United States Patent

[11] 3,532,017

[72] Inventor Walter Schlueter,
Geesthacht, Germany

[21] Appl. No. 734,586
[22] Filed June 5, 1968
[45] Patented Oct. 6, 1970

[73] Assignee Wilhelmsburger Mashinenfabrik Hinrichs & Sohn
Geesthacht, Germany
a firm

[32] Priority June 6, 1967
[33] Germany
[31] W 44,121

[54] **HYDRAULIC DEVICE FOR THE CONTROL OF OIL PRESSURE PISTONS**
6 Claims, 2 Drawing Figs.

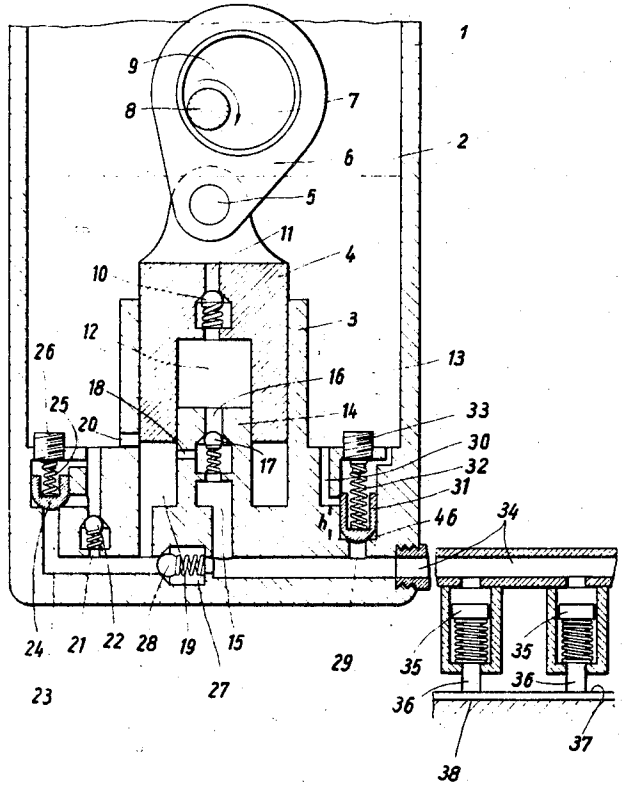
[52] U.S. Cl. 83/390, 83/461
[51] Int. Cl. B26d 7/02
[50] Field of Search 83/390, 451, 452, 453, 461, 385, 457, 639; 103/158

[56] **References Cited**
UNITED STATES PATENTS

2,323,770	6/1943	Hazelton	83/390X
2,766,825	10/1956	Pater et al	83/390X

Primary Examiner—Andrew R. Juhasz
Assistant Examiner—James F. Coan
Attorney—Lowry, Rinehart and Markva

ABSTRACT: The invention provides a hydraulic device for the control of oil pressure pistons, especially for clamping down sheet metal plates to be cut with a guillotine shear, wherein the generation of the effective oil pressure on the pistons is achieved by a plunger connected to the drive shaft of the guillotine shear and guided in a cylinder divided into a high-pressure chamber and a low-pressure chamber connected by a first pressure equalizing bore in the wall of the high-pressure chamber on a level higher than the level of the lower edge of the plunger in its bottom dead center position, so that the high pressure in the high-pressure chamber begins to decrease only after the intake stroke of the plunger has commenced.



Patented Oct. 6, 1970 3,532,017

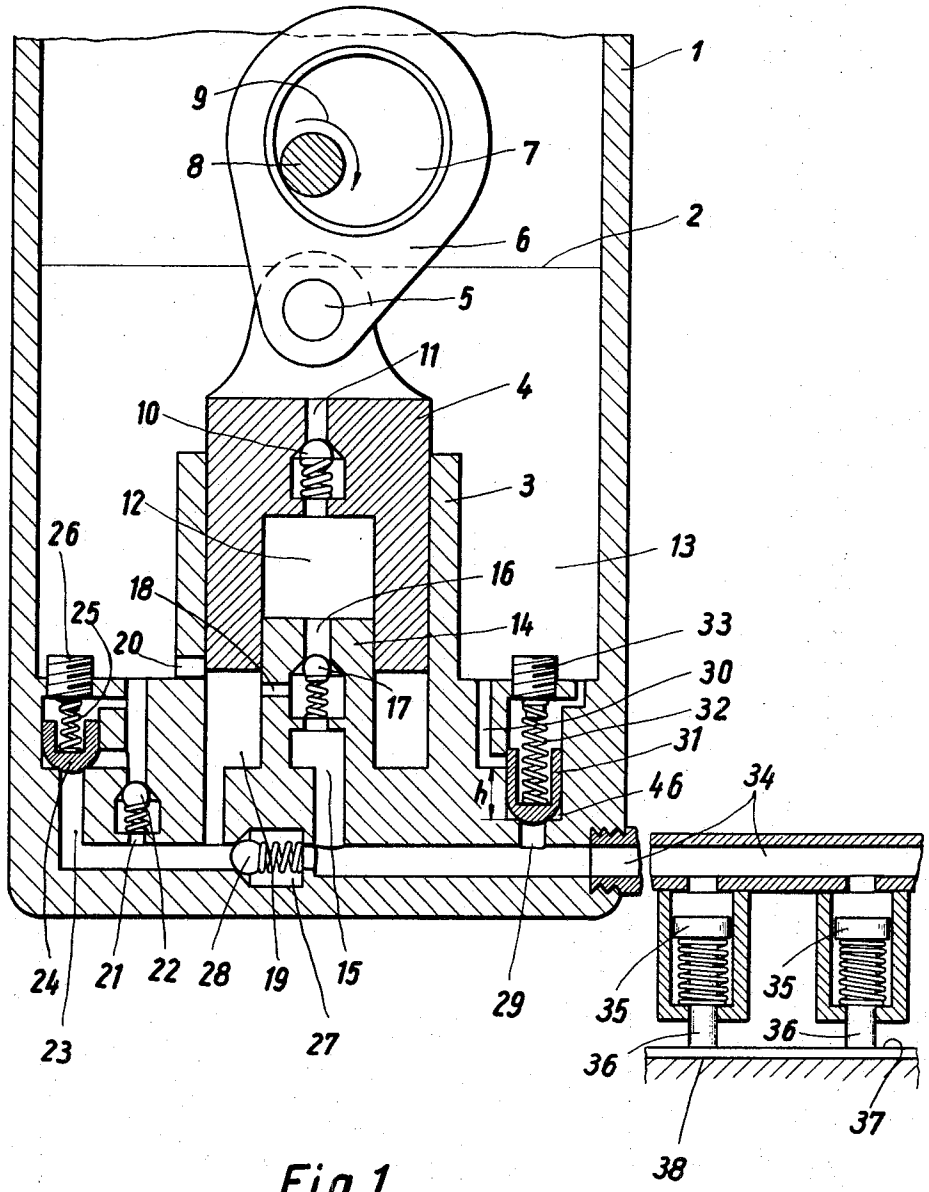


Fig. 1

Inventor:
WALTER SCHLÜTER

Lowry, Pinckert & Marsha

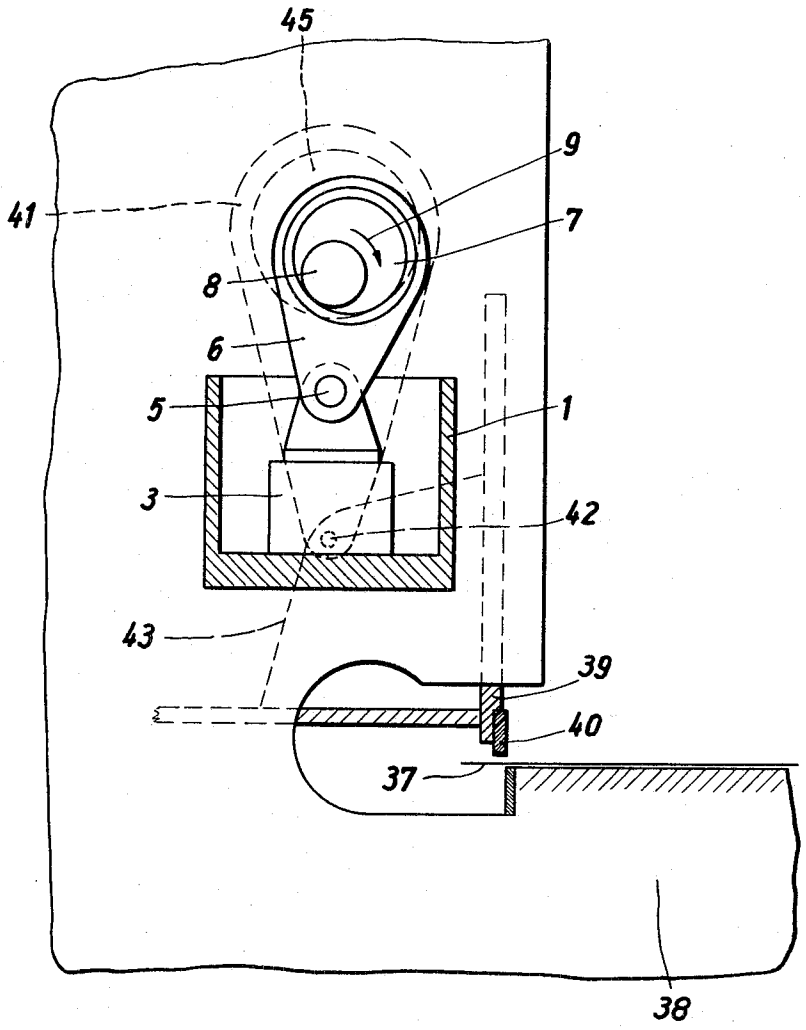


Fig. 2

Inventor:
WALTER SCHLÜTER
Lowry, Pinckaers & Markva

HYDRAULIC DEVICE FOR THE CONTROL OF OIL PRESSURE PISTONS

BACKGROUND OF THE INVENTION

This invention relates to a hydraulic device for the control of oil pressure pistons, in particular for the clamping down of sheet metal plates about to be cut with a guillotine shear, whereby the generation of the effective oil pressure on the pistons is achieved through a plunger connected to the drive shaft of the guillotine shear. The plunger is contained in a cylinder whose area is divided into a high-pressure chamber and a low-pressure chamber connected by a pressure equalizing bore. This device will henceforth also be called an oil pressure generator.

When guillotining sheet metal plates these plates must be held fast on a table immediately before and during the cutting operation. Hydraulic oil pressure pistons are used for this purpose, the oil feed of which via a common oil pressure generator is controlled as a function of the movement of the shear. These oil pressure generators are so constructed that the pistons are already operative when the guillotine shear begins to cut and the pressure exerted on the pistons ceases immediately after the cutting operation ends. In this way the cut sheet metal plate does not hinder the upward stroke of the shear.

This was achieved with a known oil pressure generator, described in German Pat. No. 1,041,766, by using a cam disc seated on the drive shaft of the oil pressure generator and the shear and working in conjunction with a pulley connected to the pistons. The use of a cam disc has considerable disadvantages since the cam disc is so highly stressed by the very high pressures occurring and because of its line contact with the pulley of the piston, that it has to be exchanged frequently due to wear. A further disadvantage is that the cam discs must have steep race portions so that the oil pressure can build up and drop suddenly. Such cam discs have a small transitional radius and are thus exposed to very high loads and considerable wear.

It is thus more advantageous to control the piston via a connecting rod with an eccentric disc since such a drive has a less surface pressure between the drive elements then the line contact of a cam disc. The use of a connecting rod with an eccentric disc has not been possible before since with the known oil pressure generators it was impossible to achieve any noteworthy operation of the generators before the shear became operative, *i.e.* the oil pressure build-up was not very rapid. The top dead center position of the piston could not be advanced with respect to the top dead center position of the shear because this resulted in the oil pressure at the bottom dead center position of the eccentric disc of the oil pressure generator dropping too rapidly.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide a hydraulic device for the control of oil pressure pistons which permits the top dead center positions of the pistons to be advanced in relation to the movement of the shear so that a connecting rod with an eccentric disc can be used as a drive which is free from the disadvantages of the known cam disc drives.

To attain this object the present invention provides a hydraulic device for the control of oil pressure pistons, especially for clamping down sheet metal plates to be cut with a guillotine shear, wherein the generation of the effective oil pressure on the pistons is achieved by a plunger connected to the drive shaft of the guillotine shear and guided in a cylinder divided into a high-pressure chamber and a low-pressure chamber connected by a first pressure equalizing bore in the wall of the high-pressure chamber on a level higher than the level of the lower edge of the plunger in its bottom dead center position, so that the high pressure in the high-pressure chamber begins to decrease only after the intake stroke of the plunger has commenced.

With this arrangement the high pressure does not drop at the bottom dead center position of the plunger as soon as the same begins its upward movement, but only after the plunger has travelled a predetermined distance upwards to its top dead center position. It is thus possible to use an oil pressure generator whose plunger is nonpositively connected to the drive shaft via a connecting rod and an eccentric disc, the eccentric disc for the drive of the plunger being preferably advanced over the eccentric disc for the guillotine shear drive on a common drive shaft in the direction of rotation.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings in which:

FIG. 1 is a cross section through an oil pressure generator with two pistons, and

FIG. 2 is a schematic side elevation of the drive for the oil pressure generator and the guillotine shear.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows an oil pressure generator comprising a housing 1 forming an oil chamber 13 about two-thirds of which are filled with oil 2. The housing 1 contains a cylinder 3 in which a cup-shaped plunger 4 having a plunger chamber 12 is able to move up and down. The plunger 4 is connected by a gudgeon pin 5 to a connecting rod 6 located on an eccentric disc 7 carried by a drive shaft 8 arranged to rotate in the direction of the arrow 9.

A suction valve 10 is arranged in the head of the plunger 4 and serves to shut off a bore 11 in the plunger head during the compression stroke of the plunger 4. This bore 11 connects the plunger chamber 12 to the oil chamber 13.

An inner plunger 14 enclosing a high-pressure chamber 15 is inserted in the cylinder 3 and extends into the plunger chamber 12. The head of the inner plunger 14 has a bore 16 which is shut off by a nonreturn valve 17 during the intake stroke of the plunger 4.

A first radial pressure equalizing bore 18 extends through the middle portion of the wall of the inner plunger 14 and connects the high-pressure chamber 15 to an annular low-pressure chamber 19. A second radial pressure equalizing bore 20 is provided in the wall of the cylinder 3 on a level higher than that of the first pressure equalizing bore 18 and connects the annular low-pressure chamber 19 to the oil chamber 13 when the plunger 4 is in its top dead center position. The low-pressure chamber 19 is further connected to the oil chamber 13 by a bore 21 which is fitted with a suction valve 22. This suction valve 22 opens the bore 21 when the plunger 4 is on its intake stroke, *i.e.* moves upwardly. The low-pressure chamber 19 is also connected to the oil chamber 13 by a bore 23 in which a relief pressure valve 24 for adjusting the low pressure is accommodated. The relief pressure valve 24 has a plunger which is loaded by a spring 25 the tension of which can be adjusted by a set screw 26.

The high-pressure chamber 15 is connected to the low-pressure chamber 19 by a channel 27 with a shutoff valve 28, and to the oil chamber 13 by a channel 29. A bypass 30 leads from this channel 29 into the oil chamber 13 and can be shut off by a combined relief pressure and storage valve 31 having its plunger kept under compression by a spring 32 the tension of which can be adjusted by means of a set screw 33.

A connecting channel 34 is connected to the housing 1 so as to communicate with the high-pressure chamber 15. The pressure oil is fed through said connecting channel 34 to one or more cylinder and piston assemblies 35. Each cylinder and piston assembly 35 comprises a spring-loaded piston rod 36 which presses the sheet metal plate 37 down onto a table 38 when a sheet metal plate is to be cut by the guillotine shear shown in FIG. 2.

It can be inferred from FIG. 2 that the cutter guide 39 together with its terminal strip 40 can be moved up and down

by a second connecting rod **41**. To achieve this end, the connecting rod **41** is pivotally connected at its free end by a pin **42** to one stanchion **43** of the cutter guide **39**. The other end of the connecting rod **41** is seated on an eccentric disc **45** which is supported by the drive shaft **8**. It can be seen from FIG. **2** that the connecting rod **6** and the eccentric disc **7** for the plunger **4** are arranged on the shaft **8** in positions advanced over the connecting rod **41** and the eccentric disc **45** for the drive of the cutter guide **39**. It thus occurs that the plunger **4** has passed its bottom dead center position and is again on the upward stroke when the cutter guide **39** reaches its bottom dead center position.

The device shown in the drawings operates as follows:

As it moves down from its top dead center position, the plunger **4** shuts off first the second pressure equalizing bore **20** and then forces oil through the first pressure equalizing bore **18** into the high-pressure chamber **15**, out of the low-pressure chamber **19** through the shutoff valve **28** into the high-pressure chamber **15** and out of the plunger chamber **12** via the nonreturn valve **17** through the bore **16** into the high-pressure chamber **15**, from which the oil flows out through the connecting channel **34** into the cylinder and piston assemblies **35**. At this point the low-pressure chamber **19** is still directly connected to the high-pressure chamber **15** by the first pressure equalizing bore **18**. As soon as the piston rods **36** begin to press the sheet metal plate **37** onto the table **38**, the pre-filling operation ends, *i.e.* the cylinder and piston assemblies can take no more of the oil forced in by the plunger **4**. The excess pressure oil thus flows through the relief pressure valve **24** into the oil chamber **13**. During further down strokes and during the progress of the pressure stroke, the first pressure equalizing bore **18** is shut off by the plunger **4**. The oil forced out of the plunger chamber **12** through the nonreturn valve **17** can thus no longer escape from the high-pressure chamber **15** into the low-pressure chamber **19**, since the shutoff valve **28** operating in this direction also shuts off the channel **27**. The oil forced out of the plunger chamber **12** must therefore pass through the nonreturn valve **17** and through the high-pressure chamber **15** to the combined relief pressure and storage valve **31** which is adjusted for high pressure. This valve **31** opens when the set high-pressure level which can be adjusted by tensioning the compression spring **32** is reached, so that further excess oil can flow out through the bypass **30** into the oil chamber **13**. First of all a stock volume of oil is collected in a storage chamber **46** since the plunger of the combined relief pressure and storage valve **31** only opens the bypass **30** when forced up in the storage chamber **46** by a certain amount from the channel **29**, *i.e.* by the distance H. The distance H and thus the size of the storage chamber **46** correspond to the distance of the upper mouth of the channel **29** from the underside of the bypass **30**.

If the plunger **4** has reached its bottom dead center position, the oil in the high-pressure chamber **15** and in the connecting channel **34** will be held at high pressure at the subsequent start of the intake stroke and upward movement of the plunger **4** by the reservoir in the combined relief pressure and storage valve **31**, since the nonreturn valve **17** and the shutoff valve **28** prevent back flow into the plunger chamber **12** or the low-pressure chamber **19**. During this stage of the upward movement of the plunger **4** the cutter guide **39** executes a downward movement as a result of the advanced position of the eccentric disc **7** in relation to the eccentric disc **45**, so that the piston rods **35** hold the sheet metal plate **37** under tension on the table **38** although the plunger **4** is already moving upwardly.

If the plunger **4** opens the first pressure equalizing bore **18**, the oil volume is relieved through the open relief pressure valve **24**. At the same time the growing low-pressure chamber **19** is being filled with oil through the suction valve **22** and the growing plunger chamber **12** is being filled with oil through the open suction valve **10**. As the plunger **4** continues its upward movement the second pressure equalizing bore **20** is opened so that complete drop in pressure and volume equalization in all oil chambers and channels occurs.

The high pressure created by the oil pressure generator thus does not fall off at the bottom dead center position of the eccentric disc **7** but later, *i.e.* after the plunger **4** has reached a point on its intake stroke high enough to open the first pressure equalizing bore **18**.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

I claim:

1. A hydraulic device for the control of oil pressure pistons, especially for clamping down sheet metal plates to be cut with a guillotine shear, wherein the means for generating the effective oil pressure on the pistons comprises a drive shaft, a cylinder having a high-pressure chamber and a low-pressure chamber, a cup-shaped plunger in said cylinder and operatively connected to said drive shaft, an inner plunger in said cylinder separating said high- and low-pressure chambers, and a pressure equalizing bore connecting said high- and low-pressure chambers and located in the wall of said inner plunger at a position such that said plunger in its bottom dead center position blocks said bore whereby the high pressure in the high-pressure chamber begins to decrease only after the intake stroke of the plunger **15** has commenced.

2. A hydraulic device as claimed in claim **1** further comprising a nonreturn valve in said inner plunger.

3. A hydraulic device as claimed in claim **1** further comprising a fluid reservoir and a second pressure equalizing bore in the wall of said cylinder above said first mentioned pressure equalizing bore connecting said low-pressure chamber with said fluid reservoir.

4. A hydraulic device as claimed in claim **1** further comprising a storage valve and conduit means connecting said storage valve with said high-pressure chamber, said storage valve including means for accumulating fluid from said high-pressure chamber and for releasing said fluid above a predetermined pressure.

5. A hydraulic device as claimed in claim **1** further comprising means eccentrically connecting said plunger with said drive shaft and further means eccentrically connecting said guillotine shear with said drive shaft, the relative positions of said two eccentric connecting means on said drive shaft being such that said plunger is driven in advance of the guillotine shear.

6. A hydraulic device as claimed in claim **5** wherein the means connecting said plunger to said drive shaft and the means connecting said guillotine shear to said drive shaft each comprise an eccentric disc mounted on said drive shaft and a connecting rod connected to said eccentric disc.