A hydraulic overload safety device with a pitman adjustable in length for a press, in which the liquid pressure assuring the press against overload at the same time tightens the screw connection between two threadedly interengaged sections of the pitman and normally keeps them firmly secured to each other during normal operation of the press while this connection is automatically disengaged in response to the pitman encountering an overload.

3 Claims, 1 Drawing Figure
PITMAN ADJUSTABLE IN LENGTH FOR A PRESS WITH HYDRAULIC OVERLOAD SAFETY MECHANISM

The present invention relates to a pitman adjustable in length for a press or similar machine tool with the hydraulic overload safety mechanism.

Presses have to meet the requirement that the smallest distance between the ram and the press table must be adjustable so as to adapt the same to the dimensions of the respective tool and workpiece.

Inasmuch as pressing tools are relatively expensive, presses have to meet further requirement, namely, that they comprise a safety mechanism which will safeguard the tool against damage or destruction in case of an overload. An overload may occur, for instance, with cap or lid punch presses when a round or disc is introduced into the tool before the last punched cap or lid has left the range of the tool. Such overload safety mechanism also protects the machine frame and driving elements against undesired stresses.

Individual solutions are known for meeting the just mentioned two requirements. The adjustability as to the length of the pitman is customarily realized by making the pitman of two parts which are interconnected by means of an axial screw thread. By turning one part relative to the other part, the effective length of the pitman can be changed.

For protection against overload, several solutions are known, such as breakers and breaker discs, flywheel circuits, circuit including springing of the frame, difference in current of the drive motor, electronic sensing of the coasting parts, as well as hydraulic overload mechanisms of various types, according to which the press force is conveyed by means of a piston moving against the liquid pressure or by means of an opening valve.

With the heretofore known adjustment as to length of the pitman, the safeguarding against undesired mutual turning of the pitman parts is effected either positively by counter nuts and clamping of a threaded part or by frictional engagement. With the strong dynamic loads occurring during the operation of the press, an accidental loosening of a frictional clamping engagement cannot be excluded in a foolproof manner. With positively acting safety mechanism, additional structural elements and costs are involved for changing-over the press.

With the above described mechanical and electrical safety devices against overload, the actual response point strays relative to the set rated value to a considerable extent. When using a breaker, no adjustability for various values is possible. In addition thereto, following the response of such safety devices, the return of the press to its operative position is frequently very time consuming. Several of these safety devices also have a certain coasting time before they come to a standstill and therefore do not furnish an actual, i.e., immediately effective, protection. A heretofore known hydraulic overload safety mechanism is built into the ram of the press. However, with high speed presses, for instance cap punch presses, as light a ram as possible is desired in view of the mass forces.

It is, therefore, an object of the present invention to provide a pitman adjustable in length for a press or similar machine tool with hydraulic overload safety mechanism which will overcome the above mentioned drawbacks and will be suited for high speed presses.

It is another object of this invention to provide a pitman as set forth in the preceding paragraph, which will with simple means furnish a reliable protection against overload and a safe adjustability as to length of the pitman.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing illustrating a section of a pitman with an overload safety mechanism according to the present invention. The pitman adjustable as to length and the hydraulic overload safety mechanism according to the present invention are characterized primarily in that the hydraulic overload safety mechanism is arranged in the pitman in such a way that the liquid pressure which brings about the overload protection simultaneously tightens the screw connection which serves for the adjustment as to length of the pitman and effects such tightening during the operation of the press and thereby secures the screw connection in the two-part pitman by a frictional engagement.

To this end, the pitman is composed of a plurality of parts two of which are axially displaceable relative to each other and move toward each other when the adjustable liquid pressure is exceeded in a pressure chamber which is located in one of two parts while the liquid pressure and together therewith the force conveyed to the tool is being reduced. During the readiness of the press for operation, and only here dynamic forces can occur, the liquid pressure, through the intervention of parts located in the pitman housing and movable relative thereto, tightens the screw thread which serves for longitudinally adjusting the pitman, the screw thread establishing in interengagement of the parts of the pitman which are rotatable relative to each other, so that this screw thread will be frictionally secured.

The liquid pressure is generated by pump which is adapted to be controlled respect to its pressure. In this way the permissible maximum force can be set in conformity with the requirements of the respective tool and material.

Referring now to the drawing in detail, the drawing illustrates a vertical section through a pitman with the pertaining control elements. The introduction of power is effected by the eccentric 1 of the crank-shaft through the pitman onto the ram 9. The pitman is composed primarily of two groups of parts which are axially displaceable partially against each other. One group comprises the pitman housing 2 which has a central bore 2a that opens in downward direction and is provided at one end with a screw thread 2b. This group furthermore comprises a sleeve 4 which is slidable in the central bore 2a and is provided with a high pressure seal 3. Sleeve 4 rests on a pressure spindle 5 which is longitudinally adjustable connected through the screw thread 2b with the connecting rod housing 2. The other group comprises a sealing member 6 and a connecting rod 7 which is firmly connected to the sealing member 6. The connecting rod 7 extends through a bore 5a in the pressure spindle 5.

These two groups are clamped to each other by liquid of adjustable pressure which liquid is provided in the pressure chamber 8 of the pitman housing 2 above the sleeve 4 and the sealing member 6.
The pressure controllable pump 10 delivers liquid from a reservoir 11 into the pressure chamber 8 of the pitman housing 2. This liquid presses the sealing member 6 onto the sleeves 4 and thus brings about the rigidity of the pitman over its entire set length. On other hand, the liquid acts through the sealing member 6 and the sleeve 4 onto the pressure spindle 5 and thereby clamps the screw connection against the housing 2 of the pitman.

If on the ram, due to some disturbance or disorder, a force is generated which exceeds the permissible force, the mechanical force exerted by the ram through the connecting rod 7 and the sealing member 6 onto the liquid in the pressure chamber 8 is thus greater than the force which results from the liquid pressure multiplied by the cross section of the sealing member 6 so that the latter moves relative to the pitman housing 2 and is lifted off from the sleeve 4. This will suffice to cause the liquid to flow through the gap created thereby into a first inner chamber 4a of the sleeve 4, then through axial bores 4b regularly arranged in a guiding ring 4c into a second inner chamber 4d of the sleeve 4, which second inner chamber is through radial bores 12 in communication with an overflow chamber 13 laterally arranged in the pitman housing 2 and is furthermore connected to the reservoir 11 by return conduit 14. Consequently, the pressure subsides and the tool is relieved.

When the liquid pressure subsides in the pressure chamber 8 and thus in the conduit 16 to which the pressure switch 15 is connected a contact within the switch 15 is released and thereby and by means of a relay (not shown) the press drive will be stopped. The pump 10 will at the pressure drop automatically start and will re-establish the set pressure thereby placing the press again in readiness for operation. After elimination of the disorder, the press may then by means of a two-hand switch again be put into operation.

By means of a pressure regulating valve 17 which preferably is fitted between the pressure conduit 6 and the return conduit 14 the pressure in the pressure conduit 16 and thus in the pressure chamber 8 can be set infinitely variably. In this way the force due to disturbance from where the overload safety device responds can be set, too, as it is proportional to the pressure.

As will be evident from the above, the outstanding advantages of the pitman according to the present invention may be summarized as follows:

a. A reliable assurance is realized an accidental turning relative to each other of the parts in operative position which make up the length of the pitman.

b. This assurance is automatically created by the required establishment of the liquid pressure prior to the start of the machine. For changing-over the machine, however, this can be made ineffective by relieving the liquid pressure.

c. The hydraulic overload safety mechanism has a high response precision with a response point which is variable in a continuous manner in a definite range, the response period being extremely short.

d. After the overload safety mechanism has responded, a quick return of the press to its operative condition will be obtained. It is, of course, to be understood that the present invention is, by no means, limited to the specific showing in the drawing but also comprises any modifications within the scope of the appended claims. What we claim is:

1. In combination with a press, a hydraulic overload safety device comprising a pitman adjustable in length for presses and similar machine tools, which includes:

   pitman housing means having a central blind bore opening in one direction and having its open end on the inside thereof provided with threads, sleeve means reciprocable in said bore, threaded spindle means threadedly engaging said threaded open end of said pitman housing means, and supporting said sleeve means, sealing means resting on said sleeve means, a connecting rod having one of its ends connected to said sealing means and being reciprocably guided by and in said sleeve means and in said threaded spindle means, the other end of said connecting rod being connectable to a ram, said sealing means together with the adjacent portion of said sleeve means and said pitman housing means defining a pressure chamber, pump means having a suction side, liquid storage means communicating with said suction side, said pump means also having a pressure side for communication with said pressure chamber to deliver liquid under pressure thereto and establish a pressure in said pressure chamber sufficient to press said sealing means in a liquid-tight manner against said sleeve means while pressing said sleeve means against said threaded spindle means thereby establishing a firm frictional locking connection between the threaded portion of said spindle means and the thread of said open end of said pitman housing means, said sleeve means having recess means surrounding said connecting rod and normally sealed relative to said pressure chamber by said sealing means, and means establishing communication between said recess means and said storage means, said connecting rod being operable in response to a pressure encountered during a pressing stroke and exceeding and acting counter to the pressure in said pressure chamber to lift said sealing means off said sleeve means to thereby establish communication between said pressure chamber and said recess means and relieve the pressure in said pressure chamber.

2. A pitman according to claim 1, which includes means for infinitely variably setting the liquid pressure in said pressure chamber at which the hydraulic overload safety device will respond.

3. A pitman according to claim 1, which includes means associated with said overload safety device and operable automatically in response to said overload safety device becoming effective to stop said press and in response to said overload safety device being in ineffective position to again place said press into operative position.

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