

UNITED STATES PATENT OFFICE

2,272,129

SPEED INDICATING MECHANISM

Roy Dalliba Palmer, Montreal, Quebec, Canada,
 assignor to Aluminum Laboratories Limited,
 Montreal, Quebec, Canada, a corporation of
 Canada

Application June 3, 1940, Serial No. 338,513

9 Claims. (Cl. 73—151)

It is sometimes desirable or even necessary to have a particular part of an apparatus move or be operated at a certain speed, as for example the ram of an extrusion press which is used for producing, say, pipe, rod, or other shapes of non-ferrous alloy. The optimum speed of extrusion often necessitates a ram speed which is so low that it is very difficult to determine it by previously known means. Also, because the pressure required for extrusion varies at different parts of the stroke, the ram speed does not usually remain constant throughout the stroke without frequent adjustment of the pressure controlling means.

I have accordingly been led to devise my present invention, which has for an important object the provision of convenient means by which the operator can be guided in adjusting the speed of the machine, say the ram of an extrusion press, to the rate it should have under given conditions. Another object is to provide speed-indicating means of simple form which can be constructed to operate with all necessary accuracy, and with unfailing certainty. A further object is to provide means which will serve not only to indicate the speed of operation of the press or other apparatus but will also indicate the position of a selected part thereof, for instance the ram of a press, so that the operator will know when to stop or reverse the apparatus. Still another object of the invention is to provide convenient and effective means by which the speed of a moving part of an apparatus can be determined; as for example the speed at which an extrusion press or other mechanism is operating under given conditions, say conditions under which a desired performance of the apparatus is attained. To these and other ends the invention comprises in its preferred form a cylinder containing a liquid, and a plunger movable in the same by or in harmony with an appropriate part of the main apparatus, for example the ram of an extrusion press, so that as the plunger moves in one direction liquid will be displaced from the receptacle. The liquid so displaced is utilized to cause movement of liquid in an upright vessel equipped with means for visually indicating the movement of liquid displaced by the aforesaid plunger. A comparison-speed indicator is also provided, which is driven at the speed at which the liquid would move in the vessel when the moving part of the main apparatus is moving at the desired speed. The two indicators are arranged for simultaneous observation so that the attendant can readily know

when the proper speed of the part (of the main apparatus) has been established, or determine the speed at which the part should operate in subsequent work under like conditions.

5 The preferred embodiment of the invention outlined above is illustrated diagrammatically, partly in section, in the accompanying drawing, in which:

Fig. 1 illustrates that embodiment of the invention in conjunction with an extrusion press;

10 Fig. 2 illustrates another form of comparison-speed indicating device.

Referring to the drawing, 10 is the billet container of an extrusion press, and 11 is a billet which is being extruded through a die 12 in the form of a rod 13 by the pressure of a ram 14 actuated hydraulically by liquid delivered to cylinder 15 through a supply pipe 16 having two valves 17, 18. One of the valves, say 17, may be so set that with valve 18 fully open the liquid passed will actuate the extrusion ram at the proper speed, which depends, among other things, upon the metal of the billet, its temperature, and the cross-sectional shape and size of the die. The other valve, 18, is used to shut off the liquid entirely when the ram has completed its desired forward movement. Extrusion presses are of course equipped with suitable means, not shown in the present drawing, for retracting the ram into position for the next extrusion operation. In the retraction of the ram the shut-off valve is of course open, or other means, not shown, are provided for outflow of water from the press as the ram moves back.

35 Operatively connected with ram 14 is a plunger 20, movable at the same or at a proportional speed in an hydraulic cylinder 21 as the ram is actuated. The plunger 20 is uniform in cross section so that as it is advanced by the ram the liquid in the cylinder will be displaced into pipe 24, connected to the cylinder at its forward end, at a rate linearly proportional to the speed of the plunger and hence of the extrusion ram also.

40 Liquid displaced from cylinder 21 by movement (rightward) of plunger 20 passes by way of outlet pipe 24 into a reservoir 25 which is connected at its top by pipes 26, 27, to the lower end of a vessel in the form of an upright tubular column 28. If vessel 28 is not made of transparent or translucent material it is provided with a window 29 through which the movement of the liquid (preferably colored) can be seen. A pipe 30 leads from the top of vessel 28 into an open-topped receptacle 31, connected at its bottom with pipes 27 and 26 through a valve 32 (preferably a

manually operated valve) which is opened and closed at the proper times, as explained hereinafter.

By preference the inner cross sectional area of the receptacle 31 is greater than that of column 28 so that rise of liquid in the former will be slower than in the other. It is also desirable to have the two arranged with their bottoms at about the same horizontal plane.

Adjacent to column 28 is a comparison-speed indicator comprising a speed-indicating belt 35 mounted on pulleys 36, 37, arranged for travel of the belt in a path parallel to the column of liquid in the vessel. One of the pulleys, say 36, is driven by a motor 38 at such speed that the belt will travel at the speed with which the liquid should rise in column 28 when the ram 14 is moving at the proper speed. If for any reason it is desirable to operate the main apparatus at some other speed, thus changing the speed of rise of the column of liquid, the speed of the comparison belt or band 35 must be changed also. For this purpose the speed of the motor can be changed, by means of a rheostat 39 or otherwise; or any suitable speed-varying mechanism, for example one of the familiar friction disk and roller type, not shown, can be used between the motor and the pulley, with or without varying the speed of the motor itself. The belt bears markings, say uniformly spaced transverse lines as shown, so that its movement can be readily seen. The motor can be a very small one, since but little power is needed to drive the band. A filling pipe 40, equipped with a valve 41, is provided on cylinder 21 for filling purposes. Other forms of comparison-speed indicator, for example a rotating helix, may be used.

The operation will now be readily understood. With ram 14 and plunger 20 fully retracted and valves 32 and 41 open, liquid, preferably colored, is delivered to cylinder 21 through pipe 40 until the liquid rises to a suitable height in column 28 and vessel 31. Valves 32 and 41 are now closed. Now suppose first, as an example, that the press is to be used to extrude a metal with which the operator has had no previous experience, or that a change has been made in some other factor which affects the extrusion speed. In such case the operator will set the press control valve 17 according to his best judgment. The product is then examined, and if it is not satisfactory, another setting of the valve can be made, or the extrusion temperature can be changed, or both, and so on. In this way a valve setting or settings can be found which will give a ram speed proper for the desired product. Then, with the press operating at the speed thus determined, the operator starts the comparison-speed indicator and adjusts its speed as may be necessary to bring the band into step with the column of liquid rising in vessel 28. Knowing the speed of the driving motor, the ratio of speed reduction (if any) between the motor and the band driving pulley, and knowing also the diameter of the pulley, the speed of the ram proper for obtaining the desired product under the given conditions can be ascertained by simple calculation, as will be readily understood. This does not mean that the lineal velocity of the ram must necessarily be found, in feet or other units per unit of time. For some purposes, at least, it will be sufficient to note the motor speed or the setting of the speed-controller of the motor. Thereafter, whenever the same extrusion condi-

tions exist, the operator starts the comparison-speed indicator and makes the proper adjustment of the device or devices which determine its speed. Valve 18 being then open, the operator adjusts valve 17 until the column of liquid rising in vessel 28 is in step with the band 35. The main apparatus is then operating at the desired speed. Keeping his eye on the two speed-indicators, if the liquid begins to get out of step with the band, the operator readjusts the control valve as may be necessary to maintain the desired correspondence between the two indicators.

If the liquid displaced from cylinder 21 exceeds the capacity of the tubular column 28 and the bend in pipe 30, liquid will be discharged into vessel 31, which is provided with a graduated window 45. The column 28 may also be provided with suitable marks 46 to indicate the height of the liquid in the column.

When it is desired to observe the position of main ram 14, valve 32 is opened to allow the liquid in 28 and 31 to come to the same level. This level will indicate the position of ram 14.

When it is desired to again observe the speed of ram 14, valve 32 is first opened to allow the liquid in 28 and 31 to come to the same level and then closed to direct all the flow from 21 into vessel 28.

If the forward stroke of the ram 14 has not expelled any liquid from column 28 into the vessel 31 the valve 32 need not, in general, be open when the ram is retracted for another operation of the press; otherwise valve 32 should be open in order to restore to the system below vessel 31 the liquid which had been discharged into the latter. If, however, valve 32 is inadvertently left closed when it should be open, the reserve liquid in reservoir 25 will be sufficient to prevent air being sucked into cylinder 21. It will be seen that though reservoir 25 and vessel 31, especially the former, are desirable if not necessary in some installations, they may be omitted from others. Indication of the position of the ram, by the height of the liquid in column 28 or receptacle 31, is particularly advantageous when the operator can not determine the position by observation of the ram itself.

The use of a rotating helix for comparison-speed indication is illustrated in Fig. 2, in which 50 is an upright cylindrical member carrying an helical line 51 and rotated at the proper speed on its vertical axis by any convenient means, say the motor through a worm gear and worm 52.

It is to be understood that the invention is not limited to the construction herein specifically described but can be embodied in other forms without departure from its spirit as defined by the following claims.

I claim—

1. The combination with an apparatus having a moving part; of a vessel adapted to receive liquid and exhibit visually the movement of the liquid therein, means actuated in harmony with the movement of said part to deliver liquid to said vessel at a rate correlated with the speed of said part, visual comparison-speed indicating means observable simultaneously with the liquid-receiving vessel, and means to cause the movement of the liquid and the movement of the comparison speed indicating means to be matched for the purpose described.

2. The combination with an apparatus having a moving part, and means for varying the speed of said part; of an upright tubular vessel adapt-

ed to receive liquid and exhibit visually the rise of liquid therein, means actuated in harmony with the movement of said part to deliver liquid to said vessel at a rate correlated with the speed of said part, visual comparison-speed indicating means observable simultaneously with the liquid-receiving vessel, and means for actuating the comparison-speed indicating means at a rate correlated with the speed of said part, said last named means and the aforesaid means for varying the speed of said part enabling the rise of the liquid to be matched with the movement of the comparison speed indicating means for the purpose described.

3. The combination with an apparatus having a part which is to be actuated at a pre-selected speed, and means for varying the speed of said part; of a vessel adapted to receive a liquid and exhibit visually the movement of the liquid therein, means actuated by said part to deliver liquid to said vessel and cause movement of liquid therein at a speed correlated with the speed of said part, visual comparison-speed indicating means observable simultaneously with the movement of liquid in the receiving vessel, and means for actuating the comparison-speed indicating means at the pre-selected speed, the aforesaid means for varying the speed of said part enabling the rate of movement of the liquid to be variably adjusted until such liquid movement matches the movement of the visual comparison speed indicating means whereby the part is actuated at the pre-selected speed.

4. The combination with an apparatus having a part which is to be actuated at a pre-selected speed, and means for varying the speed of said part; of an upright tubular vessel adapted to receive liquid and exhibit visually the rise of liquid therein, means actuated in harmony with the movement of said part to deliver liquid to said vessel at a rate correlated with the speed of said part, visual comparison-speed indicating means observable simultaneously with the liquid-receiving vessel, and comprising a member arranged to travel longitudinally in a path parallel to the rising liquid in said vessel, and means for actuating the comparison-speed indicating means at a rate correlated with the pre-selected speed, the aforesaid means for varying the speed of said part enabling the rate of movement of the liquid to be variably adjusted until such liquid movement matches the movement of the visual comparison speed indicating means whereby the part is actuated at the pre-selected speed.

5. The combination with an apparatus having a part which is to be actuated at a pre-selected speed, and means for varying the speed of said part; of an upright tubular vessel adapted to receive liquid and exhibit visually the rise of liquid therein, means actuated in harmony with the movement of said part to deliver liquid to said vessel at a rate correlated with the speed of said part, visual comparison-speed indicating means observable simultaneously with the liquid-receiving vessel and comprising a graduated endless belt and pulleys supporting the same for movement in parallelism with the rising liquid

in the vessel, and means for actuating the belt at a linear speed correlated with the pre-selected speed, the aforesaid means for varying the speed of said part, enabling the rate of rising movement of the liquid to be variably adjusted until such liquid movement matches the movement of the belt of the visual comparison speed indicating means whereby the part is actuated at the pre-selected speed.

6. The combination with an apparatus having a part which is to be actuated at a pre-selected speed, and means for varying the speed of said part; of a hydraulic cylinder, a plunger movable therein and actuated in harmony with said part to displace liquid from the cylinder at a rate proportional to the speed of said part, an upright tubular vessel adapted to receive liquid at a rate proportional to the said displacement of liquid from said cylinder and exhibit visually the rise of liquid in said vessel, visual comparison-speed indicating means observable simultaneously with the liquid-receiving vessel, and means for actuating the comparison-speed indicating means at a speed proportional to the pre-selected speed, the aforesaid means for varying the speed of said part enabling the rate of movement of the rising liquid to be variably adjusted until such liquid moves at a rate which matches the movement of the visual comparison speed indicating means whereby the part is actuated at the pre-selected speed.

7. The combination with an apparatus having a part which is to be actuated at a pre-selected speed, and means for varying the speed of said part; of a hydraulic cylinder, a plunger movable therein and actuated in harmony with said part to displace liquid from the cylinder at a rate proportional to the speed of said part, an upright tubular vessel adapted to receive liquid at a rate proportional to the said displacement of liquid from said cylinder and exhibit visually the rise of liquid in said vessel, visual comparison-speed indicating means observable simultaneously with the liquid-receiving vessel, and comprising a helix-bearing member rotatable about its axis in parallelism with said tubular vessel, and means for actuating the comparison-speed indicating means at a speed proportional to the pre-selected speed, the aforesaid means for varying the speed of said part enabling the rate of movement of the rising liquid to be variably adjusted until such liquid moves at a rate which matches the movement of the visual comparison speed indicating means whereby the part is actuated at the pre-selected speed.

8. The apparatus according to claim 1 wherein the means to cause the movement of the liquid and the movement of the comparison speed indicating means to be matched comprises means for varying the speed of the moving part.

9. The apparatus according to claim 1 wherein the means to cause the movement of the liquid and the movement of the comparison speed indicating means to be matched comprises means for varying the speed of the comparison speed indicating means.

ROY DALLIBA PALMER.