AUTOMATIC RELEASE FOR HYDRAULIC ACCUMULATORS.

By Mr. P. S. Hanton.

The operation of high pressure plant frequently calls for continuous running pumps driven by electric motor, gas engine, or belt from existing shafting; and owing to the intermittent demand for hydraulic power, storage in the form of an accumulator is desirable and usually indispensable except in the smallest plants.

To stop pumping when the accumulator is full is not so simple as it looks, and any automatic action must be carefully considered if a satisfactory result is to be obtained. The simplest case of regulating an hydraulic accumulator occurs when the pumps are driven direct by steam. It is then practicable to connect mechanically a steam throttle valve to the accumulator weights, so that any excess travel shuts steam off, and stops the engine. There are in successful use several hydraulic plants with automatic release gears of simple construction which operate well enough to make the problem look easy.

Figure 1 shows the arrangement of one of these gears. When the accumulator rises to a suitable height a tappit collar J lifts the lever A, forcing the valve D from its seat, and permits the high pressure water to escape back into the suction tank. An examination of those which were successful showed the lever to be of a light and springy nature, and that the valve box itself was secured to a wooden beam which deflected considerably before the valve lifted. This deflection was not readily observed unless a length was applied between the valve box and some fixed point. The secret of success was deflection, which allowed the accumulator to travel further than a rigid connection would before forcing the valve. When the check valve was forced from its seat the spring of the various parts, returning to the unloaded position, forced the valve to jump upwards sufficiently to by-pass the water freely. On the other hand, a connecting lever and valve box, strongly and rigidly constructed, follows the accumulator so accurately that the valve is only forced slightly from its seat, and any further movement of accumulator opens the relief valve only far enough to by-pass the quantity of water, but the pumps still operate against full pressure.

One method employs an inverted pendulum which is over-balanced by the accumulator, the weight being free to fall and in falling shifts the driving belt from the fast to the
loose pulley, and stops the pump until the accumulator de-
scends a sufficient distance. Another adjustable tappit meets
the falling accumulator and overbalances the weight on the
opposite side of the fulcrum. The weight in falling slides the
belt on to the fast pulley, causing the pumps to work again.

With a belt shifting gear it is worth noting that full
hydraulic pressure remains against the delivery valves of the
pump unless another check valve is inserted; and, as the
pumps are frequently of the three throw variety, there are
three valves which bear the full pressure, whether the pump
is running or standing, and the valve deterioration is there-
fore more rapid than when the pump is entirely relieved of
pressure by one independent check valve. This belt shifting
arrangement seems all right on paper. But the power to
shift a heavy belt is a very variable quantity, depending on
the condition of pulleys, tightness of belts, mechanical ar-
angement of belt shifting gear between the accumulator and
pumps, etc. The power to shift the belt coming from an
overbalanced weight is also very variable, depending on the
leverage the weight has when it contacts with the side of the
belt. It is therefore not surprising to find the weight unable
at times to slide the belt completely across the pulley; while,
for days, it may operate successfully.

This gear is noisy in operation, and in one instance had
so much surplus power (when the belt was slack) that the
post arranged to take the falling shock and limit the travel
of weight was actually driven into the ground.

Another method of control is to use a ram operated by
the domestic water service to push the driving belt on fast
or loose pulleys. The control being arranged by auto valves
fixed to the sides of the accumulator. The greatest objection
to this method is its dependence on an outside source of
power which may be shut off without notice; or, again, the
pressure may become too low for successful use. The above
disadvantage may be removed by substituting the hydraulic
pressure in lieu of the domestic water service, but difficulty
again arises in the fact that high pressure water acts on
small weighted rams with lightning speed; and, in practice,
it is like a hammer blow—even on pressures as low as 700 lbs.
per sq. in. To provide a reasonable speed on the small ram
requires so small a water opening that it is easily blocked up.

The difficulties enumerated are successfully overcome in
the valve now to be described, and at present operating in
the construction shops of the Metropolitan Gas Company.

Figure 2 shows the general arrangement of the valve and
its attachment to the accumulator. The lever A, fulcrumed
at B, is overbalanced by the weight E in such a manner that the spindle C and valve D remains up unless forced down by the weight of the tappit rod F. The lever A is not connected rigidly to rod F, but lifts it through the spring G becoming compressed solid. The action of the plant is as follows:—

Pumps being started (fig. 3), water enters the space between the valves D and H, the valve D being shut owing to the fact that the tappit rod F (fig. 1) rests on the end of the lever and is sufficiently heavy to overbalance the counterweight E. The valve H automatically lifts and water forces the accumulator ram up till the adjustable collar J is reached. During this time the valve D is loaded and held down by the accumulator pressure, which, in this case, is 1,500 lbs. per square inch. Consequently the lever A is fairly difficult to lift.

Further motion of the accumulator forces the tappit rod F up. This rod is free to slide in the bridle L, and is guided by the nut M, and therefore compresses the spring G solid, and compels the lever A to lift slightly, thereby allowing sufficient water to escape from the valve to lower the pressure holding A. The weight of the tappit rod F is now sustained by the accumulator, and therefore the spring G and the weight E on the other end of the lever, combined, are able to lift the lever A, the action providing ample valve lift to release the pressure from the pumps. When the accumulator falls, the weight of the tappit rod F is transferred to the lever A, forcing it down till the valve seats once more and the accumulator is again raised.

The President said the thanks of the meeting were due to Mr. Hanton for showing the ingenious methods employed for overcoming the difficulties he had referred to. The particular gear that had been shown was to a great extent Mr. Hanton's own idea, and it was known that Mr. Hanton was eminently capable of applying simple mechanical means for overcoming difficulties.

The motion was carried by acclamation.
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