No. 734,285. PATENTED JULY 21, 1903.

R. THOMANN.

DISTRIBUTING VALVE FOR HYDRAULIC SPEED REGULATORS.

APPLICATION FILED NOV. 13, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

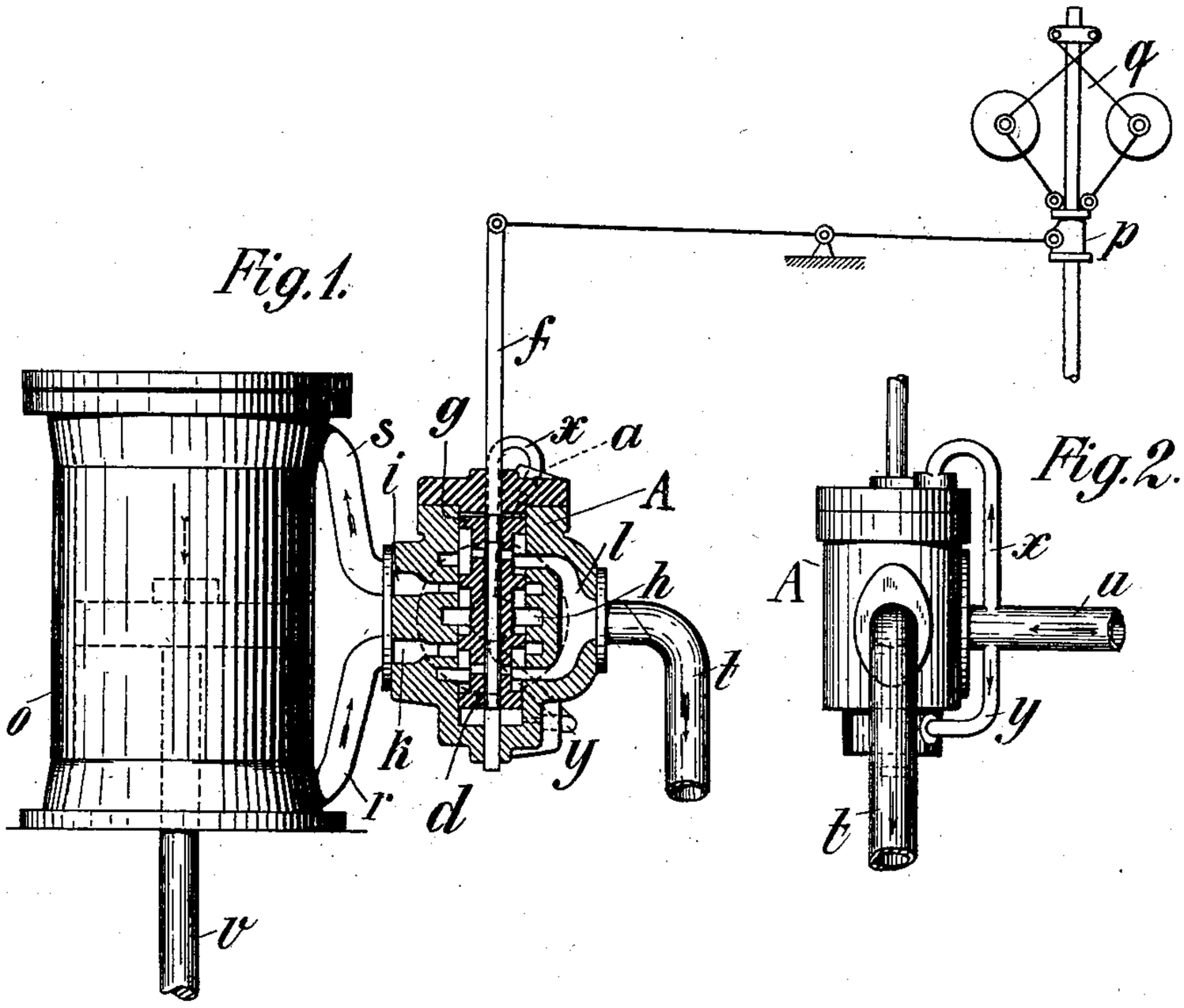

Fig. 2.

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Fig. 3.

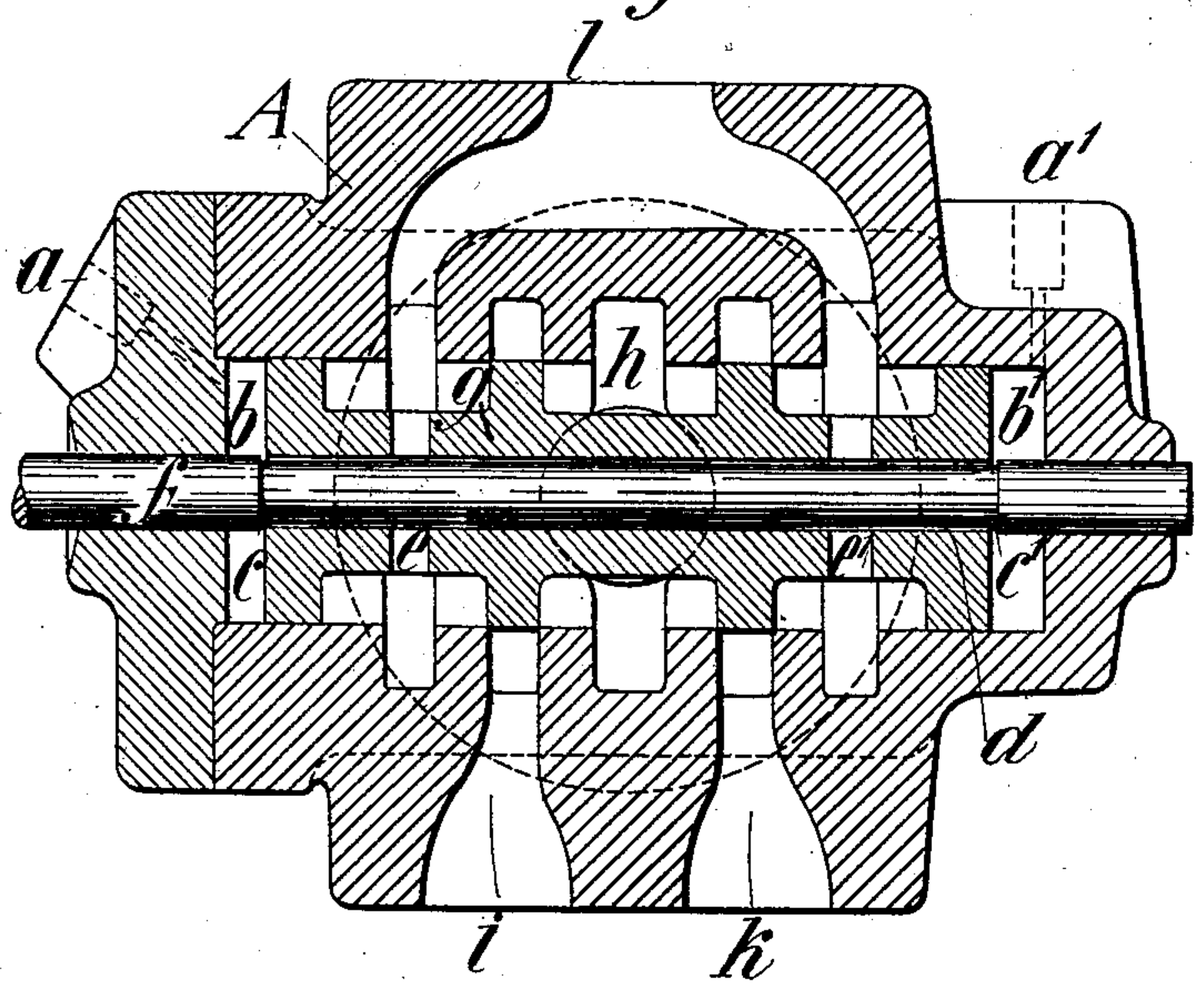
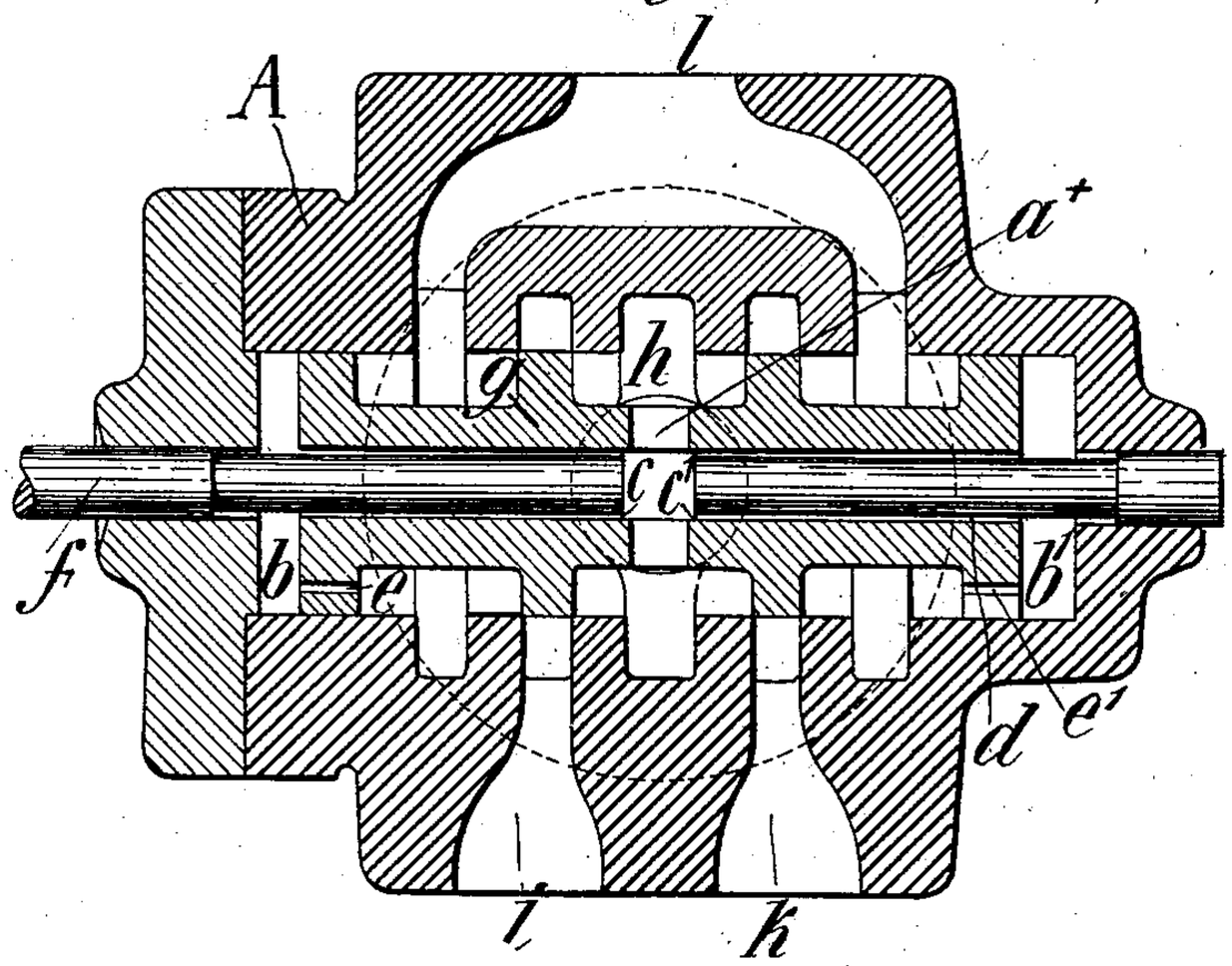


Fig. 4.



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UNITED STATES PATENT OFFICE.

ROBERT THOMANN, OF STUTTGART, GERMANY, ASSIGNOR TO J. M. VOITH, OF WÜRTEMBERG, GERMANY, A FIRM.

DISTRIBUTING-VALVE FOR HYDRAULIC SPEED-REGULATORS.

SPECIFICATION forming part of Letters Patent No. 734,285, dated July 21, 1903.

Application filed November 13, 1902. Serial No. 131,129. (No model.)

To all whom it may concern:

Be it known that I, ROBERT THOMANN, a subject of the King of Würtemberg, residing in Stuttgart, in the Kingdom of Würtemberg, German Empire, have invented certain new and useful Improvements in Distributing-Valves for Hydraulic Speed-Regulators, of which the following is a specification.

This invention relates to hydraulic speed-regulators, and more especially to an improved valve-gear for distributing-valves for hydraulic speed-regulators by which the power necessary for the movement of the regulating piston-valve and the reaction on the gearing is very small and by which the relative pressure which exists between the two faces of the piston-valve is changed in such a manner by the use of an actuating piston-rod loosely connected therewith that the supply or discharge of the medium acting on the faces of the piston-valve is regulated by the piston-rod. Only in one determined relative position of the piston-valve and its piston-rod does the regulator-piston find itself in equilibrium; but as soon as a shifting of the piston-rod takes place the piston-valve has immediately the tendency to follow it until it assumes again its position of equilibrium.

An essential feature of my improved valve is that by the use of the same the reaction on the gearing is very small and that by the least displacement of the piston-rod by the governor mechanism the piston-valve will follow the same by means of the high power exerted by the pressure fluid. This is accomplished by a double action of the valve and by causing the distributing-channels to pass completely in the piston-valve, and thus make them necessarily very short.

For carrying out these effects the invention consists in a distributing-valve for hydraulic speed-regulators comprising a valve-chest provided with a supply-pipe, outlet-channels, and discharge-channels, a piston-valve in said valve-chest provided with a central bore, a shiftable piston-rod passing through the central bore of the piston-valve and of smaller diameter than said bore, so as to form an annular channel around the same, and shoulders on said piston-rod which by opening or closing the annular channel change the amount of pressure fluid in the spaces between the heads of the piston-valve and chest, as will be more fully described hereinafter, and finally pointed out in the claim.

In the accompanying drawings, Figure 1 represents a side elevation, partly in vertical section, of my improved hydraulic speed-regulator, showing its connection with a centrifugal governor and so-called "servomotor" of a turbine. Fig. 2 is a side elevation of the distributing-valve of the same. Fig. 3 is a vertical central section of the distributing-valve, drawn on a larger scale; and Fig. 4 is a similar section of a slightly modified construction of the same.

Similar letters of reference indicate corresponding parts.

In the drawings, A represents the distributing-valve, O the servomotor or cylinder connected therewith, and q a centrifugal governor connected with the piston-rod of the distributing-valve A. The pressure medium or fluid which drives the servomotor O is supplied through the pipe u into a central channel h (shown in Figs. 3 and 4) of the cylindrical distributing-valve, while the discharge of the pressure fluid is accomplished through the channel l and pipe t. According to the position of the balanced piston-valve g the pressure fluid will pass either from the channel h into the channel k or from the channel h into the channel i. The lapping over of the piston-valve g is so calculated that the channel k or i which is not in connection with the central chamber h is in communication with the discharge-channel l. When the pressure fluid enters into the channel k, the movement of the servomotor takes place in an opposite direction from that which it assumed when the pressure fluid enters to the same through the channel i, as shown in Fig. 1. In the balanced piston-valve g is loosely placed the piston-rod f, which acts as a regulating rod or spindle and which is actuated by means of a centrifugal governor q.

In the construction of the distributing-valve (shown in Fig. 3) the chambers b and b', between the ends of the valve-casing and the faces of the piston-valve g, are connected by

an annular channel d, which is formed around the piston-rod f by slightly diminishing the diameter of the same within the piston-valve, said spaces being filled with the pressure fluid through special supply-channels $a a'$, arranged in the ends of the casing. The channel d is constantly connected with the discharge-channel l by means of the lateral openings $e e'$. The piston-rod f has projecting shoulders $c c'$, one adjacent to each face of the piston-valve and at a distance from each other which is somewhat greater than the length of the balanced piston-valve g, so that when the balanced piston-valve is in its normal position relatively to its piston-rod the spaces $b b'$ are connected by two equal narrow annular channels with the channel d and the discharge-channel l, whereby the pressure in the spaces b and b' is equalized. As soon as the piston-rod f makes the smallest movement—for instance, in downward direction—the upper ring-shaped channel at the shoulder c will be contracted or entirely closed. In consequence of this the pressure in the chamber b in contrast to the pressure in the chamber b' will be increased, so that the piston-valve g will be pressed downwardly until it assumes again its normal median position of equilibrium between the shoulders c and c'. Thus the balanced piston-valve g follows the slightest movement of the piston-rod f without producing any reaction on the connecting-rods of the gearing or on the sleeve p of the governor.

In the modified construction shown in Fig. 4 the narrow channel d, which connects the chambers $b b'$, is not connected with the discharge-channel, but with the inlet-channel h by means of openings $a^{\times}$ at the center of the piston-valve g. The spaces $b b'$ are connected with the discharge-channel l by means of small channels $e e'$ in the ends of the piston-valve. The piston-rod f in this case has near its center shoulders $c c'$, forming an enlarged portion, which when the balanced piston-valve g is in its normal position will completely cover the openings $a^{\times}$, so that the pressure fluid coming from the chamber h cannot pass to either one of the chambers $b b'$. In consequence of this there exists in the spaces $b b'$ under normal conditions one and the same pressure, which is equal to the pressure in the discharge-channel of the distributing-valve. As soon as the piston-rod f makes the smallest shifting movement—for instance, in upward direction—the pressure fluid coming from the chamber h will be permitted to pass along the shoulder c' into the channel d and into the chamber b', so that the pressure in the space b' as compared with the pressure in the chamber b will be increased, whereby the piston-valve will be raised until the opening $a^{\times}$ is again closed. In a similar manner the piston-valve will follow any downward movement of the piston-rod f.

In Figs. 1 and 2 are shown the connection of the distributing-valve A with the governor q and with the servomotor O, which latter is driven by the pressure fluid and which operates the regulating-shaft or other speed-regulating organ of a turbine. The piston-rod f of the distributing-valve A rises and falls with the falling and rising of the sleeve of the governor q, the spindle of which receives its motion from the turbine. Channels k and i are connected by the conducting-pipes r and s with the opposite ends of the cylinder of the servomotor O, while the supply-channel h is connected with the supply-pipe u and the outlet-channel l with the discharge-pipe t. The two supply-openings a and a', leading to the spaces b and b', are connected with the supply-pipe u by means of the branch pipes x and y. The piston-rod v of the servomotor O governs in the well-known manner the regulating members of a turbine. In Fig. 1 the piston of the servomotor is shown in its downward course in the direction of the arrow. The piston-rod f is shown in raised position, compared to its position shown in Fig. 3, in consequence of the lowering of the governor-sleeve. The piston-valve g has followed the piston-rod f, so that the pressure fluid can pass from the channel h to the upper outlet-channel i and through the pipe s to the space above the piston of the servomotor, while the space below the piston is connected by means of the pipe r with the channel k, outlet-channel l, and discharge-pipe t.

The operation of the improved valve-gearing is the following: The turbine is supposed to be running with its rated speed, the centrifugal governor q being connected with the turbine. The piston-rod v of the servomotor is connected to the regulating member of the turbine. With the turbine running at its normal speed the pressure of the fluid flowing continually from the supply-pipe u and channel h to the discharge-channel l and discharge-pipe t is the same in the chambers b and b', and no action of the regulating-piston f and valve g on the piston of the servomotor takes place. When, however, the turbine, due to increase of load or otherwise, should diminish its speed, fly-balls of the governor q will fall. The sleeve p will consequently be lowered, so as to raise the piston-rod f. This will cause a contraction of the annular channel formed between the shoulder c' of the piston f and the lower end of the valve g. The fluid in space c will be forced through channel d, channel e, and outlet-channel l to the discharge-pipe t. The pressure fluid entering through channel a' into the space b', owing to the contraction of the annular opening c', will force the piston-valve g in upward direction. This permits the pressure fluid entering by supply-pipe u and channel h to flow through channel i and pipe s into the upper part of the cylinder of the servomotor O and force the piston of the servomotor in downward direction. The fluid in the lower part of the cylinder of the servomotor

is passed off through the pipe *r*, channel *k*, channel *e'*, outlet-channel, and discharge-pipe *t*. The downward movement of the piston-rod of the servomotor O actuates the regulating member of the turbine, and consequently increases the speed of the same. The increase of speed of the turbine raises the fly-balls of the governor, thus raising the sleeve *p* and lowering the piston-rod *f*. This in turn causes a contraction of the annular channel *c*, increasing thereby the pressure of the fluid in chamber *b*, forcing the piston-valve *g* to follow the movement of the piston-rod *f* and either again bringing the piston-valve *g* to its position of equilibrium, in which case corresponding currents of the pressure liquid, but an inverse motion of the piston of the servomotor, takes place. Thus the slightest decrease or increase in speed of the turbine will cause the upward or downward movement of the piston-rod *f*, which will cause the downward and upward movement of the piston of the servomotor, thus increasing or decreasing the speed of the turbine.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

A distributing-valve for hydraulic speed-regulators, comprising a valve-chest provided with a supply-pipe, outlet-channels and discharge-channels, a piston-valve in said valve-chest provided with a central bore, a shiftable piston-rod passing through the central bore of the piston-valve and of smaller diameter than the said bore so as to form an annular channel, channels connecting said annular channel with the discharge-channel, and shoulders on said piston-rod, which by opening or closing the annular channel, change the amount of pressure fluid in the spaces between the heads of the piston-valve and chest, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ROBERT THOMANN.

Witnesses:
KARL ZIETRICH,
WM. HAHN.