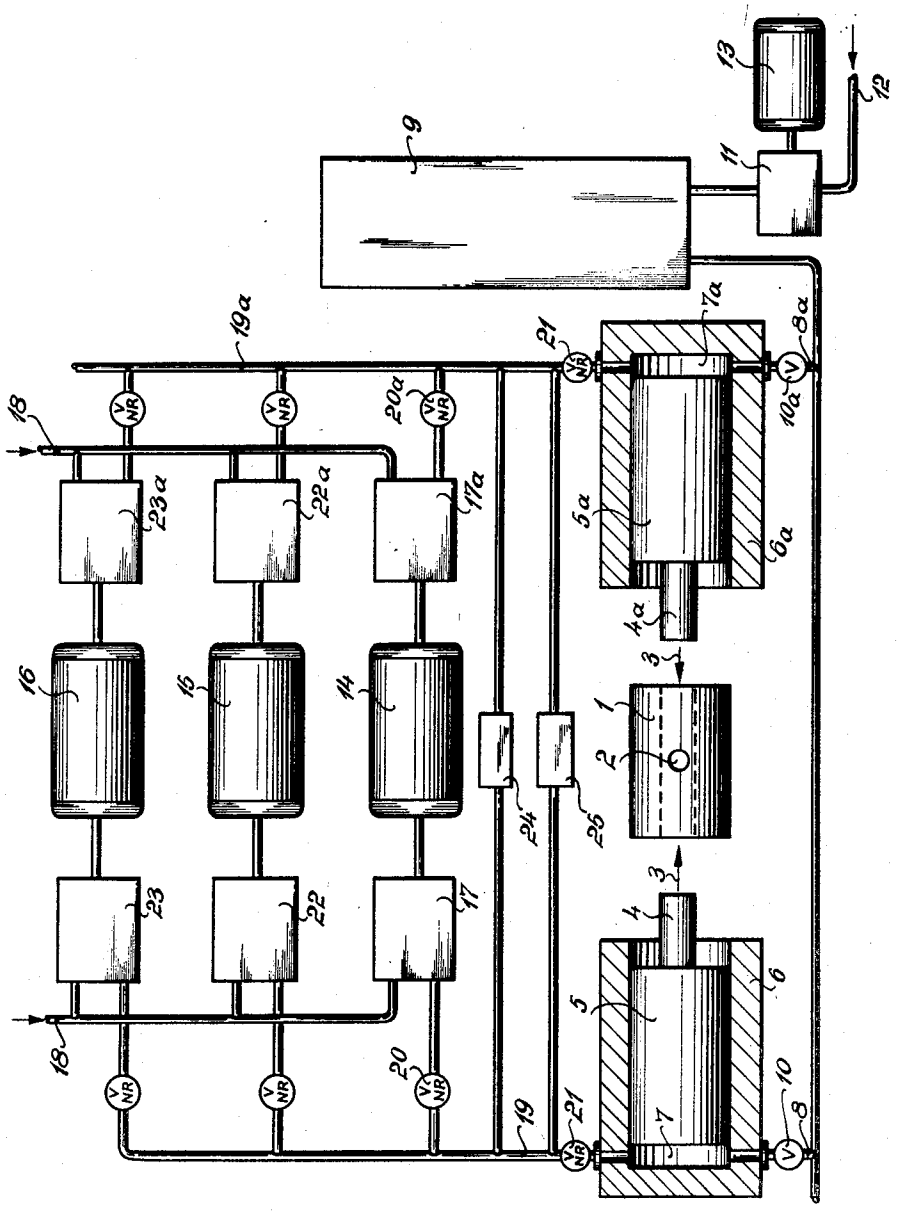
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HYDRAULIC DRIVES FOR EXTRUSION PRESS

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HYDRAULIC DRIVES FOR EXTRUSION PRESS

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In extrusion presses, particularly those for sheathing cables, with press rams hydraulically driven by pistons and acting oppositely to one another in associated containers, the material that is being extruded must always be supplied uniformly from the two containers to the extrusion die, as otherwise an uneven extruded product will result.

Extrusion presses have in the past been operated by means of direct-acting pumps or by means of accumulators. Operating with direct-acting pumps has recently fallen out of favour, as irregularities in the supply of water under pressure causes shadings in the extruded material. The use of accumulators is therefore preferred. When operating in this way, however, with two oppositely acting press rams, uniform working of the two rams cannot be attained, since billets at different temperatures, or other unavoidable differences in the two containers, lead to different speeds of extrusion. On this ground devices have been provided for compensating for different speeds of feed. One such device is constructed in such a way that each press ram is connected with at least one supplementary piston which reciprocates in a cylinder. The cylinders of the supplementary pistons on opposite sides are hydraulically connected with one another. If one of the press rams moves in advance of the other, the supplementary piston moves with it, and forces liquid into the supplementary cylinder on the opposite side, so that on the basis of this pressure the other ram is constrained to overtake the lead of the first ram. The disadvantage of this arrangement resides in the fact that the response of the device is rather sluggish, and that the ram encountering the higher resistance lags more or less until the higher pressure necessary for overcoming the greater resistance has been overcome by raising the pressure acting upon the supplementary piston. In this interval an uneven extruded product is always to be expected.

The present invention obviates this disadvantage. It is characterised by at least one pair of equal hydrostatic pressure pumps directly allocated to the driving sides of the two hydraulic pistons the two pumps of the pair having a common motor drive. In this way, on the assumption of equal efficiency of the two pumps, it is automatically ensured that the two sides of the press will always receive the same quantity of liquid. Upon a reduction in the speed of one ram, the amount of water under pressure required by its associated cylinder diminishes, so that the supply of water to one pump is reduced, and consequently, its motor runs more slowly. Since, however, with this pump, the other pump acting upon the opposite cylinder is coupled, this other pump runs more slowly and delivers less water. The result

of this is that the cylinder of the other press ram also receives a smaller influx of liquid. If the resistance on one side of the press is greater than on the other side, therefore, the same quantites of liquid are supplied to both sides, so that the quantities of liquid supplied per unit of time to both sides of the press diminish uniformly. The result of this is that equally great quantities of material are at any time extruded from both the containers of the press.

Since the demand for liquid differs in magnitude according to the profiles to be extruded, a plurality of motors are according to the invention always provided with two pumps each, one of which delivers to one side of the press and the other to the other side. The motors may be adapted to be switched on and off at will, in order that the quantity necessary at any particular time may be delivered, and that no undue waste of power may occur owing to the otherwise necessary splitting off of a part of the pressure liquid.

When extruding, the billets must first be compressed by the press rams, before the extrusion begins. For the compression of the billets great pressures are required. The compression should moreover proceed as rapidly as possible, whereas the speed of extrusion must in most cases, on technical grounds, be kept low. Now if the pumps acting directly upon the press, were of such a capacity that they could effect the compression in the short time that is desirable, the greater part of this capacity would be wasted during the extrusion, so that heavy idling losses would occur. For this reason an accumulator with a charging pump of its own is additionally provided, the storage capacity of which is adequate for the entire work of compressing the billets. The pump and the motor of the accumulator are in fact so dimensioned that they can charge up the accumulator in the time occupied by the extrusion of the billets.

The invention, as applied to a cable-sheathing press, is illustrated by way of example in the accompanying drawing, in which:

1 denotes a double-billet container, having an axial longitudinal bore 2 through which runs the cable to be sheathed. In the direction of the arrows 3, two billets to be extruded are introduced into the two-billet container 1. The compression of these billets by the two press rams 4 and 4*a* then begins. These press rams are mounted on pistons 5 and 5*a* respectively, which reciprocate in cylinders 6 and 6*a*. To the pressure spaces 7 and 7*a* of these cylinders are connected pressure supply pipes 8 and 8*a*, which come from a hydraulic accumulator 9. In these pipes controllable valves 10 and 10*a* are provided, which are opened for the compression of the billets, and then closed again. For the charging of the accumulator 9 a pump 11 is employed, which draws liquid from a reservoir through a suction pipe 12. This pump may be driven by an electric motor 13.

Three electric motors 14, 15 and 16 are also provided. The motor 14 is coupled to two hydrostatically similar and equal pumps 17 and 17*a* which can draw liquid from suction pipes 18 coming from a storage tank, not shown. These pumps force liquid through delivery pipes 19 and 19*a* into the pressure spaces 7 and 7*a* of the cylinders 6 and 6*a* respectively. Non-return valves 21 are interposed which allow liquid under pressure to pass from the pumps 17 and 17*a* to the cylinders 6 and 6*a*. The motors 15 and 16 are in a similar manner coupled to pairs

of hydrostatically similar and equal pumps 22, 22*a* and 23, 23*a* respectively. Non-return valves 20 are provided between the pumps 17, 22 and 23, and non-return valves 20*a* between the pumps 17*a*, 22*a* and 23*a*, to enable the pairs of pumps to be disconnected separately. Between the two delivery pipes 19 and 19*a* a safety valve 24 may be provided, which, in a manner already suggested, opens a connection between the two delivery pipes 19 and 19*a* when the pressure in the pipe 19*a* becomes greater to a definite extent, for instance 20 percent, than the pressure in the delivery pipe 19, or when, in the delivery pipe 19, there is a pressure greater to the said extent than in the delivery pipe 19*a*. Moreover, speed-regulating means 25 of a known kind may be provided, for the purpose of compensating for any slight differences in the feeding speed of the pistons 5 and 5*a*; for it is always possible that the pump 17*a* for example, may work with a lower volumetric efficiency than the pump 17, as a result for instance of leakage losses or bubbles of air, so that the deliveries differ somewhat from one another, and therefore, also the feeding speeds of the two press rams 4 and 4*a* are not quite equal. These slight differences in speed can be compensated for, without leading to any loss of economy, by the speed-regulating means 25 allowing small quantities of pressure liquid to escape. This device operates in dependence upon the speed of feed of the two press rams 4 and 4*a* as soon as either of these two press rams runs faster than the other. A small quantity of liquid under pressure is then automatically let out of the pipe 19 or 19*a* as required, so that the press rams 4 and 4*a* re-assume the same speed. In presses the production program of which permits certain inequalities in the feeding of the press rams 4 and 4*a*, the speed regulating means 25 may be omitted. In cable-sheathing presses, however, which are particularly sensitive with respect to the uniform supply of extruded material, such means can hardly be dispensed with.

It may be advisable to design the pumps 17 and 17*a*, or 22 and 22*a* or 23 and 23*a*, as variable-delivery pumps. If the pumps 17 and 17*a* for instance are so designed that their delivery is continuously variable the other pumps need not be provided with any such controlling means, provided their delivery is not greater than the maximum delivery of the pumps 17 and 17*a*. The control devices of the pumps 17 and 17*a* are coupled together, so that they always deliver the same quantities of liquid.

Modifications of the invention are possible, by controlling the two pumps that are driven by a common motor, and work each on one side of the press, in dependence upon the difference between the speeds of the press rams. If for instance the press ram 4*a* is moving more quickly than the press ram 4, the pump 17*a* will be so controlled as to deliver less, and/or the pump 17 so as to deliver more. As means for carrying out this control, appliances known in themselves may be employed, in which a toothed rack is rigidly connected with each of the press rams 4 and 4*a*. These racks move in parallel paths, and have between them a pinion which meshes with both of them. The displacement of the axis of this pinion provides a measure for the control of the two pumps.

I claim:

1. An extrusion press, particularly a cable-sheathing press, comprising: a container, two press rams working oppositely in the container, two hydraulic cylinders, two pistons, slidable one in each of the hydraulic cylinders, each piston driving one of the two press rams, a hydraulic accumulator the capacity of which is dimensioned according to the expenditure of work required for the compression of the billets to be extruded, a charging pump delivering liquid to the accumulator, valve-controlled piping connecting the accumulator with both the cylinders on the driving side of their pistons, two similar and equal hydrostatic pumps, valve-controlled piping connecting one hydrostatic pump with one of the cylinders

on the driving side of its piston during extrusion, valve-controlled piping connecting the other pump with the other cylinder on the driving side of its piston during extrusion, and a common motor simultaneously driving the two hydrostatic pumps.

2. An extrusion press, particularly a cable-sheathing press, comprising: a container, two press rams working oppositely in the container, two hydraulic cylinders, two pistons, slidable one in each of the hydraulic cylinders, each piston driving one of the two press rams, a hydraulic accumulator the capacity of which is dimensioned according to the expenditure of work required for the compression of the billets to be extruded, a charging pump delivering liquid to the accumulator, valve-controlled piping connecting the accumulator with both the cylinders on the driving side of their pistons, a plurality of pairs of similar and equal hydrostatic pumps, valve-controlled piping connecting one hydrostatic pump of each pair with one of the cylinders, and connecting the other hydrostatic pump of each pair with the other cylinder, on the driving side of the piston in each case, and motors for driving the hydrostatic pumps, the two pumps of each pair being simultaneously driven by a common motor.

3. In a cable sheathing extrusion press having a billet container including oppositely facing bores and aligned cylinder and piston means with each piston carrying a press ram for entry into the respective bores for compressing a billet therein and for extruding the metal thereof for cable sheathing purposes, a driving system for said rams for actuating the same to initially compress a billet in each bore and for thereafter to move said rams with a pressure sufficient to extrude metal simultaneously from both bores at equal speeds, said system comprising a hydraulic accumulator having a capacity sufficient to deliver liquid under pressure to the cylinders for moving the pistons and thus the rams a distance sufficient to compress a billet accommodated in each bore, conduit means extending from the accumulator to the ends of the respective cylinders remote from the respective bores, valve means operably related with such conduit means for controlling liquid flow therethrough and operable in one position to permit liquid to flow to both cylinders to move the pistons and thus the rams a distance sufficient to compress billets in the bores independent of any difference in volume in the billets in the respective bores, said valve means then being operable in another position to cut off flow of liquid from the accumulator to the cylinders, said system further including at least two similar and equal hydrostatic pumps, a conduit means extending from one pump to and communicating with said remote end of one cylinder, a conduit means extending from the other pump to and communicating with the remote end of the other cylinder, a motor operably connected with both pumps for simultaneously driving the same, valve means operably associated with the respective last-mentioned conduit means to permit liquid to flow into said remote ends of said cylinders, said motor being actuated when the first-mentioned valve means is in a position to cut off flow of liquid from the accumulator to the respective cylinders, whereby billets inserted in the bores are compressed by liquid supplied to the cylinders in common so that the respective rams move the distance required to compress the billet in each bore regardless of differences in volume of the billets and during operation of the motor said pumps supply equal quantities of liquid per unit of time to the respective cylinders so that extrusion from the respective bores is effected by the rams moving at the same speed so that the same quantities of billet metal are extruded from the respective bores and the system further including a charging pump for delivering liquid to the accumulator and means for actuating said charging pump during the interval that the first-mentioned valve means is in a position to block the flow of liquid from the accumulator to the cylinders so that the accumu-

lator can be recharged during extrusion, so as to be available for a subsequent billet compressing operation.

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