

July 26, 1932.

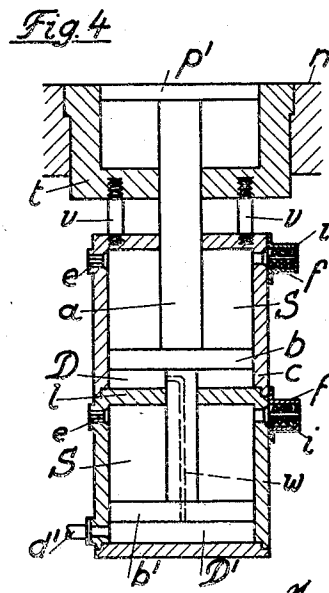
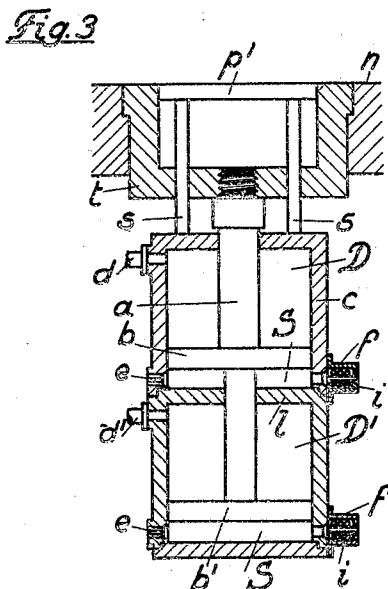
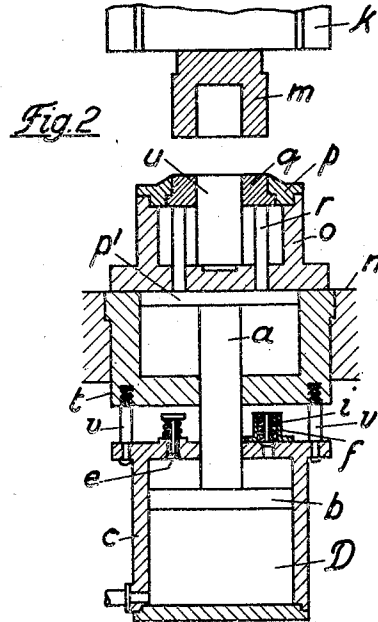
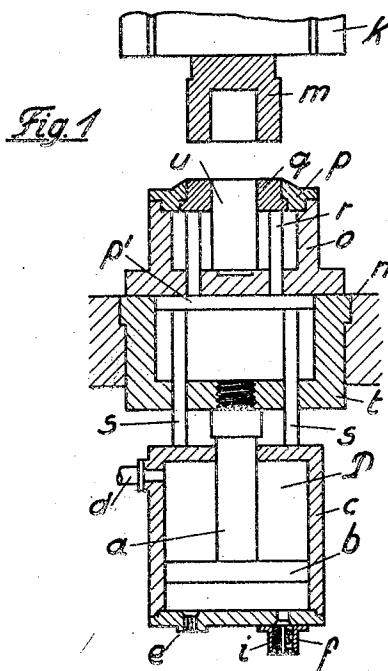
O. KÜHNER

1,868,637

DIE CUSHION FOR PRESSES

Filed Nov. 2, 1929

2 Sheets-Sheet 1



Inventor:
Ottv Kühner
by *Kühner*
Atty.

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Fig. 5

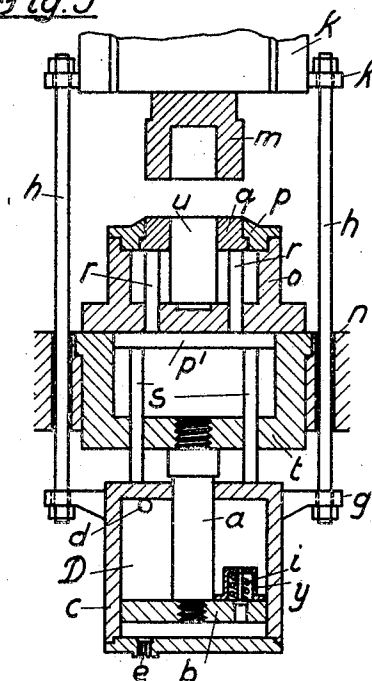


Fig. 6

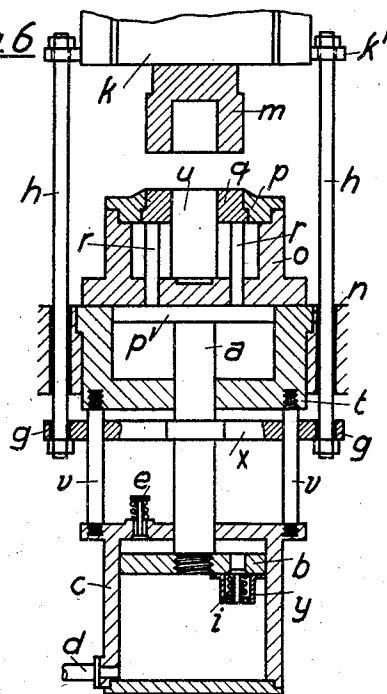


Fig. 7

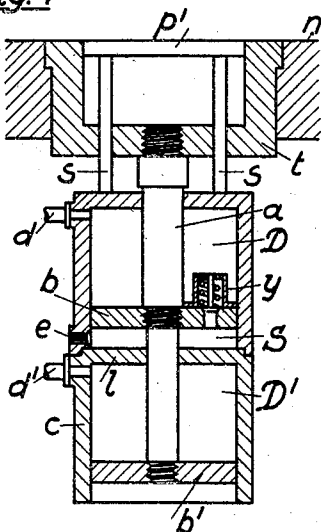
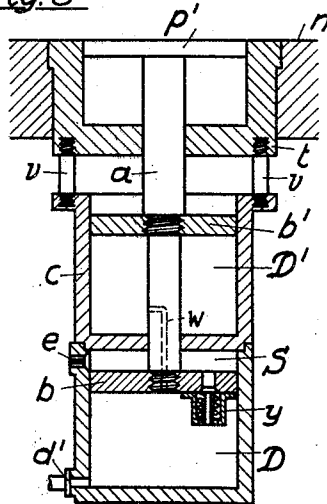


Fig. 8



Inventor:
Otto Kühner
by *Heintzel*
Atty.

UNITED STATES PATENT OFFICE

OTTO KÜHNER, OF GOPPINGEN, GERMANY, ASSIGNOR TO THE FIRM L. SCHULER A. G.,
OF GOPPINGEN, GERMANY

DIE CUSHION FOR PRESSES

Application filed November 2, 1929, Serial No. 404,493, and in Germany April 3, 1929.

My invention relates to die cushions, and more particularly to die cushions for die presses.

It is an object of my invention to improve a die cushion of the type referred to. To this end I provide a cylinder with a piston and means connected to a movable member of the press for effecting relative movement of the piston and the cylinder, so that air is compressed in the cylinder, and I provide a suction valve and a pressure-controlled relief valve which valves open into the same chamber of the cylinder.

The operative connection to the movable member of the press may be so designed that the piston is fixed and the cylinder is displaced by its connection to the movable member, or conversely the cylinder is fixed and the piston is displaced.

Die cushions of the general type described have already been suggested but in such cushions the relief valve is positively controlled by the piston and open when the piston is near the end of the stroke compressing the air which has been admitted through the suction valve. This, however, is not in accordance with the principle of exerting a steady resistance against the motion of the piston as, when the relief valve is abruptly opened by the positive control the pressure is relieved as abruptly and a jerky movement of the piston will result. A pressure-controlled relief valve, on the other hand, allows the pressure to build up to a predetermined amount and then opens gradually and not abruptly so that any jerking is eliminated.

While a die cushion according to my invention compares favorably with the type of die cushion referred to, it also compares favorably with die cushions in which a principal and a subsidiary pressure medium are employed, and the subsidiary medium is stored in a separate tank. Two tanks or sources of compressed air at different pressures are therefore required in this old system, or it is necessary to arrange several pistons of various diameters in succession, and a control valve is another inevitable complication.

All these complications are eliminated by

my invention in which atmospheric air is drawn into the cylinder of the cushion during the downward stroke, compressed during the upward stroke, and discharged through a relief valve. Preferably the load on the relief valve is made variable in order to adapt the pressure at which it opens to various operating conditions.

In the drawings affixed to this specification and forming part thereof various die cushions embodying my invention are illustrated diagrammatically by way of example, all figures being axial sections.

In the drawings

Figs. 1 to 4 illustrate cushions with a discharge valve on the casing,

Figs. 5 to 8 illustrate cushions with the discharge valve in the piston. More particularly

Fig. 1 illustrates a movable cylinder in combination with a stationary piston,

Fig. 2 illustrates the reverse arrangement, with a movable piston and a stationary cylinder,

Figs. 3 and 4 illustrate die cushions of the types illustrated in Figs. 1 and 2, respectively, but with duplicated pistons and cylinders,

Figs. 5 and 6 illustrate die cushions with a movable cylinder and a movable piston, respectively, as in Figs. 1 and 2, but with the discharge valve on the piston and not on the cylinder,

Figs. 7 and 8 illustrate the die cushions according to Figs. 5 and 6 in combination with an auxiliary piston in an auxiliary cylinder.

The press to which the die cushion according to my invention is applied, has not been illustrated in full detail but with what has been shown any expert will be able to understand the combination of the die cushion with the press. I have illustrated the die cushion in combination with a cupping or die press but it is understood that it may be applied to presses of any type without departing from my invention.

In all figures n is the table of the press, t is a casing on the table, and p' is a plate which is fitted to slide in the casing t .

Referring now to Figs. 1, 2, 5, and 6, *o* is a support for the blanking dies *g*, *p*, *u* is the male cupping die which is secured in the support *o*, *k* is the ram of the press, *m* is the female cupping die and *r*, *r* are rods connecting the inner blanking die *g* with the plate *p*'.

Referring now to Fig. 1, *b* is a piston which is secured to the casing *t* by means of a piston rod *a*, *c* is a cylinder which is fitted to slide on the piston and on the rod *a*, *s* are rods connecting the movable cylinder *c* with the plate *p*', *e* is a suction valve, *f* is a relief valve on the cylinder, and *d* is a pipe connecting the cylinder *c* with an air chamber, not shown.

The suction valve *e* and the relief valve *f* are arranged in the bottom of the cylinder *c*. The relief valve *f* is loaded by a spring *i*, and preferably provided with means for varying the load, for the purpose specified.

When the cylinder *c* descends under the pressure exerted on the blank support, the air above the piston *b* is compressed and partly discharged into the air chamber or the like through the pipe *d*, while atmospheric air is drawn into the chamber below the piston *b* through the valve *e*. When the stroke of the press has been completed, the cylinder *c* rises under the action of the compressed air above the piston, and in turn raises the inner blanking die *g*. The air below the piston is now compressed and discharged through the valve *f* at a pressure which is a function of the load on the spring *i*, so that the resistance to the upward movement of the cylinder *c* may be varied as required by varying the load.

Referring now to Fig. 2, the rod *a* of the piston *b* is connected with the plate *p*', the cylinder *c* is fixed to the casing *t* in the table *n* by stays *v*, and the piston *b* reciprocates in the cylinder *c*. Here, the compression chamber with its connection *d* is arranged below the piston *b* and the suction chamber, with the valves *e* and *f*, is arranged above the piston.

Referring now to Fig. 3, the movable cylinder *c* is divided into the compartments *D* and *D'* by a partition *l*, the piston *b* is arranged in the upper compartment *D* as described but its rod *a* is extended through the partition *l* and into the lower compartment *D'* where a second piston *b'* is secured on the rod extension. Each compartment is equipped with the valves *e* and *f* in the suction chambers *S*, *S'* below its piston, the compression chamber *D* of the upper compartment being provided with the connection *d* as described, and the compression chamber *D'* of the lower compartment being provided with a connection *d'*, for the same purpose. In this manner, and with the same piston diameter, the pressure on the blanking die *g* is duplicated. This arrangement is particularly suitable when the available space

is restricted laterally as its width is not increased by the duplication.

The die cushion illustrated in Fig. 4 is similar to the die cushion described with reference to Fig. 3 except for the fact that its pistons *b* and *b'* are movable, being connected with the plate *p*' by the rod *a*, and its extension. In this instance, the position of the suction and compression chambers is obviously reversed as compared with Fig. 3 and, in addition, the connecting pipe *d* in the upper compression chamber has been dispensed with, and replaced by a bore *w* in the piston rod extension, in combination with the pipe *d'* in the lower compression chamber *D'*.

Referring now to Fig. 5, this shows an arrangement similar to that described with reference to Fig. 1, with a movable cylinder *c* and a stationary piston *b*, but in this case the relief valve *y* is arranged in the piston *b* and not on the cylinder as in the other figures, opening toward the compression chamber *D* above the piston, and only the suction valve *e* is provided in the suction chamber below the piston. *h* are connecting rods extending between eyes *k'* on the ram *k*, and eyes *g* on the casing *c*. The rods are free to slide in their respective eyes *k'* and *g* but might be rigidly connected with one pair of eyes. It will be understood that in this case means are required for returning the blanking die *g* to its initial position as the cylinder *c* will cease moving in upward direction as soon as equal pressure obtains in the chambers above and below the piston. When this occurs, the rods *h* return the cylinder *c* and the blanking die *g* into their initial positions. Upon the downward movement of the ram, the rods *h* will not influence the cylinder *c*.

Referring to Fig. 6, the piston *b* is connected with the plate *p*' as in Fig. 2 and the chamber below the piston is the compression chamber. In this instance a crosshead *w* is secured on the rod *a* and fitted to slide on the stays *v* for returning the piston *b* to its initial position in the same manner as the cylinder *c* is returned by the rods *h* in Fig. 5.

Referring now to Fig. 7, the arrangement is similar to that described in Fig. 4 but a suction chamber is only provided between the upper piston *b* and the partition *l* while the cylinder *c* is open at the end below the piston *b'*. Atmospheric pressure therefore acts on the lower face of the piston *b'*. When the cylinder *c* moves upwards and when the pressures have balanced between chamber *D* and the suction chamber *S*, the pressure in the second compression chamber *D'* moves the cylinder *c* beyond the dead point. It will be understood that the lower portion of the cylinder *c* constitutes an auxiliary cylinder and the rods *h*, Figs. 5 and 6, are dispensed with.

A similar operation occurs in the case of Fig. 8, where the respective position of the

chambers D and D' has been reversed, as in Fig. 4, and the upper piston *b'* is connected with the atmosphere on its upper surface. A passage *w* is here provided in the extension of the piston rod *a*, for the purpose specified.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

In the claims affixed to this specification no selection of any particular modification of the invention is intended to the exclusion of other modifications thereof and the right to subsequently make claim to any modification not covered by these claims is expressly reserved.

I claim:—

1. A die cushion for die presses comprising a cylinder, a piston in said cylinder, means connected to a movable member of the press for effecting relative movement of said piston and said cylinder so as to compress air in said cylinder, a suction valve and a pressure-controlled relief valve connected to one of the closed chambers into which the cylinder is subdivided by its piston, and a pipe connecting the other chamber to an air chamber.

2. A die cushion for die presses comprising a cylinder, a piston in said cylinder, means connected to a movable member of the press for effecting relative movement of said piston and said cylinder so as to compress air in said cylinder, a suction valve connected to one of the closed chambers into which the cylinder is subdivided by its piston, a pipe connecting the other chamber to an air chamber, and a pressure-controlled relief valve on said piston which is adapted to open into the chamber having the pipe.

3. A die cushion for die presses comprising a principal cylinder, a piston in said principal cylinder, means connected to a movable member of the press for effecting relative movement of said piston and said principal cylinder so as to compress air in said principal cylinder, a suction valve connected to one of the closed chambers into which the principal cylinder is subdivided by its piston, a pipe connecting the other chamber to an air chamber, a pressure-controlled relief valve on said piston which is adapted to open into the chamber having the pipe, an auxiliary cylinder arranged on said principal cylinder at the end where said suction valve is arranged, and the outer end of said auxiliary cylinder being open to atmosphere, and a piston in said auxiliary cylinder operatively connected to the piston in said principal cylinder.

In testimony whereof I affix my signature.

OTTO KÜHNER.