April 11, 1933. F. G. L. BOYER 1,903,435

AIR DASHPOT

Original Filed Feb. 2, 1923

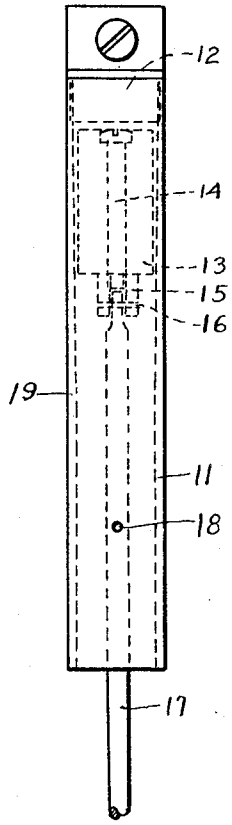


Fig. 1.

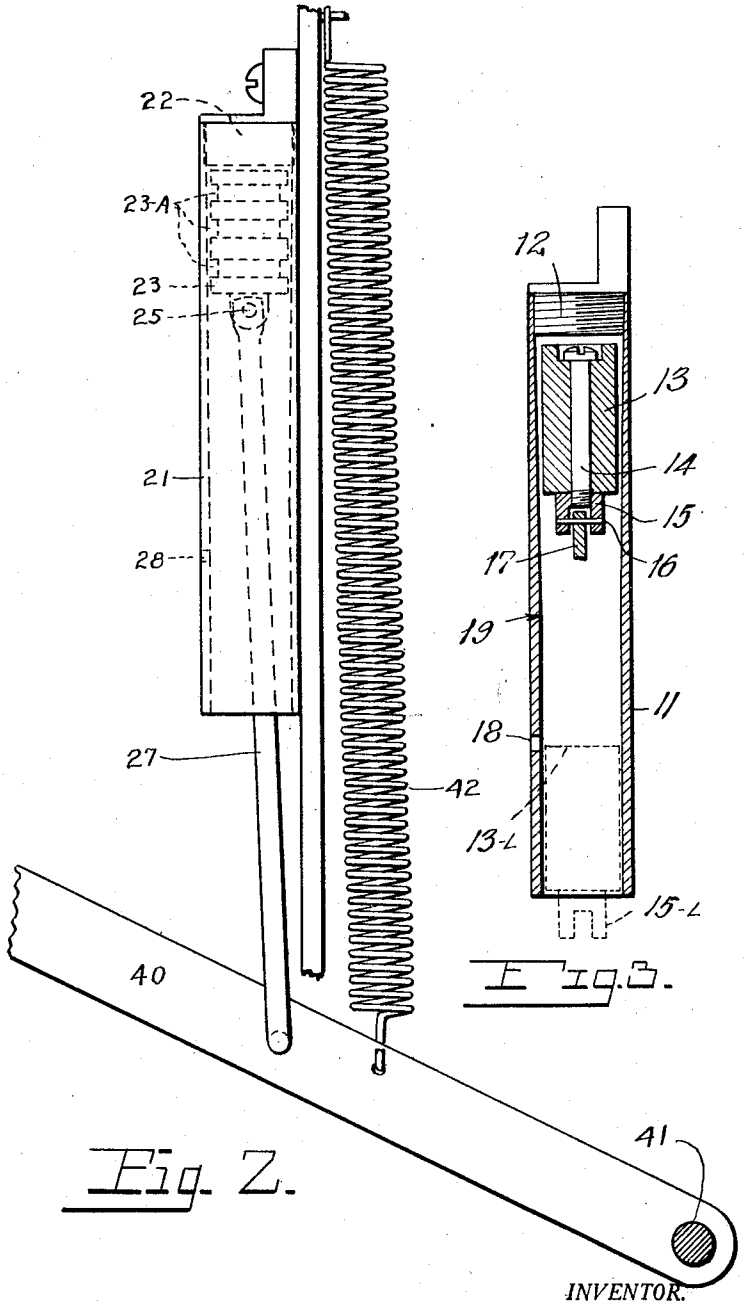


Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE

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AIR DASHPOT

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My invention relates to that type of devices known as dash pots, and has for its object the provision of a form of dash pot which will combine certain important advantages of both air and liquid dash pots and eliminate certain disadvantages of both types. In air dash pots, as is well known, the resistance increases very rapidly as the piston approaches the closed end of the cylinder. In some cases this is a desirable feature, but in other cases it is such a serious disadvantage as to compel the abandonment of an air dash pot and the use of one containing liquid. On the other hand, if a liquid dash pot is used in order to obtain uniform resistance throughout the length of the stroke, it will be found that the changes in viscosity of the liquid used, due to temperature changes, will produce objectionable changes in the resistance. Furthermore it is often found difficult to prevent leakage if oil or other liquid is used, especially if the piston must move so freely that a stuffing box may not be used.

These and other serious objections to both air and liquid dash pots as now made are overcome by my invention in which I use air to avoid the disadvantages inherent in liquid dash pots, and provide certain novel means to overcome the above mentioned disadvantage of an air dash pot. To do this I provide that, as the piston is forced into the dash pot, at the point where the resistance has reached the desired strength the inside diameter of the cylinder begins to gradually increase towards the closed end. This provides a greater relief as the pressure tends to become greater, thus comparatively equalizing the resistance throughout the length of the dash pot, or as great a portion of the length as desired.

One type of device on which dash pots of this type are particularly useful is shown in my co-pending application Serial No. 616,509, filed Feb. 2, 1923, from which application the present application is a division.

The construction and operation will be better understood by reference to the accompanying drawing in which:

Fig. 1 shows one form of dash pot embodying my invention.

Fig. 2 shows a similar form, with a modified form of piston, and shows also certain parts of a mechanism controlled thereby.

Fig. 3 is a vertical central section through the device illustrated in Fig. 1.

Referring first to Figs. 1 and 3 we see a simple form of air dash pot embodying my invention. The single cylinder 11 is open at its lower end and closed at its upper end by a plug 12 screwed into the end of the cylinder, or in any other manner desired. The piston 13 is made longer than its diameter in order to make it self-guiding and to decrease the amount of leakage between piston and cylinder. A screw 14 is used to attach a clevis 15 to the piston 13, because as will presently be described, the piston may be made of a material such that the clevis could not conveniently be formed integral with it. A pin 16 is used to attach this clevis to a pitman or connecting rod 17 which connects it to the machine part whose speed it is desired to retard. A port 18 is provided in the cylinder just above the top of the piston at its lowest position, shown in broken lines at 13—L in Fig. 3. This relieves the suction above the piston which might otherwise nullify, to a large extent, the retarding effect on the upward stroke.

As soon as the upward stroke of the piston begins the air pressure above it increases rapidly, and if there were no means of relieving this pressure as the piston approaches the closed end of the cylinder, it would soon be so great as to be objectionable in many cases. In order to provide this relief I provide for gradually increasing the internal diameter of the cylinder after the piston reaches the point, shown as 19 in Fig. 1, where the pressure behind it has reached the degree desired. The taper is made of the degree which will give the amount of relief desired on the particular device on which the dash pot is to be used. In order to make its action approximate that of a liquid dash pot the taper is made of such a degree as to make the resistance approximately uniform after it reaches the desired intensity. The degree of taper shown on the drawing is much exaggerated in order that it may be more easily distinguished. If it is

desired to have the piston move more freely at the end of the stroke than throughout its length (as is the case in the above mentioned application—a condition just opposite to that obtained with an ordinary air dash pot) greater relief may be provided for this purpose near the end.

In order that the action of this dash pot shall be as nearly uniform as possible at all times, it is desirable that it should always operate dry, and that no oil should ever be used between the piston and cylinder. This is true not only because oil tends to dry, become gummy and cause the piston to stick, if not kept fresh, but also because oil around the piston tends to form an air seal which would nullify the effect of the increasing internal diameter until the seal would break because of the larger clearance and increasing air pressure, or because of the decrease in the amount of oil with continued use of the device. In order to overcome this disadvantage I find it advisable to make the piston of a material which will work without the addition of oil or other lubricant. Various materials of this kind are now on the market and used for the construction of oilless bearings, and usually consist of wood, metal, and other material impregnated with wax, oil, or some other form of lubricant.

In Fig. 2 is illustrated a dash pot comprising a cylinder 21 closed by a plug 22 and provided with a port 28, just as is the dash pot illustrated in Fig. 1. In this case the piston is of a slightly different form, having annular grooves 23—A which tend to prevent leakage of air around the piston, and which may be provided if desired. The piston is connected, as before, by means of a connecting rod 27 to a machine part whose motion it is desired to control, which is shown as a manually or otherwise operated lever 40 mounted to rock on a center 41 and adapted to be returned to position by a spring 42.

In this case it may be necessary, in order to produce an approximately uniform retarding effect throughout the length of the stroke, to provide a greater relief as the piston approaches the closed end of the cylinder, in order to regulate the resistance to the progressively decreasing power of the spring.

When my improved dash pot is used on a device such as that indicated in Fig. 2 and more fully described in my co-pending application above mentioned, the effect of the resistance as the piston moves away from the closed end of the cylinder is of less importance than that when it is moving in the opposite direction; but it should be noted, in case it should be desired to use my dash pot where the resistance on both strokes is of importance, that the tapered cylinder which I provide has the effect of rendering the resistance on this stroke also more nearly uniform, i. e. more like that of a dash pot containing liquid. This is true because not only is the percentage increase in the volume of the imprisoned air and the consequent increase in resistance to movement of the piston, greater at the beginning of this stroke, but the pressure difference on opposite sides of the piston is less, causing less leakage around the piston, than in any other part of the stroke. The taper which I provide permits greater leakage around the piston at this point, where it would ordinarily be least, thus counteracting the abnormally rapid increase in resistance in that part of the stroke, and rendering the resistance throughout the length of the stroke much more nearly uniform than in the ordinary form of air dash pot.

Although I have illustrated but two slight modifications of structure and mentioned only one application of my device I do not wish to be understood as limiting it to the specific forms illustrated, nor to the uses mentioned, as many modifications of structure and use are possible to those skilled in the art within the scope of the present invention and the appended claims.

What I claim is:

1. In combination with manually operated mechanism: an air dash pot comprising a cylinder having a gradually enlarging internal diameter towards the closed end thereof.

2. An air dash pot, comprising a piston in a cylinder closed at one end, for use with a manually operated, spring returned mechanism, for limiting the speed of the returning motion caused by said spring, the clearance around the piston of said dash pot being varied in such a way that the clearance is greatest where the force exerted by the spring is least.

3. An air dash pot, comprising a piston in a cylinder closed at one end, for limiting the speed of the return motion of a manually operated spring returned mechanism; and means for comparatively equalizing the resisting effect of said dash pot throughout a part of the return motion.

4. An air dash pot comprising a piston in a cylinder which has one end so arranged that air may be compressed between it and said piston, and said cylinder having a form in which the internal diameter increased gradually toward said end thereof.

FREDERICK G. L. BOYER.