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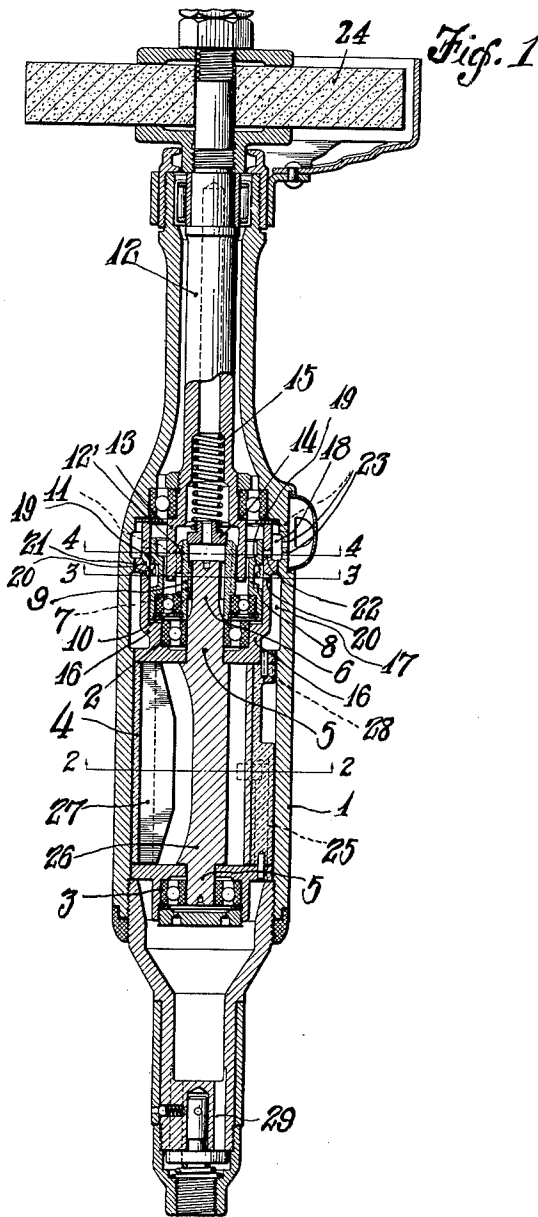
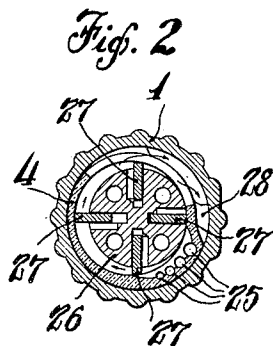
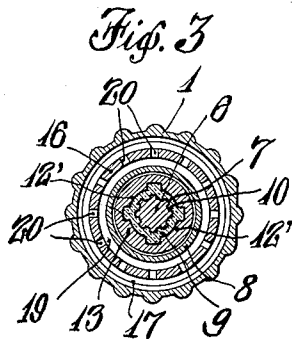
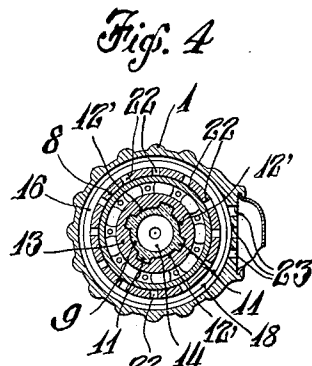
KATASHI INOUE

3,049,098

ROTATING SPEED ADJUSTING DEVICE

Filed Nov. 27, 1959

2 Sheets-Sheet 1



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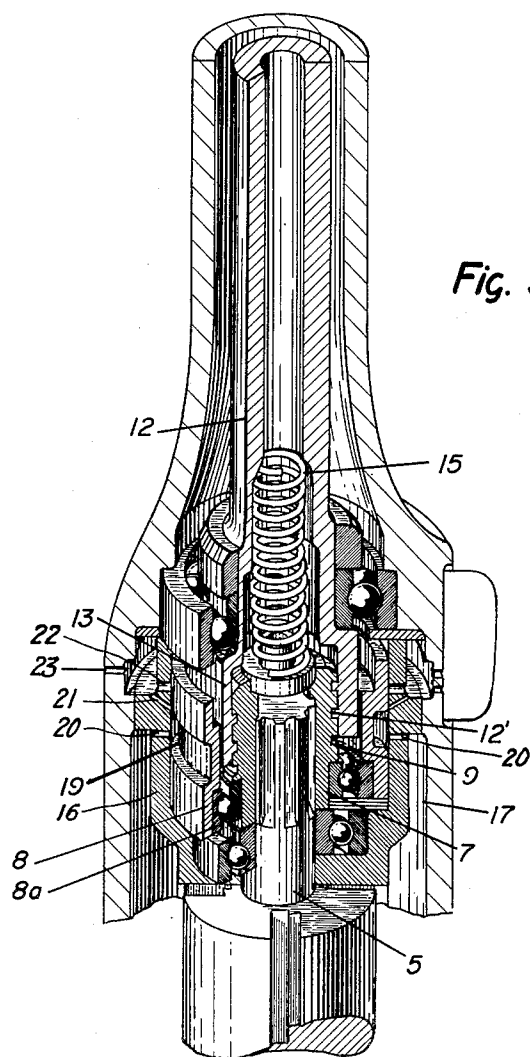
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ROTATING SPEED ADJUSTING DEVICE

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3 Claims. (Cl. 121--33)

The present invention relates to a device for adjusting a rotational tool or the like which is mounted on a shaft and driven by an air driving means.

It is an object of the present invention to provide such an adjusting device which is highly efficient, which is easily operated despite its simple structure, and which reacts to change the speed of the tool depending on the load on the tool.

The device according to the invention comprises a spur gear which is driven by the air driving means for the tool, and a coupling is provided around the spur gear which has an internal gear meshing with the spur gear. A helical gear is provided on the outside of the coupling, and the shaft for the tool has a hollow shaft end around the coupling with an internal helical gear meshing with the helical gear on the coupling. Spring means are provided in engagement with the coupling urging it away from the shaft. A cylindrical exhaust valve member is mounted on said coupling, which member has at least one air exhaust conduit along a portion of the outer surface thereof. A housing is positioned around the exhaust valve member which has a cylindrical inner wall within which the exhaust valve member slides. The housing has an inlet chamber into which air from the air driving means is vented, and it also has an outlet chamber vented to the atmosphere. The cylindrical wall around the valve member has apertures therein opening out of the inlet chamber and with which the exhaust conduit along the exhaust valve is aligned, and the said wall has a further first aperture and a second aperture opening into the exhaust chamber, both further apertures being aligned with the exhaust conduit and being spaced such that when a load on the tool causes the coupling to move along the spur gear, the valve member is also moved to cover or uncover the second aperture and thereby increase or decrease the flow of air through the air driving means.

A preferred embodiment of the invention will now be described more particularly, reference being made to the accompanying drawings, in which:

FIG. 1 is a sectional view of an air driven grinding tool having the adjusting device according to the present invention incorporated therein;

FIG. 2 is a sectional view taken along line 2-2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3-3 of FIG. 1;

FIG. 4 is a sectional view taken along line 4-4 of FIG. 1; and

FIG. 5 is a vertical cutaway view of the portion of the tool of FIG. 1 having the adjusting device therein.

As seen in the figures, the tool has a rotatable shaft 5 mounted in bearing 2 and 3 in a cylinder 4 within a handle 1. A spur gear 7 is mounted on the end 6 of the shaft 5, and meshes with an internal spur gear 10 on a coupling 9 around the spur gear 7. A helical gear 11 is formed on the outside of the coupling 9, and it meshes with an internal helical gear 12' on the inside of a hollow shaft end 13 on one end of the tool shaft 12. As an example of a tool, there is shown a grinding wheel 24 on the end of the shaft 12.

A spring 15 is positioned within the hollow end 13, and bears on shoulder 14 on the coupling 9, urging coupling 9 away from the shaft 12.

An exhaust valve member 8 is slidably positioned with-

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in housing 16, and the valve member is connected to the coupling 9 by a bearing 8a which causes the valve member to slide when the coupling 9 moves but not to partake of the rotational movement of the coupling.

An inlet chamber 17 is provided between housing 16 and handle 1 which receives air from the air driving means through passages 28. The housing 16 has apertures 20 therein which open into air exhaust conduit 19 which extends along the surface of the valve member 8. An exhaust chamber 18 is also provided between the housing 16 and the handle 1 which is vented to the atmosphere through apertures 23. Between the exhaust chamber 18 and the exhaust conduit 19 in the valve member are a series of first apertures 21 extending through the housing 16, and these apertures 21 are positioned so that they are always open to the exhaust conduit 19. Spaced along the cylindrical housing 16 from the first apertures 21 are a series of second apertures 22 which open into the exhaust chamber 18 and which are uncovered so as to open into the exhaust conduit 19 along the valve member 8 when the valve member is moved in response to a change in the load on the tool on the end of shaft 12.

To drive the tool, air is fed through a valve member 29 in the end of the handle 1 and through air conduits 25 in the handle 1. It impinges against vanes 27 mounted in the hub 26 of shaft 5 in such a manner that they can yield freely to the air pressure and return to their normal position. From the vanes the air is led to the inlet chamber 17 through apertures 28.

In operation, as the air is fed to the vanes, the vanes will act on the shaft 5 to rotate it, and the tool 24 is driven through the spur gears 7 and 10, the coupling 9, the helical gears 11 and 12' and the hollow shaft end 13 and shaft 12. The air leaving the vanes passes into the inlet chamber 17 through apertures 28, and then through the apertures 20 and along the exhaust conduit 19 in the valve member 8. In the normal operation of the tool, the valve member 8 will be positioned so that the exhaust conduit 19 uncovers only one set of apertures 21 opening into the exhaust chamber 18. The air thus passes through these apertures 21 from the exhaust conduit, passes through the exhaust chamber 18 and is vented to the atmosphere through apertures 23.

However, when a load is imposed on the tool 24 which causes it to slow down, the shaft 5 will then tend to rotate faster than the shaft 12. The result of this is that the helical gears 11 and 12' will cause the coupling 9 to move along the shaft 5 against the action of spring 15, and in the case where the tool slows down, the gears are arranged so that the movement of the coupling is toward the shaft 12. The valve member 8 is thus moved along the inside of the housing 16, and the exhaust conduit 19 uncovers the second set of apertures 22. This permits more air to pass through the exhaust conduit, and therefore permits more air to pass through the vanes 27, aperture 28 and inlet chamber 17. The shaft 5 then supplies more power to the shaft 12 through the gearing and coupling for as long as the load tends to retard the speed of the tool. When the load falls off, the spring 15 moves the coupling away from shaft 12, and the reverse of the above described action takes place, causing the parts to resume the positions for normal operation.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the form hereinbefore described and illustrated in the drawings being merely a preferred embodiment thereof.

I claim as my invention:

1. A device for adjusting the rotational speed of a ro-

tating tool or the like mounted on a shaft and driven by an air driving means, said device comprising a spur gear driven by said air driving means, a coupling around said gear and having an internal gear meshing with said spur gear and a helical gear on the outside thereof, a hollow shaft end around said coupling and connected to the shaft on which the tool is mounted and having an internal helical gear meshing with the helical gear on said coupling, spring means engaged with said coupling urging it away from the shaft on which said tool is mounted, a cylindrical exhaust valve member on said coupling, said exhaust valve member having at least one air exhaust conduit along a portion of the length of the outer surface thereof, a housing around said exhaust valve member and having a cylindrical inner wall within which said exhaust valve member slides, said housing having an inlet chamber therein into which air from the air driving means is vented and having an outlet chamber vented to the atmosphere, said cylindrical wall having apertures therein opening out of said inlet chamber and with which said exhaust conduit along said exhaust valve member is aligned, and said cylindrical wall having at least a first further aperture and at least one second further aperture therein opening into said exhaust chamber and with which said exhaust conduit is aligned, said second further aperture being spaced from said first further aperture and normally being out of communication with said exhaust conduit, whereby when a load is applied to the tool and the rotational speed thereof decreases, said coupling is moved toward said hollow shaft and said exhaust valve member moves to bring said exhaust conduit and said second further aperture into register to permit more air to pass through said air driving means.

2. A device for adjusting the rotational speed of a rotating tool or the like mounted on a shaft and driven by an air driving means, said device comprising a gear member, a coupling meshed with said gear member, and a hollow shaft end member meshed with said coupling, one of said members being driven by said air driving means and the other being connected to the shaft with the tool thereon, and one of said meshing connections having helical teeth, spring means engaged with said coupling urging it away from the shaft on which said tool is mounted, a helical exhaust valve member on said coupling, said exhaust valve member having at least one air exhaust conduit along a portion of the length of the outer

surface thereof, a housing around said exhaust valve member and having a cylindrical inner wall within which said exhaust valve member slides, said housing having an inlet chamber therein into which air from the air driving means is vented and having an outlet chamber vented to the atmosphere, said cylindrical wall having apertures therein opening out of said inlet chamber and with which said exhaust conduit along said exhaust valve member is aligned, and said cylindrical wall having at least a first further aperture and at least one second further aperture therein opening into said exhaust chamber and with which said exhaust conduit is aligned, said second further aperture being spaced from said first further aperture and normally being out of communication with said exhaust conduit, whereby when a load is applied to the tool and the rotational speed thereof decreases, said coupling is moved toward said hollow shaft and said exhaust valve member moves to bring said exhaust conduit and said second further aperture into register to permit more air to pass through said air driving means.

3. A device for adjusting the rotational speed of a rotating tool or the like mounted on a shaft and driven by an air driving means, said device comprising a gear member, a coupling meshed with said gear member, and a hollow shaft and member meshed with said coupling, one of said members being driven by said air driving means and the other being connected to the shaft with the tool thereon, and one of said meshing connections having helical teeth, spring means engaged with said coupling urging it away from the shaft on which the tool is mounted, sliding exhaust valve means on said coupling, and a housing in which said members and coupling and exhaust valve means are housed, said housing having air apertures therein between the air driving means and the outside atmosphere, at least a portion of said air apertures being uncovered and covered by movement of said sliding exhaust valve means.

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