the conduit **20** into fixedly indexed positions, and in providing an indication of such position.

In the event that the button **76** was only momentarily depressed or was not held for a sufficient time to permit the full stroke of the rod **50**, the ratchet plate **40** will be returned to its initial position, as described above, and the indicators **80** will provide an indication of this fact by the reengagement of the roller **90** with the appropriate control valve **85**.

It will therefore be seen that this invention provides a rotary turnhead which is positive in operation. It provides automatic return to its initial position and positive indexing to advanced selected positions, thereby eliminating the possibility of ambiguity. All hazardous electrical connections are avoided, ideally suiting the valve for use in explosive atmospheres.

While the form of apparatus herein described consitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a rotary turnhead having selectable positions, the improvement comprising a drive shaft, a ratchet connected in driving relation to said shaft, said ratchet having a plurality of index positions corresponding in number and in angular spacing to the number and angular spacing of said selectable positions of said turnhead, a fluid pressure operated actuator having a rod member positioned for reciprocal movement adjacent said ratchet and having means engageable with said ratchet to move said ratchet through one increment of movement corresponding to the movement necessary to position said turnhead to the next selectable position thereof with each actuation thereof, and remote means connected to apply fluid pressure to said actuator to advance said turnhead incrementally through each of its selectable positions.

2. In a rotary turnhead having selectable positions, the improvement comprising a drive shaft, a ratchet connected in driving relation to said shaft, said ratchet having a plurality of teeth corresponding in number and in angular relation to the selectable positions of said turnhead, a fluid pressure operated actuator having a rod positioned for reciprocal movement adjacent said ratchet and carrying a roller serially engagable with said ratchet teeth to move said ratchet through one increment of movement, corresponding to the movement necessary to position said turnhead to the next selectable position thereof, with each extension and retraction of said rod, and remote control means connected to apply fluid pressure to said actuator to advance said turnhead serially through each of its selectable positions.

3. A fluid pressure operated rotary turnhead comprising, a housing having means defining an inlet and a plurality of circumferentially arranged selectable outlets, a conduit rotatably received in said housing and having an inlet end arranged in continuous communication with said housing inlet and having an outlet end selectably positionable adjacent any one of said housing outlets to discharge material therethrough from said housing inlet, drive means including a ratchet wheel connected for movement with said conduit and having formed therein a plurality of notches corresponding in number and in angular distribution to the number and distribution of said selectable outlets, a fluid pressure operated motor having a piston rod, and means on said rod engageable with said ratchet wheel and effective upon the application of fluid pressure to said motor to move said wheel by an amount sufficient to move said conduit to the next adjacent housing outlet.

4. An air operated rotary turnhead comprising: a housing having means defining an inlet and a plurality of circumferentially arranged selectable outlets, a conduit rotatably received in said housing and having an inlet end arranged in continuous communication with said housing inlet and having an outlet end selectably positionable adjacent any one of said housing outlets to discharge material from said housing inlet therethrough, drive means including a ratchet wheel connected for movement with said conduit and having formed therein a plurality of notches corresponding in number and in angular distribution to the number and distribution of said selectable outlets, a source of air under pressure, a piston air motor having a piston rod, means on said rod engageable with said ratchet wheel and effective upon the application of air pressure to said piston motor from said source to move said wheel by an amount sufficient to move said conduit to the next adjacent housing outlet, pneumatically operable indicator means having a connection to said source including a separate position responsive means for each said selectable outlet, sensing the coincidence of said conduit with said selectable outlet, and a separate remote indicator connected to each of said position responsive means for indicating to an operator the position of said conduit.

5. A rotary turnhead comprising: a casing having means forming an inlet and a plurality of selectable outlets, a selector conduit rotatably received in said casing and having one end aligned to receive material from said inlet and another end positionable selectively by rotation to direct material from said inlet to one of said outlets, a ratchet plate having formed thereon a plurality of selectable engageable teeth corresponding in number and in angular distribution to said selectable outlets, means mounting said plate in driving relation with said conduit, an air motor for said conduit having a piston rod arranged to engage said ratchet at single ones of said teeth to advance said selector conduit one position corresponding to the angular spacing of said outlets for each operation of said motor, remote air pressure operated indicators one for each of said selectable outlets, and separate valve means for each of said indicators connected to apply air pressure thereto and operable in response to the position of said conduit for providing a remote indication thereof.

6. A rotary turnhead comprising: a casing having means forming an inlet and a plurality of selectable outlets, a selector conduit rotatably received in said casing and having one end aligned to receive material from said inlet and another end positionable selectively by rotation to direct material from said inlet to one of said outlets, a ratchet plate having formed thereon a plurality of selectable detent positions corresponding in number and in angular distribution to said selectable outlets, means mounting said plate for rotation with said conduit, an air motor for said conduit having a piston rod arranged serially to engage said ratchet at said detent positions to advance said selector conduit one position corresponding to

the angular position of said outlets for each operation of said motor, remote air pressure operated indicators one for each of said selectable outlets, and a separate three-way valve for each of said indicators having an inlet connected to a source of air pressure and an outlet connected to apply air pressure to one of said indicators and operable in a first position in response to the position of said conduit to apply air pressure to the associated said indicator and in a second position to provide a pressure bleed for such indicator.

7. In a rotary turnhead including an inlet and a plurality of selectable outlets which are angularly spaced about the inlet, the improvement comprising: a drive shaft for selecting said outlets by rotation thereof, a ratchet plate connected in driving relation to said shaft, said plate having formed thereon a plurality of teeth each characterized by an abrupt rise on one side and a sloping inclined surface on the other side, said ratchet teeth corresponding in number and relative angular position to the number and angular positions of the rotary turnhead outlets, a motor for advancing said turnhead sequentially through said selectable positions including a rod member positioned for extending and retracting movement adjacent said ratchet plate, a return spring for said rod member, follower means on said rod member engageable with said ratchet teeth at said abrupt rise to move said plate through one increment of movement corresponding generally to the annular spacing of said teeth with each full extension stroke and retraction of said rod member, and a second spring urging said follower means into engagement with said teeth with sufficient force together with said return spring to cause said follower means, acting against said inclined surface, to return said shaft to its initial position in the event of failure of the motor to complete said extending movement.

8. A rotary turnhead including a spout movable into a plurality of selectable positions, the improvement comprising: a separate three-way air valve for each of said positions, each of said valves having first and second ports and being movable between a first position blocking the flow of air at said first port while providing a pressure bleed at said second port, and a second position connecting said first port to said second port, a valve operator movable with said turnhead spout and engageable with one of said valves at each of said selectable positions to move said valve from said first position to said second position, a remote indicating head including a separate air pressure operated indicator for each of said valves, means connecting each of said valve second ports to the associated said indicator, and means applying air pressure to each of said valve first ports providing an instantaneous indication of the position of said turnhead corresponding to the particular one of said valves engaged by said operator while providing an air bleed for each of the remaining said indicators through said valve second ports.

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