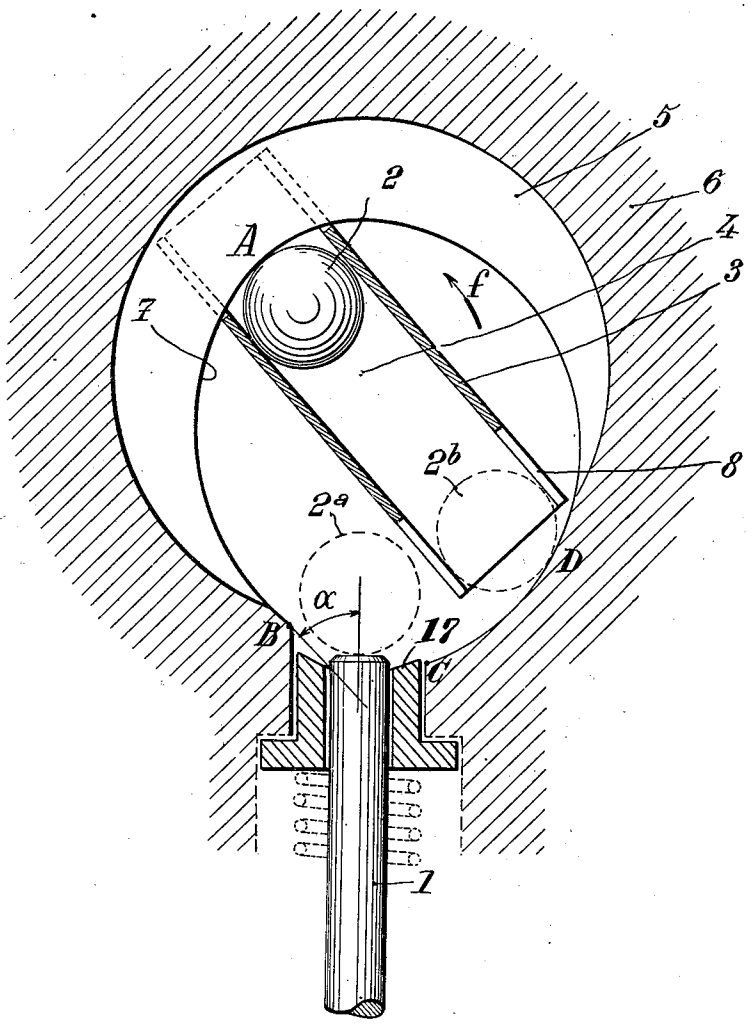
July 8, 1941. J. P. H. FRANCASTEL 2,248,523

HAMMER

Filed March 16, 1939 4 Sheets-Sheet 1

Fig. 1.



Inventor
Jacques Pierre Henri Francastel,

By Bailey & Larson

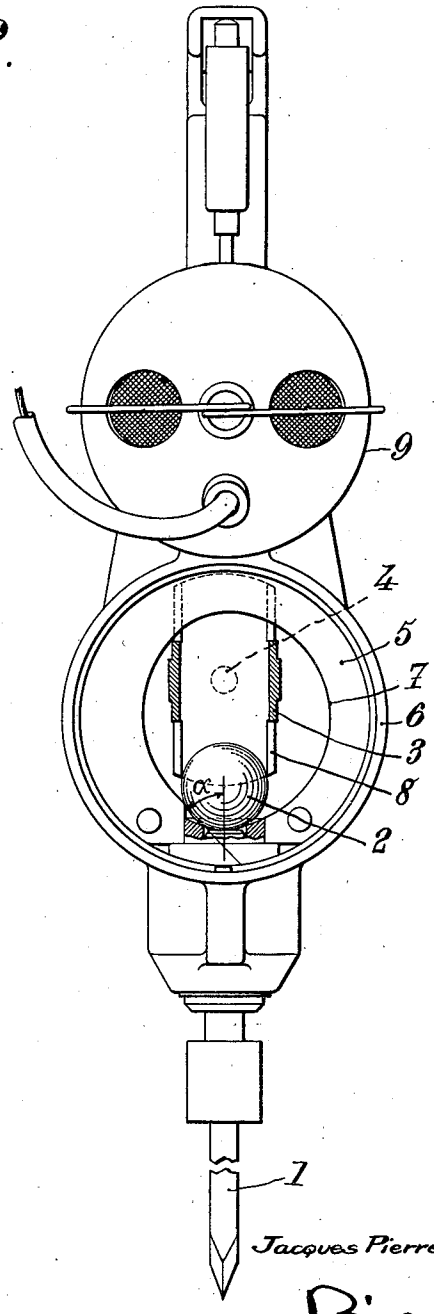
Attorneys

July 8, 1941. J. P. H. FRANCASTEL 2,248,523

HAMMER

Filed March 16, 1939 4 Sheets-Sheet 2

Fig. 2.



Inventor
Jacques Pierre Henri Francastel,

By Bailey & Parsons

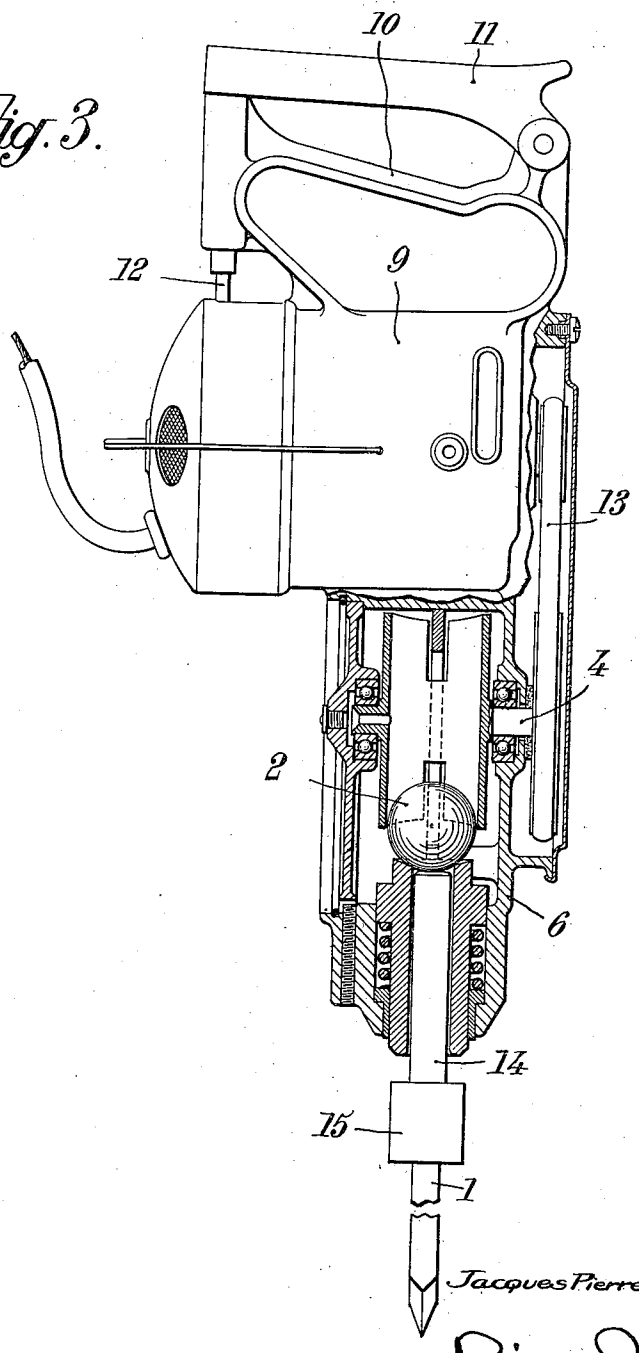
Attorneys

July 8, 1941. J. P. H. FRANCASTEL 2,248,523

HAMMER

Filed March 16, 1939 4 Sheets-Sheet 3

Fig. 3.



Inventor
Jacques Pierre Henri Francastel,
By Bailey & Parsons
Attorneys

July 8, 1941. J. P. H. FRANCASTEL 2,248,523

HAMMER

Filed March 16, 1939 4 Sheets-Sheet 4

Fig. 4.

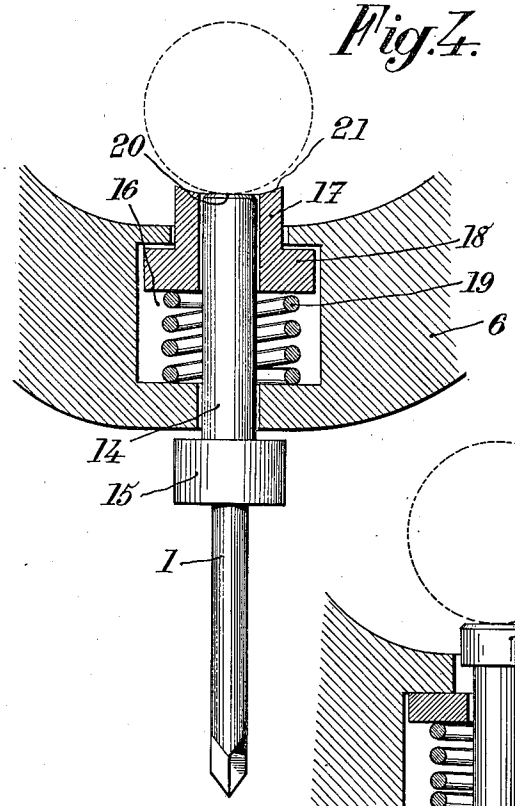


Fig. 5.

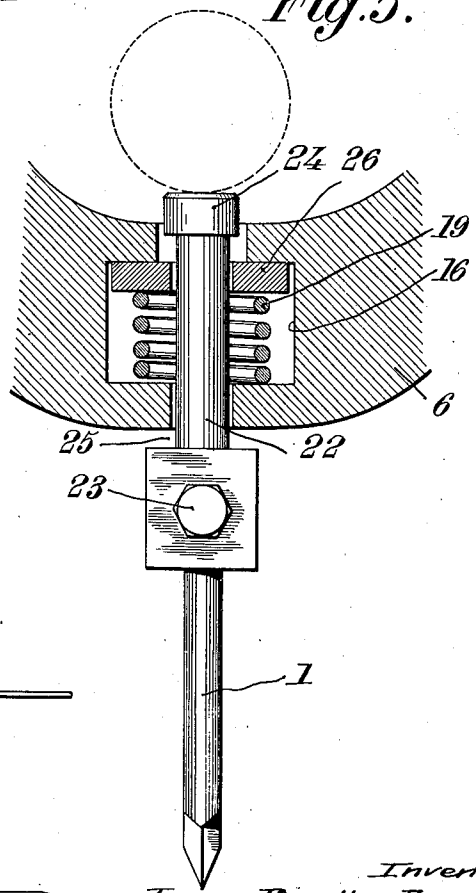


Fig. 6.

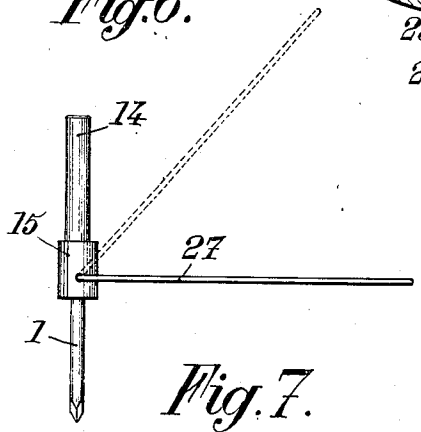
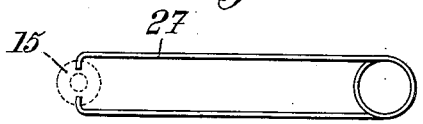


Fig. 7.



Inventor
Jacques Pierre Henri Francastel,

By Bailey & Parsons

Attorneys

Patented July 8, 1941 2,248,523

UNITED STATES PATENT OFFICE

2,248,523

HAMMER

Jacques Pierre Henri Francastel, Paris, France, assignor to The Rawlplug Company Limited, London, England, a society of England

Application March 16, 1939, Serial No. 262,301
In Belgium March 24, 1938

2 Claims. (Cl. 125—33)

The present invention relates to apparatus or hammers of the kind in which the member or tool to be controlled is subjected to the action of repeated shocks.

The chief object of the present invention is to provide an apparatus of this kind which is better adapted to meet the requirements of practice than the apparatus used for the same purpose up to the present time, and, in particular, which is simpler, more efficient, less expensive and, generally, more advantageous than said prior apparatus.

According to an essential feature of the present invention, the apparatus includes at least one striking mass which is driven and guided in such manner that, first, it is given an acceleration which makes it possible for it to store a given live force, then it gives off at least a portion of this live force to the element which is to be struck, and, finally, it comes back to its initial position, and so on.

According to another feature of the present invention, in an apparatus of the type above referred to, the tool is combined with a shock absorbing device adapted to come into play when the tool is not operated by the driving means.

According to still another feature of the present invention, an apparatus of the type above set forth is provided with holding means, preferably of an elastic type, adapted to permit of adjusting the tool while the remainder of the apparatus is in operation.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 diagrammatically shows the general arrangement of a tool and hammering or striking means made according to the principle of the present invention;

Fig. 2 is a front view, with the lid removed, of a mechanical hammer provided with striking means of the kind illustrated by Fig. 1, said hammer being made according to the present invention;

Fig. 3 is a side view, partly in section, of the hammer of Fig. 2;

Fig. 4 is a separate view showing, in section and on an enlarged scale, some devices, and in particular shock absorbing means, to be included in an apparatus of the kind shown by Figs. 2 and 3, these devices being made according to the present invention;

Fig. 5 shows a modification of these devices;

Fig. 6 is an elevational view of a device for handling the tool, this device being made according to the invention;

Fig. 7 is a plan view corresponding to Fig. 6.

As above explained, the invention is concerned with apparatus which are intended to produce a succession of shocks on a tool 1 (which may be of any type whatever, according to the purpose for which it is intended).

According to the essential feature of the invention, in order to transmit these repeated shocks on tool 1, I make use of a striking mass which is driven and guided in such manner that, in the course of one cycle,

a. It is given an acceleration which permits of said mass storing up a certain amount of live energy;

b. Then it gives off this energy to the tool by means of a shock (of course any intermediate element coacting with the tool can be interposed between said tool and the striking mass) at least partly, the energy thus transmitted to the tool constituting preferably most of the energy stored up during the preceding portion of the cycle;

c. Finally said mass comes back into its initial position.

This cycle of operations is repeated as long as the apparatus is in operation.

There are many possible embodiments of means for performing this series of operations.

In particular, according to a preferred embodiment, the striking mass is constituted by a ball, a cylinder, or a roller 2.

Concerning the means for driving and guiding the striking mass (ball or the like) they are for instance arranged in such manner that said striking mass 2 is actuated by a member which is preferably of the rotating type, with respect to which it is guided either radially or obliquely. Furthermore, I combine, with this rotating member, means against which the ball can come to bear under the effect of the centrifugal force, so as to move along a curve which is the most suitable for the particular result which it is desired to obtain.

For instance, as shown by the drawing, the rotary driving member is constituted by a tube 3 adapted to turn about an axis 4 preferably provided in line with the axis of the tool.

I might also make use, according to the in-

vention, of a fork-shaped member, or an arm extending through the mass or ball.

The above indicated means should not be given any limitative character.

The means for retaining and guiding the ball so as to cause it to move along a given path preferably consist of a kind of cam 5, which can be fitted, in a removable manner and preferably adjustably, in the frame 6 of the apparatus.

Concerning the surface 7 of this cam which is to coact with the striking ball or mass, it is then arranged in such manner that said ball can bear against it without rebounding, so that it reaches the tool without undergoing any substantial loss of the live energy it has acquired.

Furthermore, advantageously, the effort necessary for driving the ball should be as small as possible within region AB (Fig. 1) extending ahead of the zone in which the ball acts upon the tool. Even, over at least a portion of this region AB, the ball can drive the rotating element 3.

Finally, account should be taken of the fact that, the live energy of the ball in the radial direction being absorbed, at least mostly, by the shock of said ball against the tool, the ball tends to move in a direction perpendicular to the axis of said tool, after said shock.

These conditions seem to be complied with in the most advantageous manner by the embodiment shown by the drawings.

In this case, from a point A, the path of the ball, or outline of cam 5, grows gradually more and more apart from the rotation axis 4, in the direction of rotation *f* of the driving element 3. The end of this portion of the cam is a point B, at which the ball can leave said cam (the latter being suitably cut off at this point, whereby the ball can strike the tool). At this point B, the tangent to the outline of the cam makes, for instance, with the axis of the tool, an angle α approximating 45°, or even substantially smaller than 45°. On the opposite side of the gap thus produced in the cam outline, the latter starts from a point C, preferably located at a level lower than that of point B, with a tangent making with the axis of the tool an angle greater than α and which may even approximate 90°. This outline is then joined to point A, with a gradual reduction of the distance of the successive points thereof from the axis of rotation 4.

In Fig. 1, I have shown the ball at point A, in solid lines, and also in two other positions 2^a and 2^b (in dotted lines), one of these two last mentioned positions (2^a) corresponding to the striking of the ball against the head of the tool.

Figs. 2 and 3 show, with some details, an embodiment of the invention the principle of which has been above described.

The whole of the driving member 3 and the ball 2 is mounted in a frame 6, for instance of cylindrical shape, in which is mounted cam 5, the outer surface of which is adapted to fit in the corresponding housing of the frame.

This cam extends, through notches 8 (already shown by Fig. 1), across the ends of tubular element 3, which is made of sufficient length for constantly guiding the ball. Of course, any other guiding means can be provided.

Element 3 can be driven, for instance, by means of an electric motor contained in a casing 9 provided along frame 6, in such manner as to constitute a structure adapted to be easily handled with the hand, by means of a handle 10, a portion 11 of which is adapted to act as a switch at 12.

The connection between the motor shaft and the shaft of the driving member 3 can be obtained through an elastic belt 13.

Whatever be the specific embodiment that is chosen, its operation results sufficiently clearly from the preceding description for making further explanations unnecessary.

On every revolution of the driving member 3, the ball accumulates live energy, under the effect of the centrifugal force and it gives it off nearly wholly to the tool when said ball leaves the cam at B. Then the direction of the movement changes, that is to say it tends to become a tangential movement, which brings said ball with the minimum of shock against the beginning of cam portion CD, suitably traced for this purpose. Then the whole series of operations is repeated.

Anyway, the ball remains always suitably guided, so that it is accurately led to the place where it is to strike the tool.

The device above described is capable of giving satisfactory results in itself. But it may be completed by the following accessory features, which might even, in some cases, be used separately.

According to one of these features, which will be supposed to be applied to a hammering device such as that above described, the whole is arranged in such manner that the striking action can be exerted directly on the tool or on an element positively connected therewith, in combination with means for absorbing the shocks when the tool is not to be operated.

In this way, I obtain a maximum of efficiency since I avoid, when the tool is in operation, any loss of energy due to the presence of the shock absorbing means, which may remain independent of the tool or the tool carrier, and are brought into play only when the tool is not to be operated.

Furthermore, advantageously, I arrange the whole of the tool and the shock absorbing means in such manner that said tool can be mounted free in a shock absorbing means, which will be hereinafter called brake, whereby, when the work of the apparatus is to be temporarily interrupted and said apparatus is drawn back, the tool can move with respect to this brake and come into a position in which it cannot be reached by the striking mass, which then strikes said shock absorbing means or brake.

In order to comply with the above conditions, I proceed for instance as shown by Fig. 4.

The tool 1 is provided with an extension or tail 14, and an abutment 15. Said tool is engaged in a suitable hole of the frame 6 of the apparatus. This frame is provided with a chamber 16 in which is suitably mounted a sleeve 17 including a shoulder 18 and subjected to the action of a spring 19 or any other elastic device. The tool 1—14 is fitted in its housing with a certain play and its head or end 20, in the working position thereof, is located substantially as shown by the drawings. The striking mass 2, when driven by its mechanism, can therefore directly strike the end 20 of the tool.

The shock is thus transmitted to the tool and it produces its direct effects.

If, for some reason, the apparatus is drawn backwards, tool 1—14 will not follow the frame over the whole of the amplitude of this backward movement, so that the end 20 of the tool

will be retracted with respect to the upper surface 21 of brake 17—18.

Ball 2 will then directly strike the brake and it will no longer reach the end 20 of the tool. In this case, the shocks will be absorbed by the brake.

The modification illustrated by Fig. 5 works in an analogous manner, with the difference that the apparatus is provided with a tool carrier 22 including a tool fixation device 23. This tool carrier is provided with a head 24 and it is permanently mounted in the apparatus. A certain amount of play at 25 enables the tool carrier to move with respect to the frame of the apparatus, and the striking mass 2 can strike the head 24 of said tool carrier, which eliminates the action of the brake. But when, for instance, the apparatus is pulled backward and head 24 comes to bear against a ring 26 of the brake elastically mounted by means of a spring 19 or any other elastic device, the shocks of mass 2 are absorbed by the brake.

According to another characteristic of the present invention, I provide means for directly mounting the tool while the apparatus is in operation, these means advantageously including a holding member constituted by a pivoting elastic piece mounted on the tool, the tool carrier or the like, which piece advantageously consists of a steel wire bent in hairpin fashion.

Such an arrangement avoids the unbalance of the receiving portion which is struck by the movable mass; it reduces the inertia thereof due to the reduction of its weight, and it insulates the operator from the vibrations, which are generally transmitted thereto through the tool operating bar.

As a matter of fact, it is known that it is generally necessary to be able, in the course of the work, to turn the tool about its axis. In apparatus such as exist at the present time, this operation is generally performed by means of a relatively important transverse bar or of a plurality of such bars, which increase the weight of the moving portion of the apparatus and unbalance it. These relatively heavy elements are therefore advantageously replaced, according to the present invention, by the above mentioned hairpin-shaped piece, shown at 27 by Figs. 6 and 7. This piece facilitates the handling of the tool, especially when a work is to be performed at places which are not easy to reach, for instance in corners, and, for practical purposes, it does not substantially increase the inertia of the apparatus.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

What I claim is:

1. In an automatic hammer having a frame, a tool slidably mounted upon said frame, a striking roller mass, and means supported in said frame for guiding said mass into striking relationship with said tool, said means comprising means for guiding said mass in both a revolutionary and radial direction with respect to a center, and a cam presenting a smoothly curved surface lying in a plane including the longitudinal axis of said tool and starting from a point slightly below the upper face of said tool, the tangent of said surface at said starting point being substantially normal to said axis, said curved surface decreasing in radial distance from said center to a second point lying in the third quadrant from said starting point and then increasing in such radial distance to an end point located above the upper face of said tool, and said surface having a tangent at said end point which intersects said axis below the upper face of said tool and makes an acute angle of the order of 45° with said axis.

2. In a hammer as in claim 1, a guard sleeve elastically supported upon said frame and surrounding said tool, and having an upper edge normally lying in a plane above said starting point of said curved surface.

JACQUES PIERRE HENRI FRANCASTEL.