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GRINDING MACHINE ASSEMBLIES

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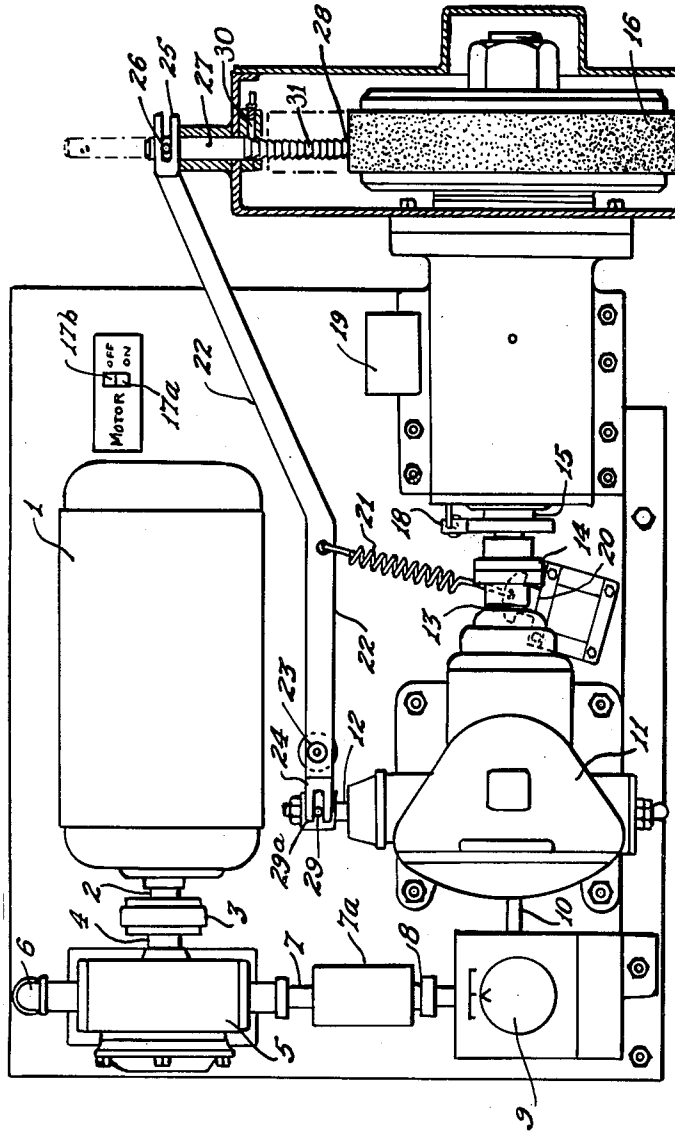


FIG. 1.

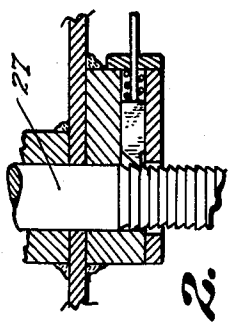


FIG. 2.

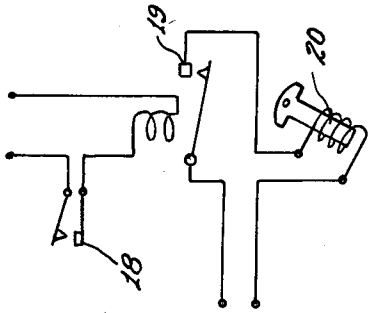


FIG. 3.

INVENTORS.
GEORGE DEWEY BEHLEN AND
GEORGE F. EMBSHOFF,
BY

ATTORNEYS.

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GRINDING MACHINE ASSEMBLIES

George Dewey Behlen and George F. Embshoff, Cincinnati, Ohio, assignors to The United States Electrical Tool Co., Cincinnati, Ohio, a corporation of Ohio

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Our invention relates specifically to hydraulic drives for grinding machines and this is a continuation-in-part of application Serial No. 694,298, filed November 4, 1957.

Grinding machines are ordinarily equipped with high speed bonded grinding wheels or vitrified grinding wheels. A bonded grinding wheel may have a surface speed of 9500 surface feet per minute. A vitrified grinding wheel may have a speed of 5500 surface feet per minute.

As grinding wheels wear down in use, a 30 inch diameter wheel may wear down to 15 inch diameter; a 24 inch diameter wheel may wear down to 15 inch diameter and a 20 inch diameter wheel may wear down to 13 inch diameter. If the rate per minute rotation of the shaft on which a grinding wheel is mounted remains constant, as the peripheral surface of the wheel is worn down the surface feet per minute is reduced so that work planning in large quantity production plants becomes erratic.

There is a point reached in the grinding of a metal part where if the surface feet per minute is reduced enough the grinding process becomes the metal grinding down the grinding wheel instead of the grinding wheel grinding off the work. It is for this reason that the maintenance of the surface feet of travel per minute of the peripheral grinding surface of the wheel becomes so very important.

With the advent of more and more accurate planning of machine shop operation, it becomes important as far as grinding wheels are concerned that the surface feet per minute speed of grinders be maintained at a substantially constant speed. This we accomplish by incorporating in the hydraulic drive for the grinder, an automatic control or combination of elements which may be set to increase the rate of rotation of the grinding wheel shaft as the grinding surface is worn down so that substantially constant surface feet per minute speed of the peripheral grinding surface is maintained.

Our automatic control is incorporated as part of the combination of driving elements. These consist of a constant speed electric motor, an hydraulic pump actuated by the electric motor and delivering a constant flow of fluid, a variable displacement piston type hydraulic motor and a flexible coupling through which rotation is imparted to the grinding wheel shaft. As an additional safety factor we may incorporate in the assembly a flow control and overload relief valve between the hydraulic pump and the variable displacement piston type hydraulic motor.

The individual mechanisms of which our combination is made up are for the most part old and well known in the art. Thus any desired type of constant speed electric motor may be employed. Thus we find an electric motor developing the required horse power at 1200 r.p.m. adequate for our combination.

The shaft of the motor is connected by a flexible coupling with a constant delivery vane type pump. The discharge from this constant delivery vane type pump is through a proportional type oil filter.

The constant flow of oil passes through a flow control and overload relief valve. An integral relief valve is independently adjustable and serves to limit the maximum operating pressure.

The oil under pressure passes to a variable displacement piston type hydraulic motor. This motor provides means for the conversion of hydraulic power to reversible variable speed adjustable torque rotary mechanical power.

The rotary mechanical power is transmitted to the drive shaft of a grinding wheel and our invention relates to a control for the hydraulic motor automatically adjustable relative to the diameter of the grinding wheel, so that the speed of rotation of the grinder drive shaft may be regulated to produce a substantially constant surface feet per minute speed of the grinding surface of the grinder wheel.

The foregoing general objectives we accomplish by that combination of elements of which we have illustrated a preferred embodiment.

In the drawings:

FIGURE 1 is a plan view of an assembly incorporating our invention.

FIGURE 2 is a slightly enlarged sectional view of the operating parts which effect our automatic control for the surface speed of the grinder wheel.

FIGURE 3 is a wiring diagram showing the electrical contacts in our automatic control.

The elecric motor **1** is provided with electrical contacts from a suitable source of electric power and the motor shaft **2** is connected with a flexible coupling **3** to the shaft **4** of a constant delivery vane type pump **5** which has an intake **6** from a suitable reservoir and delivers a constant flow of oil under pressure through the discharge pipe **7**.

A proportional type filter **7***a* is the first mechanism in the pipe from the oil pump and the filter is connected by a pipe **8** to the flow control and overload relief valve **9**. While this overload relief valve forms no essential part of my combination, we have found its incorporation in a preferred system desirable.

The relief valve **9** may be used to accurately regulate the flow of oil to the hydraulic motor. An integral relief valve is independently adjustable and serves to limit the maximum operating pressure. With this method of flow control the variable speed hydraulic motor is required to develop only the minimum amount of pressure necessary to maintain operating speed. Further more smooth and uniform operation, regardless of the change in work load may be maintained.

The discharge from the flow control and overload relief valve **9** passes through the pipe **10** to the variable displacement piston type hydraulic motor generally indicated at **11**.

Since the variable displacement piston type hydraulic motor forms no part of our invention, for purposes of understanding its operation we may state that such a mechanism is accurately described in the Harrington and Robinson U.S. Patent No. 2,472,477.

The hydraulic motor **11** has a control shaft **12**, the movement of which lengthwise changes the position of the piston within the motor and so changes the rate of rotation of the shaft **13** driven by the motor **11**. The shaft **13** passes through a bearing housing **14** and causes the rotation of the shaft **15** on which the grinding wheel **16** is mounted.

To fully describe our automatic control it may simplify the understanding if the procedure of starting and stopping be given as a direction or as instructions.

Push the starter button in the On position **17***a*. The grinder will operate at a constant speed until the starter button is actuated to the Off position **17***b*. The electric motor **1** then stops but the grinding wheel **16** continues to coast for approximately forty seconds.

As the grinding wheel **16** comes to a dead stop the

mercury switch **18**, carried on the grinding wheel shaft drops down and closes its contacts. This closes the contacts in the contactor **19** and the solenoid **20** is then energized. The solenoid through the spring **21** pulls down on the long arm **22** of a lever pivoted at **23**. The short arm **24** of the lever rocks upwardly causing outward actuation of the fluid adjustment control rod **12**.

Meanwhile with the rocking of the lever the long arm **22** of the lever through a pin and slot connection **25**, **26**, moves the plunger or wheel sizer **27** down to a position in which the lower end **28** of the rod **27** engages the peripheral surface of the grinding wheel **16**.

A setting of the shaft **12** for the next starting up of the grinding wheel is thereby accomplished in which wear on the grinding surface of the wheel is compensated for.

To repeat the instructions for operation after compensation for wear on the grinding wheel would be as follows: Push the starter button. As soon as the oil pressure actuates the hydraulic motor the suction on the shaft **12**, through the pin and slot connection **29**, **29***a*, which provides the connection between the short arm **24** and the shaft **12**, causes enough downward movement of the short arm of the lever to elevate the end **28** from contact with the surface of the grinding wheel about ⅛ inch.

A pawl latch **30**, spring pressed inwardly against the teeth **31** formed in the lower portion of the rod **27**, holds the rod in the new position of adjustment. As soon as the grinding wheel shaft **15** begins to rotate the mercury switch **18** breaks the contact and the solenoid **20** is deenergized. The solenoid **20** is repositioned by the tension of the spring **21** and the grinder will now operate with its peripheral speed the same as in the first operation.

The type of switches employed may be varied. The principle of automatic adjustment of peripheral speed of the grinding disc is accomplished during periods when the grinding wheel is not in operation but each time the motor **1** is started the speed of operation of the grinding wheel shaft will be such that the peripheral speed of the grinding wheel remains constant.

Having thus described the apparatus employed in the combination and the sequence of operations, what we claim as new and desire to secure by Letters Patent is:

1. In combination with a grinding wheel driven by a variable speed hydraulic motor having a speed controlling element, a grinding wheel contactor mounted for movement substantially radially to said grinding wheel into and out of contact with the periphery of said grinding wheel, means operative at each cessation of rotation of said grinding wheel to bring said contactor into contact with the periphery of said grinding wheel, means

operative in response to the movement of said contactor to move said controlling element proportionally, and means responsive to each commencement of rotation of said grinding wheel to back said contactor off said grinding wheel periphery a small amount.

2. The structure of claim 1, wherein means are provided to prevent substantial movement of said contactor in a direction away from said grinding wheel.

3. The structure of claim 2, wherein said last named means comprise ratchet teeth on said contactor and a pawl coacting with said ratchet teeth.

4. The structure of claim 1, wherein the means to bring said contactor into contact with the periphery of the grinding wheel and the means for moving the controlling element proportionally comprise a lever pivoted intermediate its ends and connected at one end to said contactor and at its other end to said controlling element.

5. In combination with a grinding wheel driven by a variable speed hydraulic motor having a speed controlling element, a grinding wheel contactor mounted for movement substantially radially to said grinding wheel into and out of contact with the periphery of said grinding wheel, a proportioning linkage between said grinding wheel contactor and said speed controlling element, means operative at each cessation of rotation of said grinding wheel for actuating said linkage to bring said contactor into contact with the periphery of said grinding wheel and thus to position proportionately said speed controlling element, said means at each commencement of rotation of said grinding wheel actuating said linkage a small amount, sufficient to move said contactor out of contact with the periphery of said grinding wheel.

6. The structure of claim 5, wherein means are provided to prevent substantial movement of said contactor in a direction away from said grinding wheel.

7. The structure of claim 6, wherein said last mentioned means comprise ratchet teeth on said contactor and a pawl coacting with said ratchet teeth.

8. The structure of claim 5, wherein said linkage comprises a lever pivoted intermediate its ends and connected at one end to said contactor and at its other end to said controlling element.

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