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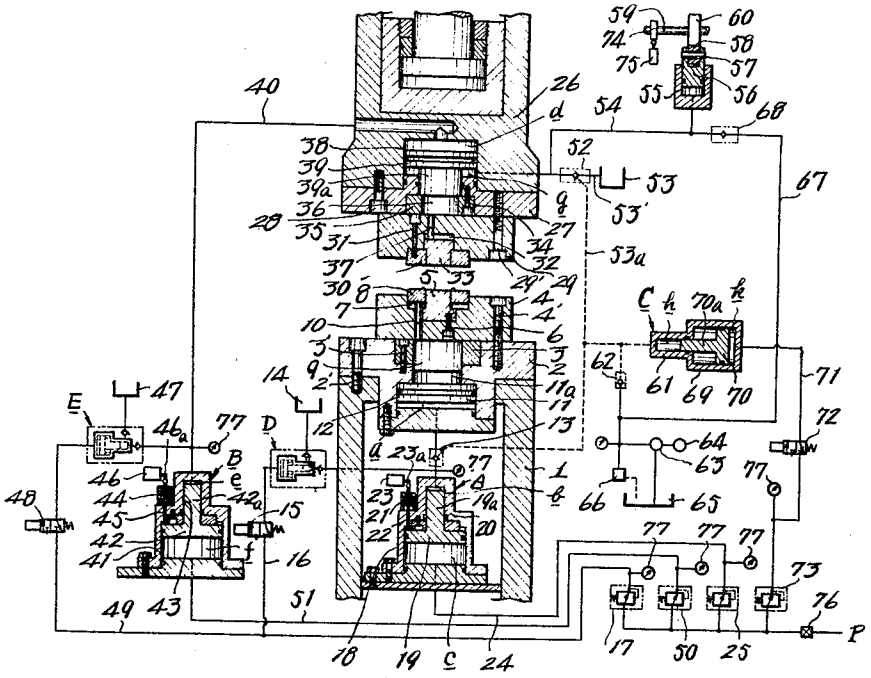
[54] **FINE BLANKING PRESS**
7 Claims, 1 Drawing Fig.

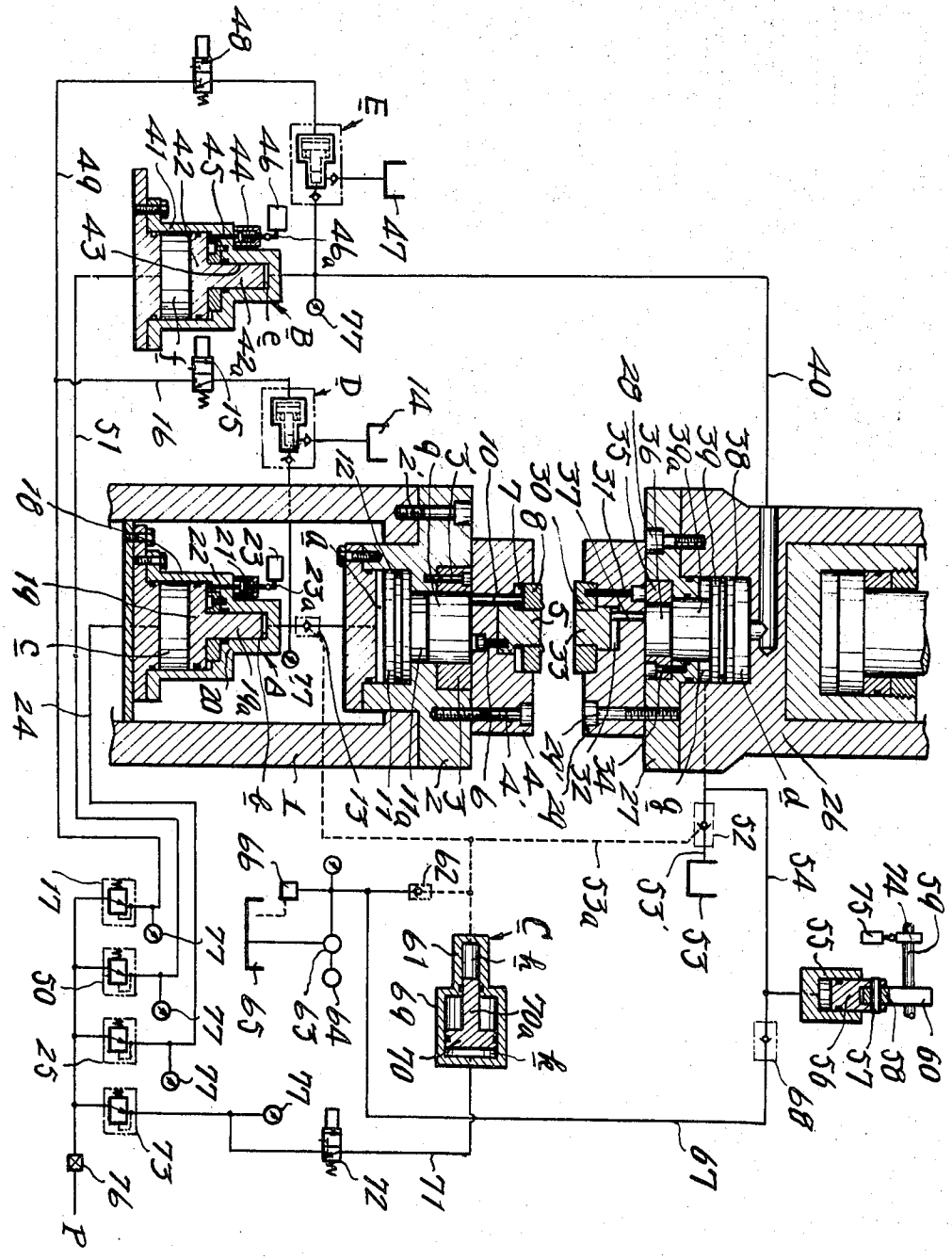
[52] **U.S. Cl.** **83/124,** 83/137, 100/218
[51] **Int. Cl.** **B26d 7/18**
[50] **Field of Search** 83/124, 137; 100/218; 72/344, 345

[56] **References Cited**
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ABSTRACT: A fine blanking press comprising a punch holder mounted on the bolster of said press; a blank holder loosely fit in said punch holder encircling a punch; a first cylinder provided in said bolster; a first piston for indirectly supporting said blank holder; a first booster for supplying oil pressure to said first cylinder; a die holder mounted in the slide of said press for supporting a die; a counter blank holder received in said die; a second piston fit in a second cylinder provided in said slide for indirectly applying oil pressure to said counter blank holder; a second booster for supplying oil pressure to a chamber above said second piston; and means for controlling and maintaining oil pressure within a chamber below said second piston.





FINE BLANKING PRESS

BACKGROUND OF THE INVENTION

There have been proposed various types of fine blanking presses which essentially comprise elements such as punches, dies, blank holder and counter blank holder, but all of the prior art blanking presses have rather complicated constructions and accordingly, the operation of such presses is inevitably complex which makes it difficult to produce blanked pieces having desired precise dimensions and shapes and necessitate additional operation or operations for finishing the incomplete blanks to the precise dimensions and shapes called for. Furthermore, in any of such prior art fine blanking presses the counter blank holder can not be completely locked in position and the die is frequently snugly fit in the mating die leading to the breakage of the punch and/or die whereby the service life of the these parts is shortened.

SUMMARY OF THE INVENTION

The present invention relates to a fine blanking press of the type in which a punch, a die, a material support plate and a counter blank holder constitute essential component parts of said press and these component parts are actuated by their respectively associated pneumatically operated oil pressure boosters, respectively.

One object of the present invention is to provide a vertical or horizontal fine blanking press in which a punch, a die, a blank holder and a counter blank holder which constitute essential component parts of said press are actuated by very simplified pneumatically operated oil pressure boosters which are respectively associated with these parts.

Another object of the present invention is to provide a fine blanking press which has a very simplified construction and can produce any desired blank having predetermined precision dimensions and shape in a single step of operation whereby eliminating the necessity for any additional finish process.

A further object of the present invention is to provide a fine blanking press in which a counter blank holder is adapted to be completely locked in position so as to prevent a punch from snugly fitting in a die adapted to effect blanking a material in cooperation with said punch whereby the punch and die may be protected from free of any possible damage which would occur otherwise resulting in the extension of the service life of the punch and die.

According to the present invention, there is provided a fine blanking press, comprising a punch holder fixedly secured to the bolster of said press for holding a punch therein; a blank holder encircling said punch and loosely fit in said punch holder; a first piston received in a first cylinder provided in said bolster and supporting said blank holder through intermediate means under the action of oil pressure; a first booster for supplying oil pressure to said first cylinder; a die holder fixedly secured to the slide of said press for supporting a die; a counter blank holder adapted to loosely fit in said die; a second piston received in a second cylinder provided in said slide for applying pressure on said counter blank holder through intermediate means under the action of oil pressure in an upper chamber of said second cylinder; a second booster for supplying oil pressure to an oil chamber above said second piston; and means for controlling oil pressure in a chamber below said second piston to maintain the oil pressure at a predetermined value or release such oil pressure therefrom.

The above and other objects and advantages of the present invention will be more apparent to those skilled in the art from a reading of the following description referring to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The sole FIGURE of the drawing is a vertical section view of principal parts of a preferred form of fine blanking press according to the present invention and which also diagrammatically shows the oil pressure circuit system and the compressed air circuit system to be employed in conjunction with said press.

EMBODIMENT OF THE INVENTION

The present invention will now be described referring to the sole FIGURE of the accompanying drawing in which a preferred form of fine blanking press according to the present invention is shown in a vertical section view together with its oil pressure and compressed air circuit systems which are diagrammatically shown. The novel blanking press generally comprises a bed **1** having a bolster **2** fixedly mounted on the top thereof by means of bolts **2'** and the bolster in turn has a punch holder **4** fixedly mounted on the top thereof by means of bolts **4'**. The punch holder **4** fixedly carries a punch **5** therein by means of bolts **6** and is provided on the upper surface with a recess **7** for loosely receiving a hollow blank holder **8** which is adapted to slide vertically within the recess in slide contact with the periphery of the punch **5**. The bolster **2** further has a pressure ring **3** received in a recess on the upper surface thereof and the ring is fixedly held in position within the recess by means of bolts **3'**. The pressure ring **3** loosely receives a pressure pad **9** therein and a pin **10** extends between the bottom surface of the blank holder **8** and the upper surface of the pressure pad **9** loosely piercing through the punch holder **4**. The bolster **2** has an oil cylinder **12** defined therein whose transverse dimension is larger than that of the upper opening in which the pressure pad **9** is received and a vertically reciprocal piston **11** is received within the oil cylinder. The piston **11** has an integral upper extension **11***a* received in the upper opening in the bolster **2** and in abutment with the bottom surface of the pressure pad **9**. The oil cylinder **12** defines an oil chamber *a* therein and the oil chamber is communicated through a pilot check valve **13** with an oil chamber *b* defined in a booster A which is disposed in the opening in the bed **1**. The oil chamber *b* provided in the booster A is communicated through a line of the oil pressure circuit system with an oil supply pump D which is in turn communicated through a line with an oil tank **14**. The oil supply pump D may be of any conventional compressed-air operated pump and is also communicated through an electromagnetic valve **15**, a line **16** and a pressure regulating valve **17** with a compressed air supply source P. The booster A comprises an air cylinder **18** in which a piston **19** is disposed for vertically reciprocal movement and an oil cylinder **20** in which a plunger **19***a* integrally formed with a piston **19** is disposed. A pin **22** extends through the top wall of the air cylinder **18** and the upper end portion of the pin extends above the air cylinder and is surrounded by a coil spring **21** which is received a suitable housing mounted on the top of the cylinder **18** and which urges the lower end of the pin **22** against the upper surface of the piston **19**. The extreme upper end of the pin **22** is in normally contact with the operating piece **23***a* of a limit switch **23** which is adapted to control the electromagnetic valve **15** as will be in detail described hereinafter. The air cylinder **18** of the booster A defines an air chamber *c* which is communicated through a line **24** and a pressure regulating valve **25** with the compressed air supply source P.

Reference numeral **26** denotes the lower portion of a slide in the press which is adapted to be moved vertically and reciprocally by a suitable drive means such as a crank shaft (not shown). The slide **26** has a die holder mounting plate **27** fixedly secured to the lower end face thereof by means of bolts **28** and the mounting plate in turn has a die holder **29** fixedly secured to the lower end face thereof by means of bolts **28** and the mounting plate in turn has a die holder **29** fixedly secured to the lower end face thereof by means of bolts **29'**. A hollow die **30** which mates and cooperates with the punch **5** is fixedly secured to the lower end face of the die holder **29** by means of bolts **31**. The die holder **29** is provided on the bottom surface with a recess **32** for loosely receiving the enlarged upper portion of a counter blank holder **33** while the lower reduced portion of the counter blank holder is loosely fit in the opening in

the die 30. A pin 37 extends vertically and loosely through the die holder 29 between the bottom surface of a pressure pad 36 loosely received in a pressure ring 35, which is in turn fixedly secured to the mounting plate 27 by means of bolts 34, and the upper surface of the counter blank holder 33. The upper surface of the pressure pad 36 abuts against the bottom surface of the lower extension 39*a* integrally formed with a piston 39 received in an oil cylinder 38 defined in the slide 26. The upper oil chamber *d* provided in the upper portion of the oil cylinder 38 is communicated through a line 40 with the oil chamber *e* of a second booster B.

The second booster B has substantially the same construction as that of the first-mentioned booster A and comprises a lower air cylinder 41 in which a piston 42 is disposed for vertical and reciprocal movement and an upper oil cylinder 43 in which a plunger 42*a* integrally formed with the piston 42 is received. A pin 45 vertically extends through the top wall of the air cylinder 42 having the lower end abutting against the upper surface of the piston 42 and the upper end portion of the pin is surrounded by a coil spring 44 which is in turn received in a housing fixedly disposed on the top wall of the air cylinder 41. The extreme upper end of the pin 45 abuts against the operating piece 46*a* of a limit switch 46. The limit switch 46 is adapted to control an electromagnetic valve 48 in a manner which will be in detail hereinafter. The oil cylinder 43 defines an oil chamber *e* therein and the oil chamber is supplied with oil from an oil tank 47 by a suitable conventional feed pump E which may be a conventional pneumatically operated type. The pump E defines an air chamber therein and the air chamber is communicated through a line 49 including the above-mentioned electromagnetic valve 48 and pressure regulating valve 17 with the compressed air supply source P. The air cylinder 41 defines an air chamber *f* therein and the air chamber is communicated through a line 51 including an air pressure regulating valve 50 with the compressed air supply source P.

The cylinder 38 provided in the slide 26 defines an oil chamber *g* below the piston 39 and the oil chamber is communicated through a pilot check valve 52 and a line 53' with an oil tank 53. The oil chamber *g* is also in communication through a line 54 with a cylinder 55 in which a piston 56 is disposed for vertical and reciprocal movement and the piston has a roller 58 mounted thereon by means of a transverse pin 57. The roller 58 is in engagement with a cam 60 on a transverse rotary shaft 59 which is adapted to rotate in synchronization with the crank shaft (not shown) which drives the press slide 26.

The above-mentioned pilot check valves 13 and 52 are communicated through a line 53*a* with an oil chamber *h* defined by the oil cylinder 61 of a third booster C and these valves are also communicated through a line check valve 62 with a lubricant feed pump 63 which is adapted to be driven by an electric motor 64. Reference numerals 65 and 66 denote an oil tank and a relief valve, respectively. The lubricant feed pump 63 is communicated through a line 67 and a line check valve 68 with the above-mentioned cylinder 55.

The third booster C comprises an air cylinder 69 in which a piston 70 is disposed for horizontal and reciprocal movement and the oil cylinder 61 in which a plunger 70*a* integrally formed with the piston 70 is disposed. The air cylinder 69 defines an air chamber *k* therein and the air chamber is communicated through a line 71, an electromagnetic valve 72 and an air pressure regulating valve 73 with the compressed air supply source P. The electromagnetic valve 72 is adapted to be controlled by a limit switch 75 which is in turn adapted to be controlled by a rotary cam 74 mounted on the above-mentioned rotary shaft 59 at the end remote from the end on which the stationary cam 60 is mounted. Reference numerals 76 denotes a stop valve disposed in the compressed air supply circuit and normally blocking the flow of compressed air in the circuit, and reference numeral 77 denotes pressure gauges which are adapted to indicate the air pressure in the lines in the compressed air supply circuit system which lines are associated with the boosters A, B and C, respectively.

In operation, the stop valve 76 is opened so as to permit a flow of compressed air to be fed from the compressed air supply source P through the pressure regulating valve 25 into the air cylinder chamber *c* in the first booster A. Whereupon the piston 19 within the air chamber *c* is pushed upwardly and accordingly, the plunger 19*a* integral with the piston 19 is also pushed up to compress the oil within the oil chamber *b* thereby to increase the pressure on the oil to a predetermined value. If the oil pressure within the oil chamber *b* fails to reach or rise to a predetermined value from one cause or another, then, the pin 22 is caused to move up to operate the limit switch 23. When energized in the manner mentioned just above, the limit switch 23 opens the electromagnetic valve 15 whereby the oil feed pump D is actuated to pump up oil from the oil tank 14 and force the oil through the line, which leads from the tank to the booster A, into the oil chamber *b* in the oil cylinder 20. The pumping of oil by the feed pump D is continued until the oil pressure within the oil chamber *b* has reached to the predetermined value whereupon the piston 19 descends down and accordingly, the pin 22 also descends down to operate the limit switch 23. The limit switch 23 closes the electromagnetic valve 15 thereby to stop the oil feed pump D.

The upper oil chamber *d* defined in the cylinder 38 is normally subjected to the pressure of the oil from the oil chamber *e* in the second booster B which is actuated by compressed air supplied from the compressed air supply source P via the air pressure regulating valve 50, but if the oil pressure within the oil chamber *d* fails to reach a predetermined value from one cause or another, the pin 45 is caused to move up to operate the limit switch 46. When operated in the manner mentioned above, the limit switch 46 opens the electromagnetic valve 48 whereby the oil feed pump E is actuated to pump up oil from the oil tank 47 and force the oil through the line, which leads from the tank to the second booster B, into the oil chamber *e* in the oil cylinder 43. The pumping of oil by the feed pump E is continued until the oil pressure within the oil chamber *e* has reached the predetermined value whereupon the piston 42 descends down and accordingly, the pin 45 descends down to deenergize the limit switch 46. The operation of the limit switch 23 closes the electromagnetic valve 15 thereby to stop the oil feed pump E. Thus, the oil pressure within the oil chamber *d* is maintained at the predetermined value.

The above-mentioned lubricant oil feed pump 63 is adapted to be operated by the electric motor 64 only when the amount of oil within the oil chamber *g* in the cylinder 38 and/or that within the oil chamber *h* in the third booster C is insufficient for proper operation of the press. When operated, the pump 63 feeds oil under pressure through the line check valve 62 into the oil chambers *g* and *h* / or either one of these oil chambers until the oil chambers have been filled to a predetermined level for proper operation of the press. Whereupon the preparatory procedure for effecting a cycle of blanking operation on the press is ready for commencement.

When a cycle of blanking operation is to be performed on a material by the use of the above-mentioned press, as usually followed, the slide 26 descends thereby to cause the die 30 carried by the slide and the cooperating stationary punch 5 to shear a desired blank off material which is held in position on the punch 5 and blank holder 8. When the blank is sheared off the remaining material in the manner mentioned just above, the counter blank holder 33 which abuts against the material is caused to retreat deeper into the recess 32 in the die holder 29 which is carried by the slide 26 and the counter blank holder pushes up the piston 39 and its integral plunger 39*a* by means of the pin 37 and pad 36. Whereupon the oil within the oil chamber *d* in the cylinder 38 is forced to flow through the line 40, which leads from the cylinder 38 to the second booster B, into the oil chamber *e* in the cylinder 43 of the second booster B. In such a case, since the volume of the oil chamber *g* in the cylinder 38 increases, an additional amount of oil, the amount of which corresponds to the increase in the volume of the oil chamber *g*, is introduced from the tank 53 through the pilot check valve 52 and at the same time the

piston 56, which is adapted to be actuated by the cam 60 on the rotary shaft 59 at the completion of a cycle of blanking operation, forcibly feeds oil from the cylinder 55 into the oil chamber *g* of the cylinder 38 thereby to hold the piston 39 in its present position or raised position. The piston 39 is maintained in this position until the slide 26 rises up to a predetermined point in its upward stroke whereupon the limit switch 75, which is adapted to be actuated by the rotary cam 74 on the rotary shaft 59, provides a signal to open the electromagnetic valve 72 which in turn moves the piston 70 of the third booster C leftwards as seen in the FIG. to compress the oil within the oil chamber *h* of the same booster. The compressed oil within the oil chamber *h* opens the pilot check valve 52. Simultaneously, the cam 60 on the rotary shaft 59 allows the piston 56 to rise and accordingly, the oil within the oil chamber *g* of the cylinder 38 returns to the tank 53 and cylinder 55 whereby the oil pressure within the oil chamber *g* is reduced resulting in the oil within the oil chamber *e* of the second booster B being fed into the upper oil chamber *d* of the cylinder 38. As mentioned above, since the oil pressure within the oil chamber *g* of the cylinder 38 and the force which holds the piston 39 against its downward movement is removed from the piston 39, the piston is pushed down and the extension 39*a* of the piston 39 pushes down the counter blank holder 33 through the pad 36 and pin 37 whereby the blanked piece (not shown) may be pushed out of the die 30.

On the other hand, when the blank holder 8 is pushed down by the slide 26 through the material supported thereon, the blank holder 8 pushes down the piston 11 through the pin 10 and pad 9. Accordingly, the oil within the cylinder chamber *a* is fed through the pilot check valve 13 into the oil chamber *b* of the first booster A and the piston maintains this position during the period from the time at the completion of blanking operation to the time at which the slide 26 reaches a predetermined point in its upward stroke. When the slide 26 has reached the above-mentioned predetermined point the rotary cam 74 on the rotary shaft 59 operates the limit switch 75 which in turn opens the electromagnetic valve 72. The opening of the electromagnetic valve 72 causes the oil pressure within the oil chamber *h* of the third booster C to open the pilot check valve 13 whereby the oil within the oil chamber *b* of the first booster A returns to the oil chamber *a* of the cylinder 12 to push up the piston 11 whereby the blank holder 8 is pushed up through the pad 9 and pin 10 to its original position. Thus, one cycle of blanking operation by the use of the novel blanking press has been completed.

Although the present invention has been illustrated and described as being applied to a vertical fine blanking press, it will be understood that the invention may be also applied to a horizontal fine blanking press without departing the scope of the same.

According to the present invention, as mentioned above, air pressure actuated oil pressure boosters are employed for actuating the punch, die, material support member and counter blank holder and accordingly, as compared with the conventional like-type blanking presses, the novel fine blanking press can be fabricated with a very simplified and compact design. Since the cooperating material support member and counter blank holder are designed to precisely function, pieces produced by the novel blanking press may have precisely predetermined dimensions and shapes which require no additional or finish operation for correcting or adjusting the dimensions and shapes of the pieces. Furthermore, since the counter blank holder is designed to be perfectly locked or pushed up, there will be no possibility that the punch is snugly fit in the die during the operation whereby the punch may be protected from any damage due to such a snug fit resulting in the extension of the service life of the punch. In addition, no compressed air is discharged out of the compressed air recycling circuit system of the press to the atmosphere and consumption or waste of compressed air in the system may be reduced to a minimum level.

While one preferred embodiment of the present invention has been shown and described in detail, it will be understood that the same is only illustrative in nature and not to necessarily limiting upon the scope of the teaching in its broader aspect. Many additional variations and changes within the scope of the appended claims will occur to those skilled in the art.

I claim:

1. A fine blanking press, comprising a punch holder secured to the bolster of said press for holding a punch; a blank holder encircling said punch and loosely fit in said punch holder; a first piston received in a first cylinder provided in said bolster and supporting said blank holder through intermediate means under the action of oil pressure; a first booster for supplying oil pressure to said first cylinder; a die holder fixedly secured to the slide of said press for supporting a die; a counter blank holder adapted to loosely fit in said die; a second piston received in a second cylinder provided in said slide for applying pressure on said counter blank holder through intermediate means under the action of oil pressure present in an upper chamber of said second cylinder; a second booster for supplying oil pressure to an oil chamber above said second piston; and means for controlling oil pressure in a chamber below said second piston to maintain the oil pressure at a predetermined value or release such oil pressure therefrom.

2. A fine blanking press as set forth in claim 1, in which said means for controlling oil pressure in said chamber below the second piston comprises an oil tank; a line providing communication between said tank and chamber; a check valve in said chamber; an oil cylinder in communication with said chamber; a piston received in said chamber; a rotary cam for operating said piston; and a third booster adapted to open said check valve.

3. A fine blanking press as set forth in claim 2, in which said first booster has an oil chamber which is communicated through a second check valve with an oil chamber in said first cylinder and said second check valve is adapted to be opened by said third booster.

4. A fine blanking press as set forth in claim 3 inclusive, in which said second booster has an oil chamber which is communicated with an upper chamber of a second cylinder provided in said slide and said second booster has a compressed air chamber which is communicated with a compressed air supply source.

5. A fine blanking press as set forth in claim 4, in which said press further includes a third booster having an oil chamber which is communicated through a third check valve with an oil pump which is adapted to be driven by an electric motor and said compressed air chamber of the second booster is communicated through an electromagnetic valve with said compressed air supply source.

6. A fine blanking press as set forth in claim 5, in which said press further includes a pump means adapted to automatically supply oil to the oil chamber in said first booster when the oil pressure within said first booster oil chamber has dropped to values below a predetermined value.

7. A fine blanking press as set forth in claim 6, in which said press further includes a second pump means adapted to automatically supply oil to the oil chamber of said second booster when the oil pressure within said second booster oil chamber has dropped to values below a predetermined value.