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SAFETY DEVICE FOR MACHINES HAVING OPPOSITELY ROTATING CYLINDERS

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Fig. 1

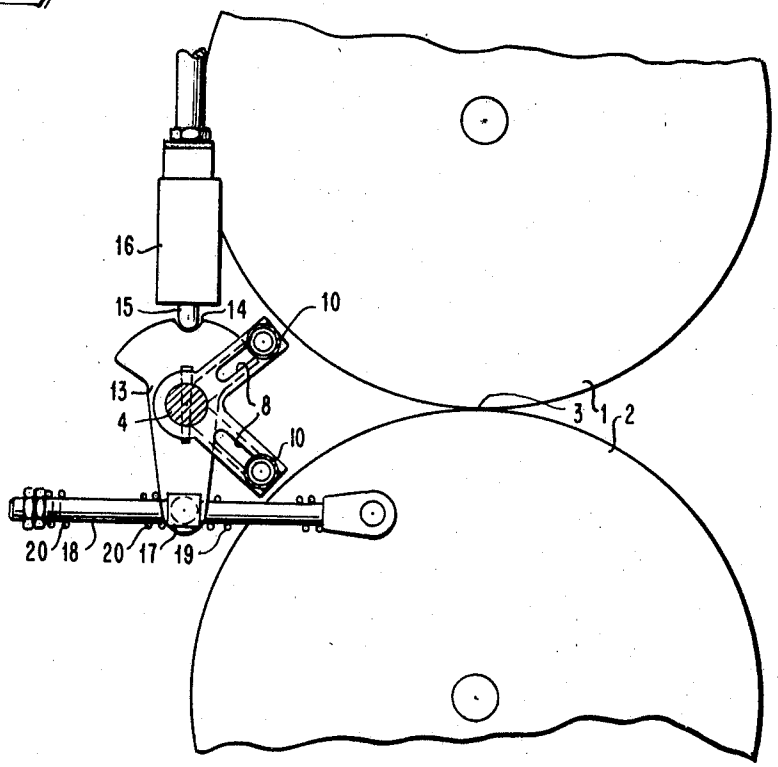
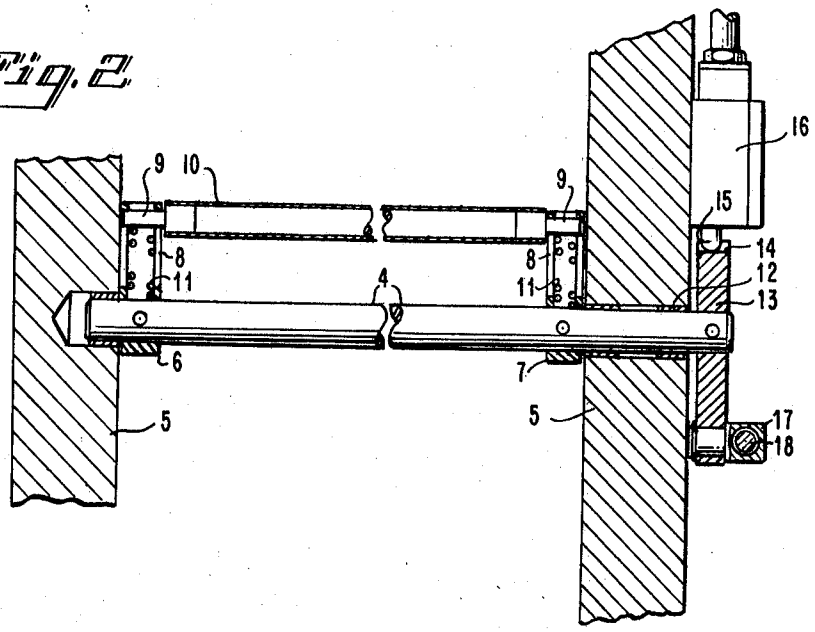


Fig. 2



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SAFETY DEVICE FOR MACHINES HAVING OPPOSITELY ROTATING CYLINDERS

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ABSTRACT OF THE DISCLOSURE

A safety device for a machine, such as a printing machine, which has oppositely rotating cylinders which define a contact gap between themselves. A swingable switch-actuating assembly is provided to actuate a control current limit switch to stop the operation of the machine when this assembly is turned. The switch-actuating assembly includes a pair of elongated protective members which are respectively located adjacent the pair of oppositely rotating cylinders while at the elevation of the contact gap therebetween there is a rotary shaft which extends parallel to the oppositely rotating cylinders. This latter shaft fixedly carries a pair of bell cranks whose arms respectively extend to ends of the pair of elongated protective members to carry the latter. A mounting means mounts the ends of these protective members on the bell crank arms for free rotary movement with respect thereto as well as for movement toward and away from the rotary shaft, and a spring means coacts with the elongated protective members to urge the latter away from the rotary shaft.

My invention relates to safety devices.

In particular, my invention relates to safety devices which are adapted to be used in connection with oppositely rotating cylinders, particularly those of a printing press.

Thus, a pair of such oppositely rotating cylinders define between themselves a contact gap where the cylinders may, for example, directly engage each other or where they engage a sheet material which passes between and in engagement with such cylinders. These cylinders have parallel axes, respectively, and the safety device will generally include a swingable switch-actuating assembly turnable about an axis parallel to that of each cylinder and coacting with a control current limit switch in order to terminate the operation of the machine.

Safety devices of this general type are known in connection with the oppositely rotating cylinders of printing presses, for example, where a suitable detent structure releasably maintains a swingable protective rod in a given operating position. This protective rod has the form of an easily movable switch-actuating body which coacts with an interrupter switch in such a way that when the body is swung a movement of a switch plunger and thus a termination of the flow of current takes place. This switch-actuating body has a non-circular configuration and is provided with edges which in the safety position of the assembly are situated closely adjacent to the oppositely rotating cylinders to be displaced away from the latter when the safety assembly is swung to terminate the flow of current and stop the machine.

However, since the switch-actuating body is releasably maintained in its operating position by a detent structure, it will not exert any pressure on an object which approaches the danger zone of the contact gap between the oppositely rotating cylinders as soon as the safety assembly has been displaced beyond the position in which it is held by the detent structure. As a result with this known construction of a safety device the danger zone becomes completely exposed without any substantial resistance so that, for example, an operator's hand which rapidly approaches the contact gap between the oppositely rotating cylinder can be compressed therebetween before the machine has come to a full stop upon actuation of the switch. See German Patent 766,210.

There are also known safety devices which have a pair of switch rails respectively supported by spring-mounted bearing arms in close proximity to the pair of oppositely rotating cylinders. Each of these switch rails has a contact tube mounted thereon and provided with a flexible wall which upon being contacted by an object which approaches the danger zone establishes a contact so that in this way a switch impulse is provided for stopping the operation of the machine. Because of the manner in which these switch rails are mounted, upon being contacted they can be displaced along circular paths away from the cylinders. However, this construction has the disadvantage that when an object approaches the danger zone, such as, for example, the hand of an operator, this object may be clamped between the contact rail and the exterior surface of the cylinder when as a result of a reflex action the operator attempts to withdraw his hand from the danger zone. Even if the machine is brought to a stop in good time, there can still be injury to an operator because the contact rail acts practically as a block preventing withdrawal of a hand of the operator which approaches the danger zone. See British Patent 938,993.

In another type of known safety device to be used in connection with oppositely rotating cylinders there is situated in front of the danger zone a hose which is connected with a pneumatic cylinder in which there is a piston for actuating an interruptor switch when the piston moves within the cylinder. With this known construction there is the primary disadvantage that the actuation of the interruptor switch does not take place through transmission of motion between rigid elements. The actuation takes place by way of the gas which is situated within the hose, and such a control medium is not reliable. On the one hand it is possible that during operation the hose will not remain fluid-tight or that the piston will seize in the cylinder. On the other hand such a safety device which if it is constructed in a particularly sensitive manner cannot be used because even during normal fluctuations in temperature, as are encountered during heated driving of the parts, the stopping of the operation of the machine can undesirably take place in an automatic manner. See Swiss Patent 407,173.

There are other known safety devices which have the disadvantage of requiring too much space, for example. In a known safety device of this type the switch-actuating assembly is made up of a pair of components which require separate bearings and which include separate pairs of levers. The turning axes for the lever bearings are arranged behind the contact gap of the cylinders, so that as a result it is essential to locate a pair of heavy levers between the ends of the cylinders and the side walls of the machine. Such a lever arrangement requires a considerable amount of space which is not customarily available with modern printing presses between the cylinder ends and the side walls of the machine frame. See German Patent 1,156,044.

It is accordingly a primary object of my invention to provide a safety device of the above general type which will avoid the above drawbacks.

In particular, it is an object of my invention to provide a safety device which will reliably bring the machine to a stop in the event that an object, such as the hand of an

operator, approaches the danger zone, while at the same time preventing any possible injury to the object.

Furthermore, it is an object of my invention to provide a construction which is composed of simple elements assembled together into a compact unit requiring a relatively small amount of space without sacrificing any safety features.

In accordance with my invention there are situated adjacent to the pair of oppositely rotating cylinders a pair of elongated protective members which may have a tubular construction and which are preferably situated at a distance of approximately a hand-width from the contact gap of the oppositely rotating cylinders. At the elevation of the contact gap between the opositely rotating cylinders is situated a rotary shaft which is in front of the danger zone, and a pair of bell cranks are fixed to this rotary shaft and have their arms extending up to the elongated protective members to carry the latter. These elongated protective members are supported at their ends for free rotary movement at the arms of the bell cranks and they are capable of being displaced toward the rotary shaft in opposition to the force of a spring means. Thus, this latter assembly forms a swingable switch-actuating structure which when actuated, as by engagement of a hand of the operator with one of the protective members, will bring about actuation of a control current limit switch to stop the operation of the machine.

My invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a partly sectional side elevation of a safety device of my invention shown with an offset printing press which is fragmentarily illustrated in a schematic manner; and

FIG. 2 is a fragmentary sectional transverse elevation of the structure of FIG. 1 shown as it is carried by the side walls of the machine frame.

The offset printing press which is fragmentarily illustrated in the drawings includes a rotary plate cylinder **1** and the rubber-blanketed cylinder **2** which receives an impression from the plate cylinder **1** in a well known manner. These oppositely rotating cylinders **1** and **2** of the printing press define between themselves the contact gap **3** where these cylinders engage each other although in other cases the oppositely rotating cylinders may pass any suitable sheet material between themselves by frictional engagement therewith at the contact gap **3**. Just to the left of the contact gap **3** is situated the danger zone where the safety device of my invention is located.

This safety device includes the rotary shaft **4** which forms a swing shaft supported for rotation about its axis at both of the side walls **5** of the machine. A pair of bell cranks **6** and **7** are respectively fixed to the rotary shaft **4** for swinging movement therewith. As is apparent from FIG. 1, each of the bell cranks has a pair of lever arms of equal length forming an angle of 90° between themselves. A suitable cross pin extends through the hub of each bell crank and the part of the shaft **4** surrounded thereby for fixing each bell crank to the shaft **4**. The axis of the shaft **4** is situated at the elevation of the contact gap **3** and extends parallel to the parallel axes of the cylinders **1** and **2**. Thus, a horizontal plane which contains the axis of the shaft **4** will also contain the contact gap **3** and will in fact define a plane of symmetry with respect to the shaft **4** and the bell cranks, as is apparent from FIG. 1.

The arms of the bell cranks **6** and **7** are respectively formed with longitudinally extending slots **8**, and each slot **8** receives an end **9** of an elongated tubular protective member **10**, the members **10** respectively terminating at their ends in the elements **9** which form bearing pins extending from the tubular parts of the protective members **10** through the slots **8**. Thus, there is an upper elongated protective member **10** terminating in a pair of opposed

bearing pins **9** which respectively extend through the slots **8** of the upper arms of the pair of bell cranks, and in a corresponding way there is a lower protective member **10** terminating in a pair of bearing pins **9** which are received in the slots **8** of the lower arms of the bell cranks, respectively. In this way the pair of elongated protective members **10** can be arranged closely adjacent to the exterior surfaces of the cylinders **1** and **2** at a distance of approximately a hand-width from the contact gap **3** and it will be noted that the elongated protective members **10** are supported for free rotary movement in slots **8** of the bell cranks.

These bell crank arms are of tubular form and house within themselves compression springs **11**, respectively, these springs respectively extending between the bearing pins **9** and the shaft **4** so that the springs **11** serve to urge the bearing pins **9** toward the outer ends of the slots **8** which are most distant from the shaft **4**. Thus, while the protective members **10** can be displaced along the arms of the bell cranks in the slots **8** thereof toward the shaft **4**, this latter displacement takes place in opposition to the spring means formed by the several compression springs **11**. The gap between the elongated protective members **10** and the exterior surfaces of the cylinders **1** and **2**, respectively, is on the order of 4 mm.

As is shown in FIG. 1 as well as at the right portion of FIG. 2, one end of the rotary swing-shaft **4** extends through a bearing **12** in a side wall **5** of the machine frame and beyond the latter wall **5** this end of the shaft **4** is fixed with a switching-actuating lever **13**. This lever **13** has a top surface extending along an arc of a circle and formed with an axially extending groove **14** which receives the bottom end of the switch plunger **15** of a control current limit switch **16**. As is apparent particularly from FIG. 1 the configuration of the bottom end of the plunger **15** conforms to the cross-sectional configuration of the slot **14**, so that even a slight angular turning of the lever **13** of the switch-actuating means will result in actuation of the limit switch **16**.

Below the shaft **4** the lever **13** pivotally carries a block **17** which is freely turnable with respect to the lever **13** while being carried thereby. This block **17** is formed with a through-bore, and an elongated rod **18** extends freely through the bore of the block **17** in opposite directions beyond the latter. A pair of compression springs **19** and **20** are coiled about the rod **18** which is pivotally supported at its right end, as viewed in FIG. 1, on a machine wall **5** and which carries at its left end, as viewed in FIG. 1, a pair of lock nuts. Thus, the block **17** is acted upon by the equal and opposite forces of the springs **18** and **19**, and in this way the lever **13** is yieldably and resiliently urged to the neutral position of FIG. 1 where the slot **14** registers with the plunger **15**. Since the lever **13** is fixed to the shaft **4**, as by way of a suitable cross pin, for example, the shaft **4** swings with the lever **13**, and thus the springs **19** and **20** serve to determine the neutral or operating position of the safety device of my invention, this position being indicated mostly clearly in FIG. 1. Thus, the central neutral or operating position of the parts as determined by the springs **19** and **20** and as shown in FIG. 1 corresponds to the safety position of the safety device.

The above-described structure operates as follows:

Assuming, for example, that during washing of the plate cylinder **1** the hand of the operator approaches the contact gap **3** and thus strikes against the upper protective tube **10**, then the entire switch-actuating assembly (**4**, **6**, **7**, and **10**) swings, because the compression springs **19** and **20** act on the block **17** with only a small fraction of the force exerted by the springs **11** in the arms of the bell cranks **6** and **7**. If it should happen that the hand of the operator is frictionally dragged along by the plate cylinder **1**, then the upper elongated protective member **10** will be pressed toward the swing-shaft **4**, so that an increasing pressure is exerted on the hand which

approaches the contact gap 3. The smallest turning of the entire switch-actuating assembly brings about, however, an actuation of the limit switch 16 because of even a slight angular displacement of the groove 14 with respect to the plunger 15. Therefore, the switch operation will itself act to warn an individual who happens to be in danger. Even before the machine has been brought to rest by the switch structure and brakes, it is possible for the operator to retract his hand because the elongated protective member 10 provides a free space through which the hand may be quickly retracted as a result of the springy support of the protective member 10 and the possibility of free rotary movement thereof. Thus, even if as a result of a reflex action the hand which approaches the contact gap 3 is retracted, this latter motion can take place without any injury.

It is apparent, therefore, that the rotary mounting of the protective members 10 and the movement thereof toward the shaft 4 in opposition to a spring force makes it possible at any time for an object which approaches the contact gap of the oppositely rotating cylinders to be retracted. If, for example, during operation of the machine the hand of the operator, as during cleaning of a cylinder or for any other reason, tends to be dragged along by a cylinder, this hand or other object will strike against a protective tube 10 so as to turn the latter to provide an immediate actuation of the limit switch. However, before the current flow terminates and the brakes of the machine bring it to a full stop, the operator is warned by the increasing pressure of the springs which act on the protective members 10 and retracts his hand. It is thus possible for the operator without any danger of injury to his hand in the form of a reflex movement to very suddenly retract his hand, since the yieldable springy and rotary mounting of the elongated protective members 10 provide an unobstructed space for retraction of the object such as the hand of the operator. Therefore, clamping of an object such as the hand of the operator is not possible with the safety device of my invention.

I claim:

1. In a machine, such as a printing press, having a pair of oppositely rotating cylinders which respectively have parallel horizontal axes and which define between themselves a contact gap situated between and extending parallel to said axes at a given elevation, a safety device comprising a swingable switch-actuating assembly for actuating a control current limit switch to stop the operation of the machine, said assembly including a pair of elongated protective members extending parallel to and respectively located adjacent said cylinders, a rotary shaft situated at said elevation of said contact gap and extending parallel to the axes of said cylinders, a pair of bell cranks fixed to said rotary shaft for turning movement therewith said bell cranks respectively having arms extending to and carrying said elongated protective members, mounting means mounting said protective members on said bell crank arms for free rotary movement as well as for movement along said arms toward and away from said rotary shaft, and spring means urging said protective members away from said shaft so that said protective members are displaceable toward said shaft only in opposition to said spring means.

2. The combination of claim 1 and wherein said protective members are each spaced from said contact gap by approximately the size of a hand-width.

3. The combination of claim 1 and wherein each of said protective members is in the form of an elongated tube.

4. The combination of claim 1 and wherein said mounting means includes elongated tubular portions of said bell crank arms which are respectively formed with longitudinally extending slots which receive ends of said protective members, said ends of said protective members respectively being freely turnable in said slots of said arms and said spring means including compression springs extending along the hollow interiors of said arms and engaging said ends of said protective members for urging the latter to the ends of said slots which are most distant from said shaft.

5. The combination of claim 4 and wherein a switch-actuating lever is fixed to said shaft for rotary movement therewith, limit switch means coacting with said switch-actuating lever and including a switch plunger, and means forming part of said switch-actuating lever and plunger for providing therebetween a coaction which will actuate said switch to stop the operation of the machine as soon as said switch-actuating lever turns with said shaft.

6. The combination of claim 5 and wherein said means forming part of said plunger and switch-actuating lever includes a cut-out formed in an end of said lever and receiving said switch plunger at an end of the latter, said cut-out having a configuration conforming subtstantially to that of said end of said plunger.

7. The combination of claim 5 and wherein a spring means coacts with said switch-actuating lever for maintaining the latter and said shaft therewith yieldably in a predetermined safety position.

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