PUBLISHED
MAY 11, 1943.
BY A. P. C.

G. PINAZZA
ACTING DEVICE FOR CENTRIFUGAL FORCE
PERCUSSION APPARATA
Filed Jan. 31, 1940

Serial No.
316,697
2 Sheets-Sheet 1

Fig. 2.

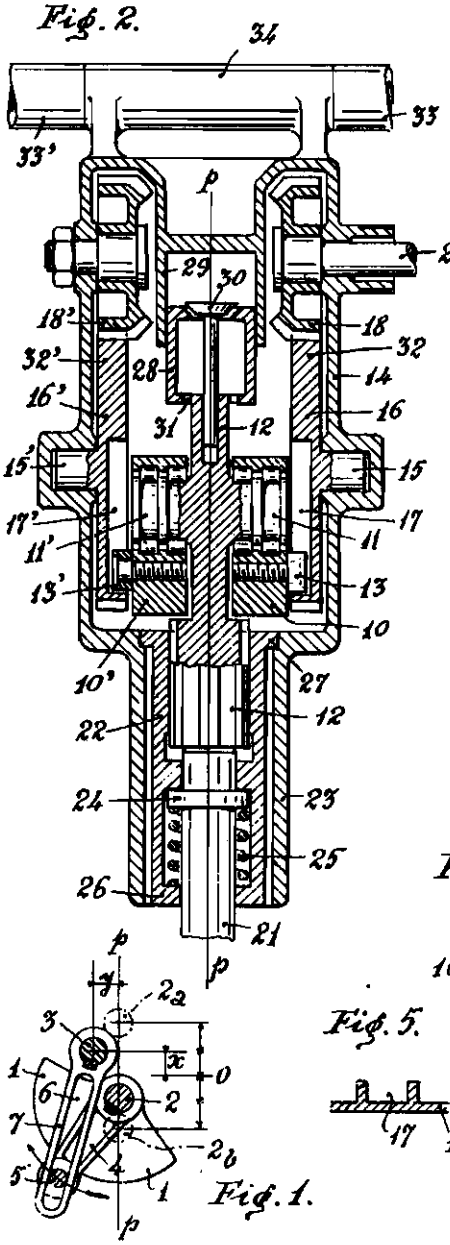


Fig. 3.

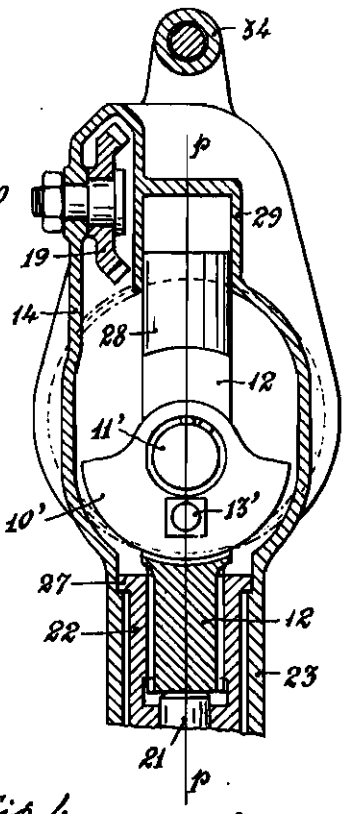


Fig. 4.

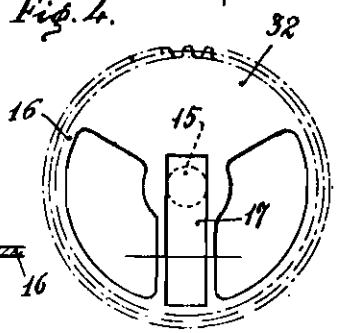


Fig. 5.

Fig. 1.

Inventor,
G. Pinazza
By: Glascock Downing & Seibold
Attys.

PUBLISHED
MAY 11, 1943.
BY A. P. C.

G. PINAZZA
ACTING DEVICE FOR CENTRIFUGAL FORCE
PERCUSSION APPARATA
Filed Jan. 31, 1940

Serial No.
316,697
2 Sheets-Sheet 2

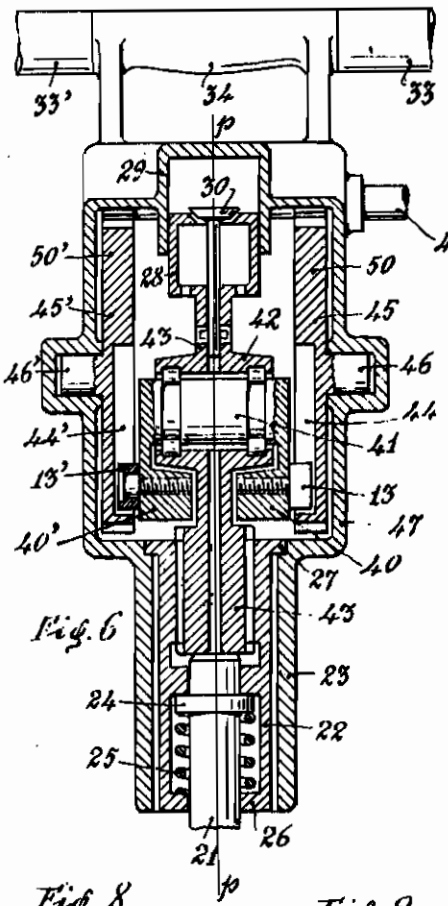


Fig. 6

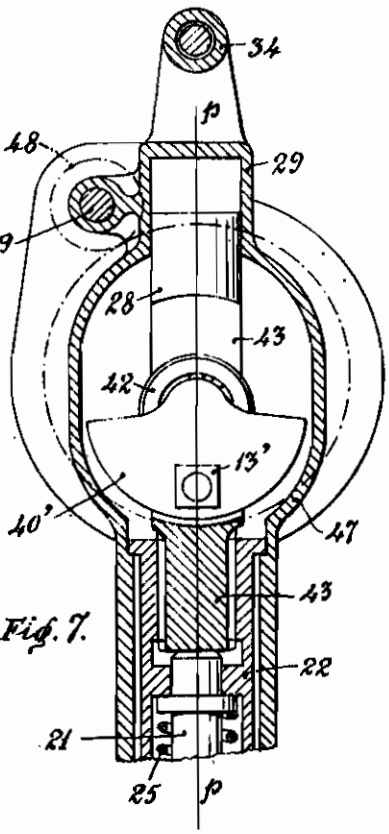


Fig. 7.

Fig. 10.

Fig. 8.

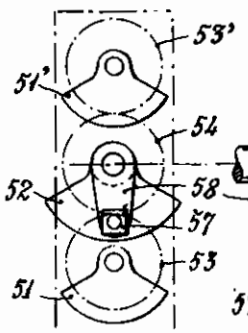
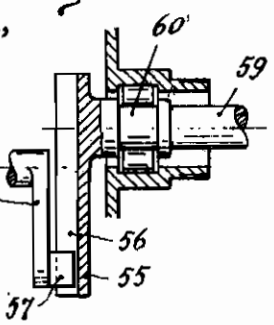
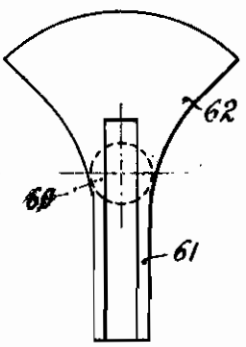


Fig. 9.





Inventor
G. Pinazza

By: Glascock Downing & Seebold
Attys.

Published May 11, 1943 Serial No. 316,697

ALIEN PROPERTY CUSTODIAN

ACTING DEVICE FOR CENTRIFUGAL FORCE PERCUSSION APPARATA

Giosuè Pinazza, Milan, Italy; vested in the Alien Property Custodian

Application filed January 31, 1940

There are already known percussion appliances in which the percussion force is the resultant of the centrifugal forces of eccentric masses rotating in the percussor. There are also known appliances in which the rotation of the masses is not uniform, but is periodically accelerated and retarded during each rotation of the masses, so that the aforesaid resulting force has a great intensity in the direction of the useful percussion, namely of the forward stroke of the percussor and has a small intensity in the opposite direction, namely of the backward stroke of the percussor. In order to obtain such variable rotation, there have been used in the appliances contrived till the present time exclusively drive chains, which set in action the masses by engaging into chain wheels which form a sole mass with them.

The present invention is concerning a device for acting appliances having the construction spoken of, by means of which the velocity of rotation of the masses can be varied not only according to what said here above, but also according to other laws and, moreover, one obtains for the apparatus a more simple, a more compact and a more resistant structure, which is very suitable for high power, too.

The fundamental feature of the invention consists in the fact, that the driving shaft is being connected to the rotating masses through the medium of at least one couple of crank arms, one of which being connected with the driving shaft and rotating uniformly, and the other being connected solidarily to the masses; the lengths of these crank arms standing one with respect to the other in a periodically variable ratio during each rotation of said arms and of the masses.

In such a way, as the rotation of the driving crank arms, which are connected with the driving shaft, is an uniform one, and as the relation between the lengths of these arms and those of the driven crank arms, which are connected with the masses, is varying during the rotation, the angular velocity of rotation of the masses proves to be necessarily variable, exactly as desired. Furthermore, there exists a perfect correspondence between the law of variation of said relation between the lengths of the crank arms and the law of variation of the angular velocity of the masses; so that, in order to obtain a certain degree of variation of the angular velocity of the masses, it is sufficient to establish a corresponding degree of variation of the said relation between the arm lengths.

The rotating axle of each crank arm connected with the driving shaft is firmly fixed on to the body of the apparatus, so that it does not change position with reference to it. Whilst the axle of rotation of each crank arm connected with the eccentric masses is continually oscillating together with the percussor, given that these masses are journalled on it.

A second feature of invention consists in the fact, that the periodical variation of said ratio existing between the lengths of the crank arms is being obtained by means of the relative position of the axle of rotation, fixed on the body of the apparatus, of each crank arm connected with the driving shaft, in respect of the middle position of the rotation-axle of the corresponding crank arm connected with the masses, namely to the position standing midway of the amplitude of oscillation of this axle.

Thus, according to the effect desired, the position of the axle of rotation of each driving crank arm connected to the driving shaft will coincide with the said middle position of the rotation-axle of the corresponding driven crank arm connected to the masses, or it will be situated, with respect to the percussion or oscillation axle of the percussor, longitudinally and/or transversally shifted in relation to the same aforesaid middle position of the axle of rotation of the corresponding driven crank arm. Among the many and different cases that in practice may occur, it is of particular interest the one already taken into consideration at the beginning of the present description, where may be desired, that the rotation of the masses is accelerated during the forward stroke of the percussor and retarded during its backward stroke, for the purpose already stated.

The connection between each driving crank arm and the corresponding driven crank arm can take place immediately, namely by direct engaging of one arm into the other, or also mediately, namely by interposing other connecting elements, and this according to requirements, both of constructive nature and relating to the various and manifold applications of the invention. Obviously, the first direct engaging will be, for its simplicity, the one to be preferred, and in this case it will be sufficient that the point where the crank arms engage into each other could be shifted along the said arms.

The periodical variations of the velocity of the masses have the tendency of acting upon the driving cranks and of modifying their uniform rotating motion. In order to eliminate this effect and to free in some degree the driving shaft

from the torsional strains resulting therefrom, and in order to preserve a constant and uniform rotation of this shaft, the crank arms connected with the driving shaft are, according to invention, jointly provided with eccentric masses acting upon them as stabilizing fly-wheels.

The masses may be so arranged, that their centers of gravity should all be rotating on the same plane, or in parallel planes respectively, and all of them in the same direction, or some in one sense and the others in the opposite one. In certain cases, f. instance when the centers of gravity are moving in parallel planes, the masses give way to torsional moments or to moments of deviation, which tend to cause the apparatus either alternatively to rotate around the percussion axle or alternatively to deviate from said axle, respectively. According to the invention, these disturbances are mediately at once equilibrated through the said eccentric masses applied jointly to the driving crank arms, by utilizing the moments with which they are acting upon the body of the apparatus by the medium of the pins of rotation of the arms which are bearing them.

Other less outstanding features, of a structural nature, of the invention, will be put in evidence during the description that follows and which is referring to some practical examples. The examples are illustrated in the drawings enclosed, where they exactly represent:

Fig. 1, schematically, an elementary realisation, illustrating the fundamental idea of the invention;

Fig. 2 the axial section of a first executive example of the invention;

Fig. 3 presenting a view at a right angle with that of Fig. 2, partially in section, of the same executive example;

Fig. 4 illustrating a particular of the example of Figs. 2 and 3; and

Fig. 5, a cross-section, partial, of this particular;

Figs. 6 and 7, in analogous views to those of Figs. 2 and 3, another example of the execution of the invention;

Fig. 8 presenting a schematical front view, a variant of the disposition of the eccentric masses rotating in the percussor;

Fig. 9, in axial section, another example of driving crank;

Fig. 10, in front view, a variation of the example of Fig. 9.

In the Fig. 1, where the invention is being realized in its simplest expression, there is indicated by 1 one of the eccentric masses, by 2 its pin of rotation on the percussor and by 3 the driving shaft. By $p—p$ is stated the axle of oscillation of the percussor which constitutes also the axle of oscillation of the pin 2; by $2a$ and $2b$ are indicated with dotted lines the extreme positions that the pin 2 is reaching during oscillation. Its central or middle position does correspond to the axle 0, equidistant from the positions $2a$ and $2b$. The mass 1 is firmly provided with a crank arm 4, the pin 5 of which runs freely in a slot 6 provided radially in a crank arm 7, set up rigidly on the driving shaft 3. The position of this shaft, the axle of which is fixed on the body of the apparatus, is established by the carthesian coordinates x, y in respect to the axle $p—p$ and to the central position 0 of the pivot 2. Upon the choice of these coordinates depends the degree of variation of the rotation velocity of the mass 1. In the case illustrated, if the rotation takes place in the direction of the arrow, the rotation of the mass is substantially being retarded in the lower part and on the left hand side of its travel (on the left side seen from the reader in respect of the axle $p—p$), whilst the arm of the driving crank 7 becomes shorter as compared to the constant one of the driven crank 4, whereas on the higher part and at the right hand side of the travel, the rotation of the mass 1 is substantially being accelerated as, then the arm of the driving crank arm 7 becomes longer with respect to that of the driven crank 4. The other manners of variation that could be arrived at from other figures of the coordinates x, y, not excluded the case of $x=o$, $y=o$, can be easily deduced.

In the executive example of the Figs. 2 to 5, the eccentric rotating masses are two 10 and 10', mounted turnably in opposite directions on a same rotation-pin 11—11'. This pin is fixed in the percussor 12, which in the rotation region of the mass is flatted, in order that the two parallel planes of rotation of the masses be the nearest possible between them. Such nearness is convenient to reduce to the minimum the torsional couple produced by the masses, which tends to make the percussor to rotate alternatively around the axle of percussion $p—p$.

Each of the two masses is provided with a crank pin 13, 13' respectively, at equal distance from the axle 11—11', whilst in the body 14 are turnably mounted around coaxial pins 15, 15' two discs 16, 16', each one bearing a radial groove 17, 17' respectively: therein can engage and run respectively the pins 13, 13'. The discs 16, 16' are provided on their circumference with a tooth collar and are thus driven by two tooth-wheels 18, 18' respectively, which also are provided with conic toothing and are connected one with another by means of a conic tooth-pin 19. This pinion, or one of the two wheels 18, 18', is connected with the driving shaft 20 having uniform rotation. Owing to the pinion 19, the two discs 16, 16' have uniform but opposite rotations, so that the masses 10, 10' are rotating, too, in the contrary directions. In this example the coordinates of the axle 15—15' of the drive cranks are $x=a$ and $y=o$, being a orientated toward the back of the body.

By 21 is being indicated the tool on which the percussor strikes; the latter is longitudinally grooved and is being guided by a socket 22, which is internally provided with longitudinal grooves engaging into those of the percussor. This socket is also provided with longitudinal external grooves engaging into the corresponding internal grooves applied on the face 23 of the body.

The tool is provided with a collar 24 bearing a compressure spring 25, the other end of which is leaning against a collar 26 of the socket 22, which is axially and solidarily connected to the body 14 by means of the collar 27. In this way, a portion of the energy of the stroke is being transmitted to the body and pushes it forward in the direction of the penetration of the tool. The back end of the percussor has a hollow piston 28, which runs tightly in a cylinder 30 of the body 14 and bears on its head a valve 30, which is opening toward the cylinder-chamber. During the backward stroke of the percussor, the valve 30 is being closed, compressing the air in the cylinder 29, thus the power that the percussor possesses during its backward stroke is being stored and given back to the percussor during its forward stroke. Valve 30, opening again at the end of the forward stroke, serves to re-introduce into the cylinder box 29

the air eventually escaped due to imperfect packing of the piston. Into the piston **28** the air is introduced through openings **31**.

In order to balance the moment of torsion produced by the masses around the axle *p—p*, the driving discs **16**, **16'** are provided with eccentric masses **32**, **32'** situated in a position diametrically opposed to the eccentric masses **10**, **10'** in respect of the axle **15**, **15'** of rotation of the same discs. These masses **32**, **32'** have also the other task of a fly-wheel, as already said above.

The toothed pinion **19** can be located on the upper bottom of the clothing, coaxially to the axle *p—p*, and keyed directly upon a small drive situated between the two handles **33**, **33'**, instead of the central crossing **34** bar.

In the example of the Fig. 6 and 7, the two eccentric masses **40**, **40'** form a single block with their shaft of rotation **41**, but they both are rotating in the same direction. Their shaft **41** is rotating in a support **42** of the percussor **43**, which also in this case is preferably flatted at the utmost between the masses. The masses are, as in the former case, provided with crank pins **13**, **13'**, being in touch and running in radially arranged grooves **44**, **44'** of two discs **45**, **45'** being turnable on coaxial pinions **46**, **46'** which are mounted on the body **47**. These discs are provided with toothing on the circumference set in motion through toothed pinions **48** which are keyed on the same driving shaft **49**.

In the other parts this example is equal to the previous one, therefore the parts are identically numerated in the two cases.

Also in this case the driving discs are provided with eccentric masses **50**, **50'** which, besides the function of a fly-wheel already established, have the task of balancing the cross shifting that the two eccentric masses **40**, **40'** trend to produce through their rotation in the same direction.

If the eccentric masses on the percussor have no tendency to produce torsions and deviations, as for instance has been said in the case of Fig. 8, in which there are three masses **51**, **52**, **51'** in rotating motion in the same plane and being coupled among them by gearings **53**, **54**, **53'**, then the driving discs above described can be substituted by a simple crank **55** which has a slot **56**. Into the slot engages a pin **57** fixed on one of the eccentric masses, eventually by means of the crank **58**. In this case the crank **55** can be acted directly by the drive shaft **59**, without any use of gears, by rigidly joining to this shaft the pin of rotation **60** of the crank.

The same elimination of gears you can operate also in the case of the Fig. 6 and 7, in which the two masses are solidarily joined together and in fact only one of them could be set in motion. You will thus apply also in such case the simplified device, as shown by Fig. 9, adopting, however, for the drive crank the structure shown by the Fig. 10, in which this crank **61** is being provided with an eccentric mass **62** for the already said aim. For the symmetrical balancing of disturbances already described, it will be convenient that a crank such as **61—62** be provided also for the other of the two masses rotating on the percussor.

During the present description one has taken into consideration the case in which each driven crank is being provided with a pin and the corresponding driving one with a slot; but it is obvious, that you can also adopt the opposed structure, namely to provide with pin the driving cranks and with a slot the driven cranks. Further, instead of pins and slots, one can also adopt other moveable engaging systems between the cranks: this, obviously, has no bearing on the fundamentals of the invention.

It is at any rate obvious and expressly understood, that the illustrated and described examples cannot be construed as a limitation of the invention and that, therefore, also each variation concerning them, as well as each other realisation pertaining to the basical idea underlying the invention enunciated in first place, falls within the scope and under the protection of the present invention.

GIOSUÈ PINAZZA.