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3,027,918

THROTTLE VALVES FOR EXTRUSION PRESSES

Filed Nov. 4, 1960

2 Sheets-Sheet 1

FIG. 1

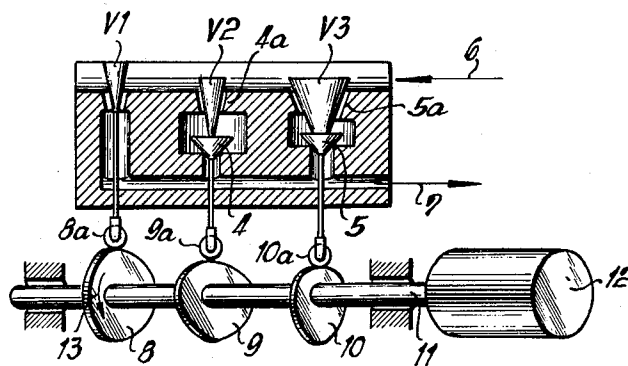


FIG. 2

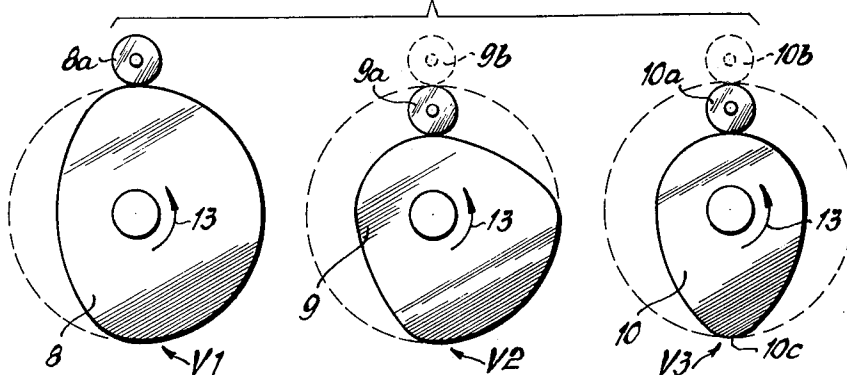
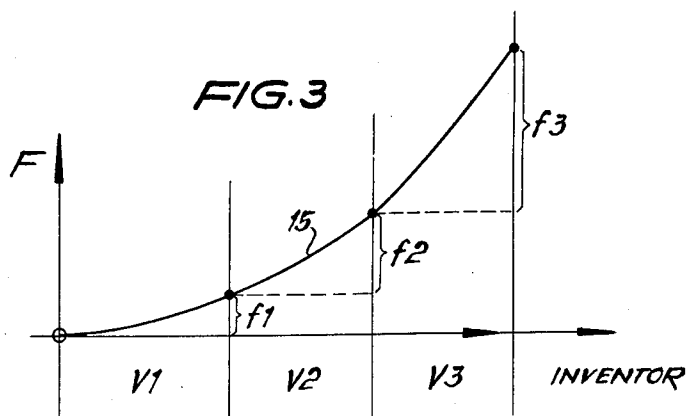


FIG. 3



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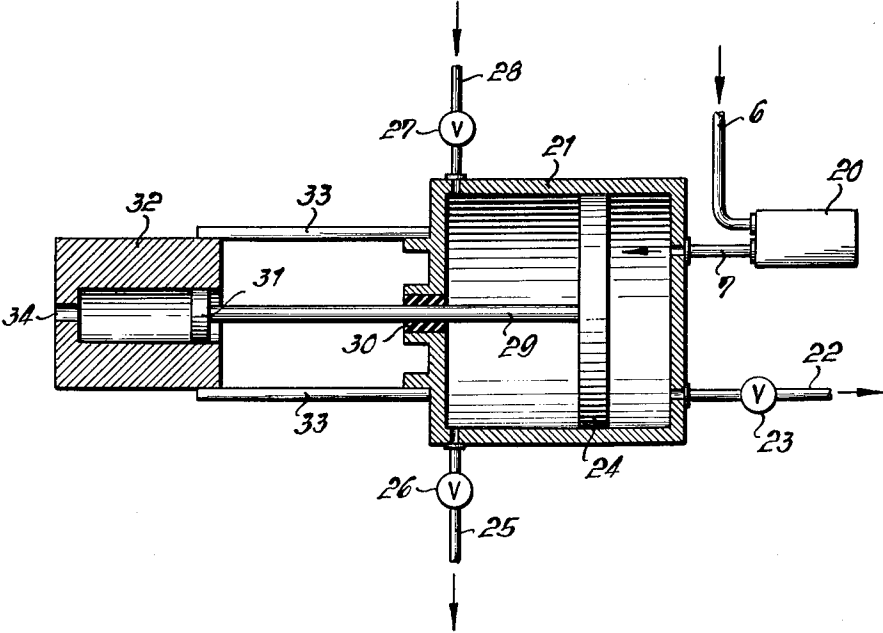
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FIG. 4



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1

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THROTTLE VALVES FOR EXTRUSION PRESSES
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In tube and rod extrusion presses, particularly those for metal-working, the speed of extrusion has to be varied according to definite requirements, for instance for the purpose of obtaining a uniform texture and uniform strength of the extruded product notwithstanding any change in the temperature of the container contents. In hydraulic presses this variation in the speed of extrusion is effected by throttling, to a greater or less extent, the supply of liquid to the cylinder of the press. This throttling has hitherto been obtained either by adjusting a single throttle valve, which is interposed in the pressure pipe of the main press cylinder of the extrusion press, or, if the desired range of regulation is too great for a single valve, by means of a number of throttle valves of unequal cross-sectional areas of opening connected in parallel. The throttle valves of such a throttling arrangement are then each opened and closed by a valve spindle, the usual procedure being that the motor controlling the valve having the smallest maximum cross-sectional area fully opens this valve first, and that when a larger cross-sectional area of opening is wanted, the motor of the valve provided with a greater maximum cross-sectional area is started, for the purpose of opening this valve to a greater or less extent by rotating the valve spindle. In this case the regulating action must skip to and fro between the motor of the valve of smallest maximum cross-sectional area of opening to the motor of the valve of greater cross-sectional area, which is particularly disadvantageous when regulating is to be effected round about the maximum cross-sectional area of opening of the smallest valve, that is to say, when the range of regulation lies in a region in which the opening of the smallest valve is temporarily sufficient, and then again, in addition to the opening of the smallest valve, the larger valve has to be opened, the larger valve having to be closed again the next moment, and the smaller valve more or less throttled. The jumping of the regulating means from the smallest valve to the larger valve and back again is at first difficult, and can only be carried out with complicated means, and very frequently also brings with it a jump in regulation, if the regulating overlaps from one valve to the other valve.

The object of the present invention is to provide a throttling appliance which regulates over the entire range of regulation with as much freedom from disturbance as possible, and which does this without requiring relatively large technical expenditure. For this purpose the invention starts from a throttling appliance with at least two throttle valves of unequal cross-sectional areas of opening, connected in parallel, which are arranged in the pressure pipe of the main extrusion cylinder of an extrusion press. The invention consists in the feature that the several throttle valves are adjustable by means of control cams mounted upon a common regulating shaft, in such a way that after the complete opening of the valve of smallest cross-sectional area, upon further rotation of the regulating shaft, the opening of the valve of next larger cross-sectional area begins.

It is advantageous to make the arrangement such that upon further rotation of the regulating shaft the valve of smallest cross-sectional area remains open. It is however also possible to make the arrangement such that at or after the beginning of the opening of the valve of greater cross-sectional area, a gradual closing of the

2

valve of smaller cross-sectional area is effected. The latter arrangement involves that the cross-sectional areas of opening of the two valves are not additive, but, from and after a certain regulating point, are subtractive.

The invention is illustrated by way of example in the accompanying drawings, in which:

FIGURE 1 is a diagrammatic representation of a throttling appliance according to the invention, with three throttle valves;

FIGURE 2 shows the three control cams in elevation; FIGURE 3 shows a curve of valve opening which is attainable with the means according to FIGURES 1 and 2; and

FIGURE 4 shows the arrangement of a throttling appliance according to the invention on a hydraulic press.

According to the last-mentioned figures, a throttling appliance 20, which is more fully illustrated in FIGURES 1 to 3, is interposed in the admission pipe 6, 7 of an extrusion cylinder 21, from the outlet pipe 22 of which pressure liquid can escape when the valve 23 is opened. In the cylinder 21 a piston 24 is displaceable towards the left when pressure liquid flows through the pipe 7 into the cylinder and an outlet pipe 25 is set free by opening a valve 26. After the valves 20 and 26 have been closed and the valve 23 opened, the return movement of the piston 24 towards the right is effected by opening a valve 27, which is seated in a pressure pipe 28. The piston rod 29 of the piston 25 is extended out of the cylinder 21 through a packing 30, and carries a press ram 31, which is displaceable in the bore of a container 32, which is secured to the cylinder 21 by means of rods 33. Extrusion material enclosed in the container 32, for instance heated steel or heated aluminium, is extruded through the die aperture 34 of the container 32 when the piston 24 is moved towards the left.

The throttling appliance according to FIGURE 1 has three valves, V1, V2 and V3, the increase in the cross-sectional area of opening for a definite valve lift being greater with V2 than with V1, and greater with V3 than with V2. While V1 is a closure valve, which can be completely closed, the two valves V2 and V3 are merely throttle valves, with restrictors 4a and 5a, with which separate sealing cones 4 and 5 are associated. Pressure water enters the throttling appliance in the direction of the arrow 6, and flows out of the throttling appliance again, when the valve V1 is opened and the valves 4 and 5 are closed, only through the valve V1, in the direction of the arrow 7. In the drawing the valve V1 is shown fully opened, and the valves V2 and V3 fully closed. To this there corresponds the position of the control cams 8, 9, and 10, which are mounted on a common regulating motor 12. From FIGURE 2 it is clear that the control cam 8 has fully raised the cam roller 8a of the valve V1, so that the valve V1 is fully opened. The control cam 9 has however not yet raised the cam roller 9a, so that the valve V2 is still closed. The same applies to the control cam 10, which has not yet raised the cam roller 10a, so that the valve V3 is still closed.

When the shaft 11 is rotated further in the direction of the arrows 13, the cam roller 8a remains for the next 180° at the same height, while the roller 9a, during the rotation through the next 90°, moves to the height 9b shown in broken lines, whereby the valve 4 is gradually fully opened. In this rotation through 90° the point 10c of the cam 10 has likewise travelled through 90°, so that upon further rotation of the cam 10 the cam roller 10a is lifted, until it finally reaches the position 10b. In this position all three of the valves are fully opened. Upon the control shaft 11 rotating back, a closure of the valves is effected in the reverse sequence.

FIGURE 3 shows a curve 15, which indicates the cross-sectional area of flow available at any time in the

3

throttling appliance. When the valve V1 is fully opened, a cross-sectional area of flow f^1 is reached. This is maintained while the valve V2 is opened, which, at full opening, reaches the valve opening f^2 , so that the total opening f^1 plus f^2 is then provided. When the control shaft 11 has again turned through 90°, there is added to the existing cross-sectional area of flow f^3 also.

In the drawings the effective regulating section of each cam extends through 90 degrees. This is obviously not a prerequisite for the invention, for on the contrary the effective regulating sections may extend either to more or to less than 90°. They may even overlap one another. Finally they may be given forms differing considerably from those shown in the drawings, so that it will be readily understood that with the throttling appliance according to the invention, curves of throttling may be obtained which deviate in any desired manner from the curve 15 shown in FIGURE 3.

What I claim is:

1. For use in a pipe conveying liquid under pressure to the main press cylinder of an extrusion press, a throttling appliance comprising: at least two parallel-connected throttle valves of unequal cross-sectional areas of opening, for the fine regulation of the speed of extrusion, a

4

common regulating shaft, and cams, one for each valve, mounted fast on the common regulating shaft, the cams being so designed that as the shaft revolves, the valve of smallest cross section opens first, and the valve of next larger cross section begins to open when the valve of smallest cross section is fully open.

2. A throttling appliance as claimed in claim 1, the cams being so designed that as the shaft continues to revolve the valve of smaller cross section remains fully open as long as the valve of greater cross section is open.

3. A throttling appliance as claimed in claim 1, further comprising sealing cones arranged underneath some at least of the valves.

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