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TRANSMISSIONS AND MEANS FOR OPERATING THE SAME

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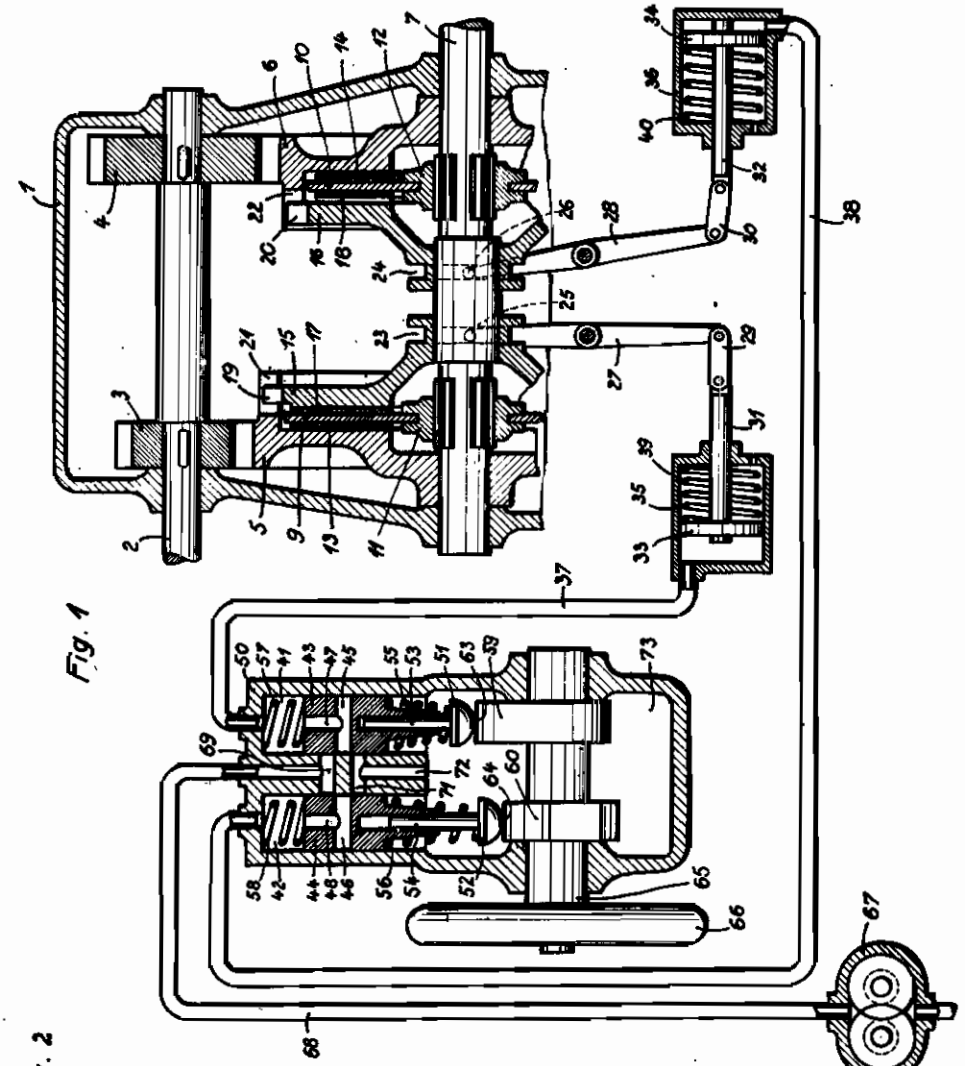

Fig. 1

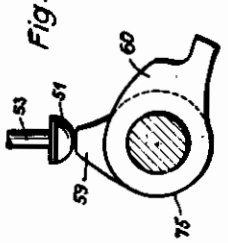

Fig. 2

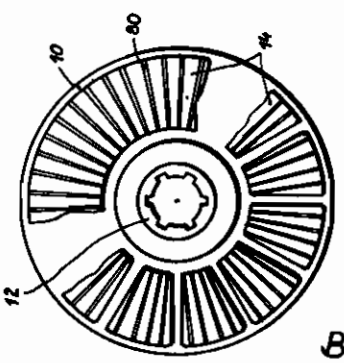

Fig. 3

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TRANSMISSIONS AND MEANS FOR OPERATING THE SAME

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My invention relates to transmissions and means for operating the same, especially of such clutch mechanisms as are used for change speed gears in tool machines, motor vehicles, for example in steering gear, brakes or other apparatuses of this kind. It has special reference to friction clutches operated by fluid pressure.

The main object of my invention is adaptability of the clutch to the efficiency wanted in every case, which means that only portions of the normal power acting on the clutch may be transmitted thereby for longer time periods.

For this purpose I provide a control or operating device for the clutch which allows for regulation of the pressure exerted on the clutch. And furthermore, the friction surfaces of the clutch elements are provided with channels allowing for a constant and quick passing of the lubricating and cooling oil.

This combination makes it possible that the friction clutch may operate for a longer time period with a certain slip depending upon the clutch pressure set and prevailing. By such friction clutch devices according to my invention every turning moment may be transmitted which is lower than the maximum moment for which the clutch is constructed.

Thus, the clutch mechanism according to my invention is capable of reducing the efficiency and the number of revolutions in a desired degree as compared with the normal conditions for a certain time, at least for several minutes. If a power transmission is equipped with one or a plurality of such mechanisms it becomes adaptable to any and every desired ratio of transmission in numbers of revolution or in efficiency. With change speed gears, in normal cases, it is sufficient to provide only two stages.

A transmission thus equipped is extraordinarily simple and accurate in operation and adaptable to the working conditions for example to the resistance offered to a tool machine. Also, changing from one stage or gear in a change speed gear to another one is rendered much easier because of the adjustable clutch pressure so that it is hardly to be observed.

As explained above, I make use of fluid pressure for operating the clutch. It is advisable, according to my invention, to provide a regulating device which automatically controls the clutch pressure in dependency on the pressure exerted on said device.

Having given a general description of my invention I now want to point it out more in detail having reference to the drawings which represent an example embodying my invention.

Fig. 1 is a diagrammatic, longitudinal cross section through a change speed gear in portion including the control mechanism; Fig. 2 represents a detail in side view; and Fig. 3 is a side view of the friction surface of the clutch.

In the change speed gear 1 on the driving shaft 2 are fixed gears 3 and 4. Gear 3 meshes with gear 5 and gear 4 with gear 6, gears 5 and 6 being loosely journaled on driven shaft 7. There are friction discs 9 and 10, splined to shaft 7 and adapted to be pressed against the side surfaces of gears 5 and 6, respectively, by means of pressure discs 15 and 16, respectively. On the side faces of the friction discs 9 and 10 special friction surfaces 13—17 and 14—18, respectively, are provided. Besides, the pressure discs 15 and 16 on their circumferences have teeth 19 and 20, respectively, fitting between guiding teeth 21 and 22, respectively, which are provided on gears 5 and 6, respectively, so as to make sure that pressure disc 15 rotates together with gear 5 and pressure disc 16 together with gear 6. For the purpose of shifting pressure discs 15 and 16 on shaft 7 so as to cause engagement of friction clutch 5—13—9—17—15 and of friction clutch 6—14—10—18—16, respectively, their hubs have circular grooves 23 and 24, respectively, into which forks 25 and 26, respectively, fit which form one end each of double levers 27 and 28, respectively. The other ends of these levers are connected to links 29 and 30, respectively, and these again to rods 31 and 32, respectively, belonging to pistons 33 and 34, respectively, situated inside of cylinders 35 and 36, respectively. Conduits 37 and 39 are connected to cylinders 35 and 36, respectively, for conducting pressure fluid thereto, adapted to act on pistons 33 and 34, respectively, against the reaction of springs 39 and 40, respectively. These conduits 37 and 38 originate from casing 50 which embodies the control mechanism.

There are two main borings 41 and 42 inside of casing 58 into which fit two piston valves 43 and 44, respectively, having cross channels 45 and 46, respectively, and longitudinal channels 47 and 48, respectively. Guided in longitudinal borings of the piston valves 43 and 44 are bolts or pins 53 and 54, respectively, which have rounded lower heads 51 and 52, respectively, pressed by means of springs 55 and 56, respectively, with their touching surfaces 63 and 64, respectively, against cams 59 and 60, respectively, provided on shaft 65. There are springs 57 and

58 inside of borings 41 and 42, respectively, tending to shift valves 43 and 44, respectively, downward against the reaction of springs 55 and 56, respectively. There is a fluid pressure pump, for instance an oil pump, 67 which presses oil into conduit 68 and thereby into the middle boring in casing 50 wherefrom it may enter by means of cross channel 69 into cross channels 45 and 46 of valves 43 and 44, respectively, on adequate positions of these valves which are controlled by turning hand wheel 66 situated on shaft 65. If the oil pressure in spaces 41 or 42 surpasses a certain limit it causes valves 43 and 44, respectively, to move downward so that cross channels 45 and 46, respectively, get in connection with cross channel 72 and longitudinal channel 71, which opens into the inner space of casing 50 allowing the pressure oil to escape, thereby reducing the pressure in spaces 41 and 42, respectively, so that the valves 43 and 44 will always automatically return to their neutral positions, as represented in the drawing.

The friction surfaces 13/17 and 14/18 are provided with radially extending grooves or open channels 60 of small cross section, so that the lubricating oil entering at the hub may easily be transported to the circumference by centrifugal force, thus causing good lubrication and also serving for reducing the heat which is created when the two respective clutch members rotate at different speeds.

The shape of the cams 59 and 60 is so chosen that on normal rotation of hand wheel 66 the bolts 53 and 54 are only slowly lifted in the beginning and faster at the end of their path, so that the oil pressure in the cylinders 35 and 36, respectively, is slowly raised at the beginning and increases faster at the end of the stroke of pistons 33 and 34, respectively. Thus the friction clutches 5—13—9—17—15 and 6—14—10—18—16 are compressed in the same manner.

The operation of the entire device is as follows:

Assuming the hand wheel 66 be at rest in the position in which both bolt heads 51 and 52 bear on the lowest cam circumference 75 (Fig. 2) and it be thereafter turned to the left so that bolt 53 is slowly lifted its head 51 following the shape of cam 59. This movement of head 51 causes compression of spring 55 and as a result therefrom piston valve 43 moves upward allowing pressure oil to pass from channel 69 through channels 45 and 47 into the space 41 above the valve 43 and thereafter through conduit 37 into cylinder 35. Consequently, piston 33 is moved to the right so that by means of lever 27 pressure disc 15 is pressed gradually against friction disc 9 causing the friction clutch 5—13—9—17—15 to get into engagement slowly and in dependence on the operator's turning of the hand wheel 66. If he does not turn the wheel at once to the position in which bolt head 51 bears against the highest portion of cam 59 but makes a rest in-between, then the oil pressure in cylinder 35 will not reach its maximum and piston 33 gets at rest at some position in the middle of its path so that the friction clutch 5—13—9—17—15 will not come to full engagement but have a certain desired slip which means that shaft 7 will turn at a lower speed than would correspond to the gear ratio of gears 3 and 5. All this is due to the fact that valves 43 and 44 automatically return to their neutral middle position, as explained above.

If it is desired to change from the first speed to the second speed, which means disengagement of friction clutch 5—13—9—17—15 and engagement of clutch 6—14—10—18—16, hand wheel 66 has to be turned further to the left so that bolt head 51 sliding on the right hand portion of cam 59 (Fig. 2) moves downward causing reduction in the pressure of spring 55 which again results in downward movement of valve 43, escape of pressure oil from cylinder 35 through conduit 37 and channels 47, 45, 71 and 72, movement to the left of piston 33, and disengagement of friction clutch 5—13—9—17—15. Thereafter bolt head 52 is lifted by cam 60 and, in similar manner as described above with regard to valve 43, now valve 44 gets into operation causing pressure oil to pass through conduit 38 into cylinder 36, thereby moving piston 34 to the left and engaging friction clutch 6—14—10—16—16 more or less in dependence on the angle to which hand wheel 66 is turned. In certain cases, it may be advisable to give the cams such a shape that the operation of the second valve 44 is caused before the first valve 43 has come to its final rest, as shown in Fig. 2.

Of course, it is possible to cause only any desired partial friction pressure in clutch 6—14—10—18—16 in absolutely similar manner as described above relative to friction clutch 5—13—9—17—15.

I do not want to be limited to the details described or shown in the drawings as many variations will occur to those skilled in the art without deviating from the scope of my invention.

KARL MAYBACH.