EB – 224D MIT

4/26/37

~~TBR~~ Differential analyzer ~~added~~

At Massachusetts Institute of Technology there is being constructed, with Foundation aid, a great mechanical and electrical computing machine. With amazing accuracy, this device will in a few hours solve mathematical formulae some of which would require months of computing by ordinary methods, and others of which would be essentially impossible of solution by any other means. The essential mechanical brain of this computing engine is a small, thin disc which rolls upon the polished surface of a glass plate. Actually the machine derives its range and power from the fact that it has not one, but eighteen of these disc "brains". These discs are about as thin as a silver dollar, a little larger, and very much lighter, being made of a light alloy. Together with the delicate shaft on which it is mounted, each weighs only a few ounces, and yet the detailed motions of these delicate discs must precisely control the motions of the whole computing engine, turning many heavy gears, ~~etc.~~ From the shaft which carries each disc, there projects a light plate, shaped somewhat like one petal of a flower. This plate, which is fixed on the shaft and therefore rotates whenever the disc does, moves in relation to another nearby, similar, but fixed plate. These two plates do not touch one another, and there is no mechanical connection between them; but the two plates form part of an electrical circuit ~~whose~~ characteristics change as the position of the movable plate is changed relative to the fixed one. Changes in the electrical characteristics of this circuit reflect themselves, in turn, in changes in the electrical currents which flow in the circuit. Feeble as these changes may be, modern radio techniques can magnify these changes, without distortion, until they are of sufficient magnitude to control the motions of a sizeable motor, say of ½ horsepower. In this way the delicate motions of the tiny disc serve to control the motion of a powerful motor. Although there is no mechanical connection at all between the disc and the motor, if one twirls the disc with his fingers, making it run rapidly, stop suddenly, jerk in the other direction ..... , the large motor, as the perfect and mysterious slave of the tiny disc, performs exactly the same motions.

It is practically impossible to give to the disc, with one's fingers, so small a movement that the large motor will not respond. If the disc is running steadily at any speed from zero up to 2,000 revolutions per minut the motor obeys within 1° of arc. If the disc is suddenly speeded up or suddenly slowed down, the large motor obeys these orders with an accuracy which is always well within 1% of revolution.

This amazing device will have many applications in the machine. Since it furnishes a method whereby the motions of any one shaft can be made exactly to control the motions of any other shaft, the more delicate portions of the machine will make no use of the mechanical gears which are ordinarily used to drive one shaft from another. Thus "shifting gears" in this machine - a mechanical process which in the earlier model sometimes required days to accomplish by hand - will be

accomplished merely by changing certain electrical connections, this latter process being accomplished in a few moments, and automatically, by means of a punched card.

A statement recently received from the group which has developed this machine under the leadership of Dean Bush, reports that this essential unit of the machine has now been completed, has met all test requirements, and has gone into production.

WW:PHP
4/26/37