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SAFETY DEVICE FOR MACHINE TOOLS  
USING PHOTO-ELECTRIC TUBES  
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Fig. 1.

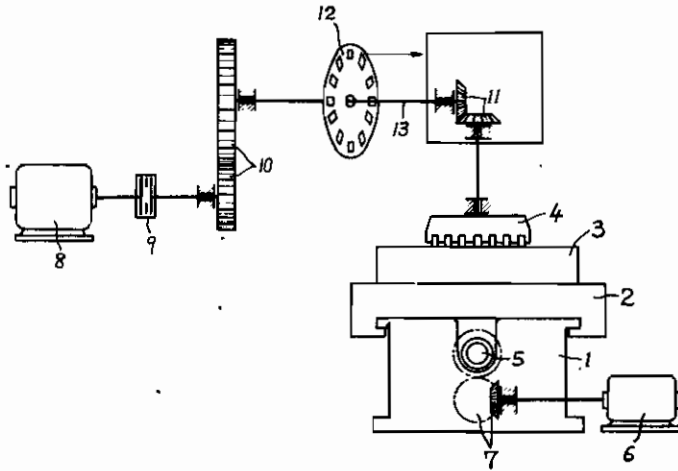
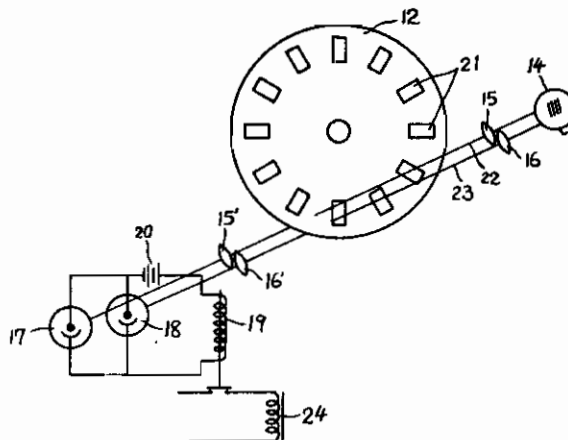


Fig. 2.



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## SAFETY DEVICE FOR MACHINE TOOLS USING PHOTO-ELECTRIC TUBES

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My invention relates to improvements in a safety device for machine tools using photo-electric tubes for controlling the operation of driving motors and has for its object to provide a simple and positive safety device for protecting a machine tool by stopping the feeding operation immediately in case of accidents in a driving mechanism such as the slipping of the clutch due to an overload on the cutting tool.

In machine tools the feeding motion of a work can be stopped during the operation of a cutting tool without objection. It is however very dangerous if the feeding operation is not stopped when the cutting tool has been stopped. In order to avoid the danger the motor for driving the cutting tool and the motor for feeding the work to be machined are mechanically inter-connected so that if one stops by some cause the other also is stopped. But the cutting tool is not directly connected to the shaft of the motor for driving the cutting tool, usually through gearings, friction clutches and the like power transmitting mechanism. Accordingly the mechanical inter-connection of the driving motors cannot perfectly protect the machine tools when the cutting tool is stopped due to the slip of the clutch mechanism or other accidents occurred in the intermediate driving mechanism.

My invention is specially devised to stop the feeding operation of a machine tool easily and positively by using photo-electric tubes when the cutting tool is stopped owing to some accidents in the driving gear itself.

In the accompanying drawing, Fig. 1 is an elevation of a milling planer drawn diagrammatically combined with a device embodying my invention and Fig. 2 is a diagrammatic view of a photo-electric controlling device for use with the machine tool embodying my invention.

Referring to the drawing, 1 represents a base frame of the milling planer having a working table 2, on which a work 3 to be machined is fixed. 4 represents a cutting tool and 5 is a leading screw shaft mounted on the machine frame 1 and meshing with a half-nut secured to the sliding table 2 and is driven by a motor 6 through suitable gear mechanism for effecting the feeding operation of the table. The cutting tool 4 is driven by a motor 8 through a friction clutch 9 and gear wheels 10 and 11.

According to my invention I provide a light

interrupter 12, secured to a suitable shaft 13 in the driving mechanism between the friction clutch 9 and the cutting tool 4 to control the light beam projected from a light source 14 through the lenses 15, 15' and 18, 18' to the photo-electric tubes 17 and 18 which cooperate to stop the feeding motor 6 by means of an electro-magnetic device 19 connected in the output circuit of the photo-electric tubes 17 and 18. 20 represents an energizing source of the photo-electric tubes. The interrupter 12 is provided with a number of slots 21 arranged on a circle at equal distances apart. The light beams projected through the lenses 15 and 18 from the light source 14 are passed successively through the slot 21 on the interrupter 12 when it is revolving and through the lenses 15' and 18' and led into the photo-electric tubes 17 and 18 alternately which then conduct electric currents in the output circuit and energize the relay 19 by the combined effect of both photo-electric tubes. The relay 19 is arranged to control a solenoid 24 which operates the main switch of the work feeding motor 6 to stop it accidentally. A plurality of photo-electric tubes 17 and 18 and the light source 14 should be so arranged with regard to the interrupter 12 that either one or both of the light beams 22 and 23 can not pass through the same or more slots 21 when the interrupter 12 is stationary.

In the above described arrangement of this invention, under the normal operation of the machine tool the photo-electric tubes 17 and 18 conduct sufficient current alternately within a very short time interval so that the relay 19 may be effectively energized to operate the solenoid 24 of the motor switch and maintain the motor 6 in operation. But if there occurs slip in the friction clutch 9 and the disc 12 is stopped by some accidents in the driving mechanism of the cutting tool at least one or all of the light beams 22 and 23 will be interrupted by the disc 12 so that sufficient current does not pass through the photo-electric devices 17 and 18 to energize the relay 19 and the motor 6 can be stopped immediately. Thus according to this invention the machine tool can be safely protected by stopping the feeding motor simply and positively when the cutting tool is stopped suddenly by some accidents of the driving mechanism.

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