(No Model.)

E. HAMMESFAHR.

POWER HAMMER.

No. 535,446. Patented Mar. 12, 1895.

Fig. 1.

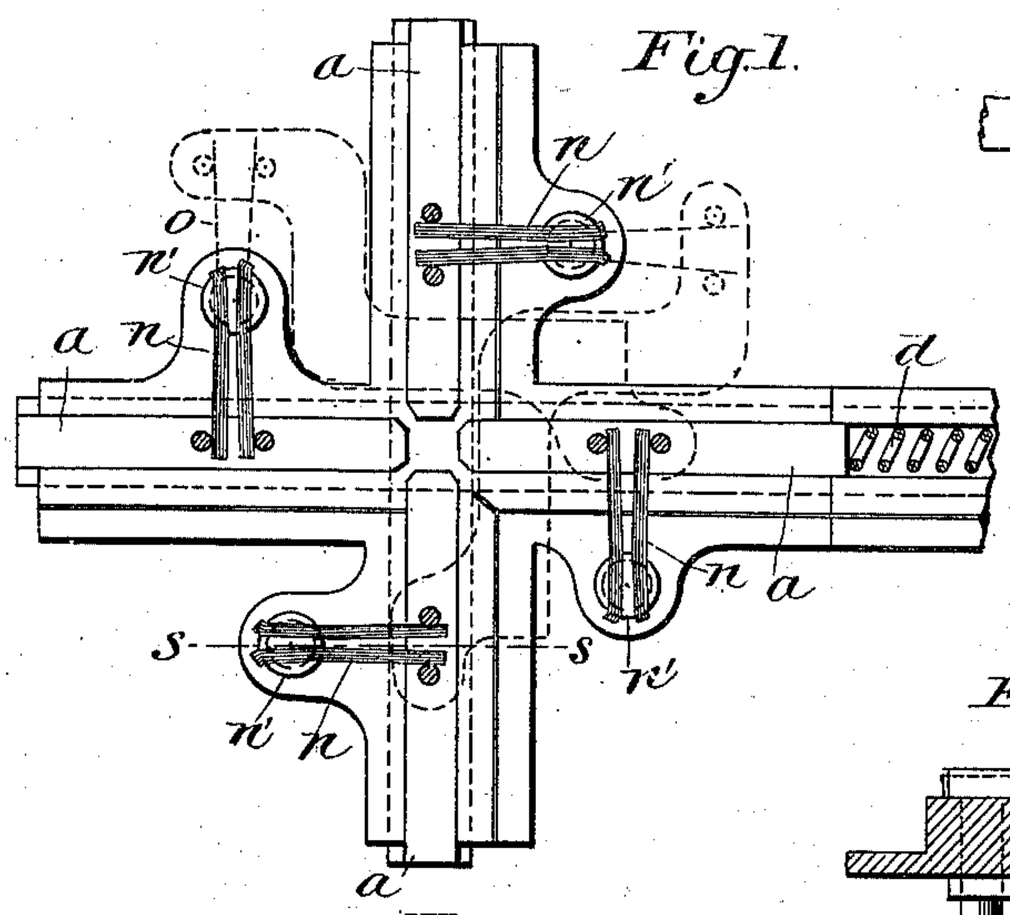


Fig. 8.

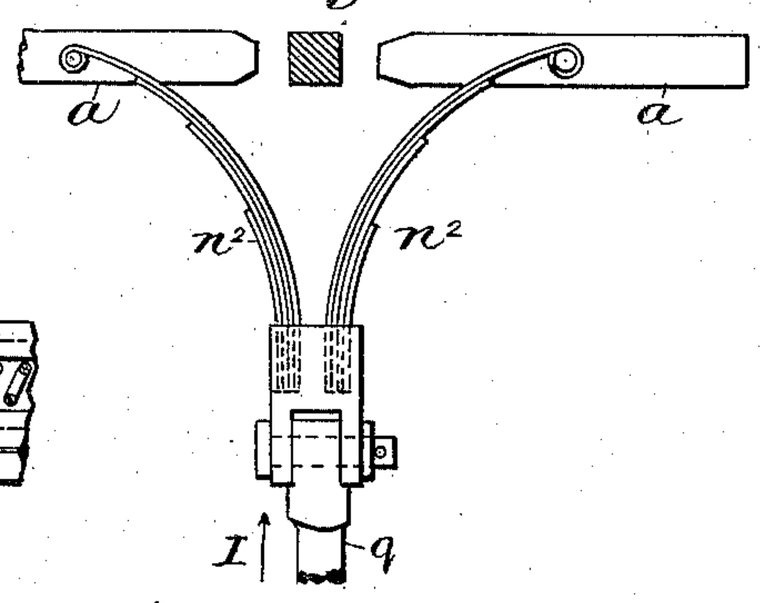


Fig. 7.

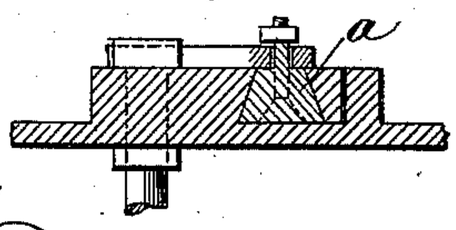


Fig. 2.

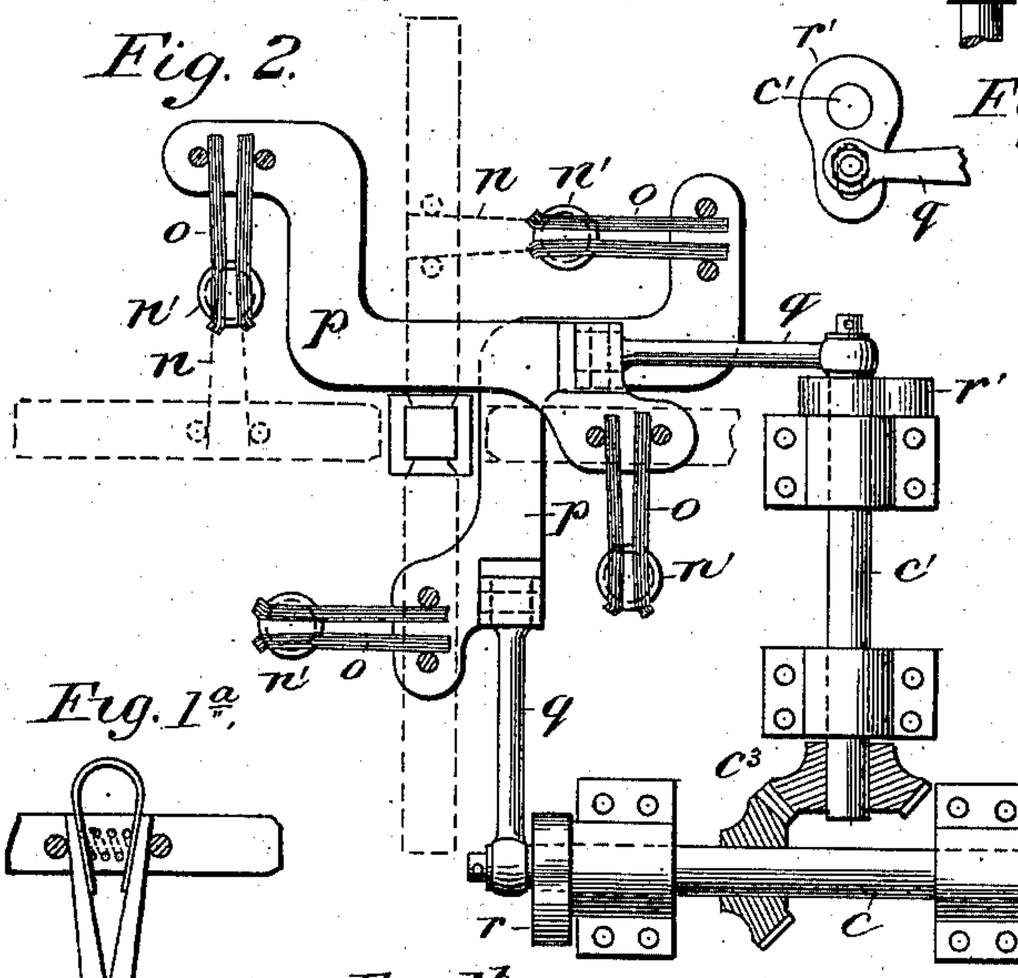


Fig. 2a.

Fig. 8a.

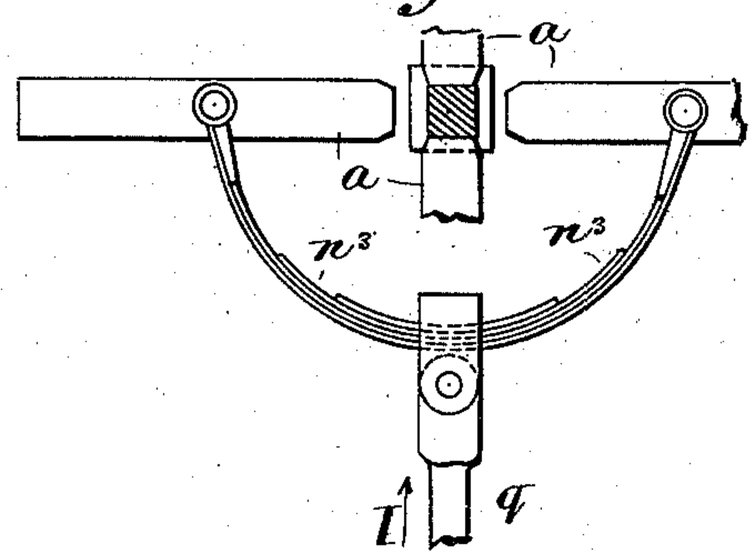


Fig. 1a.

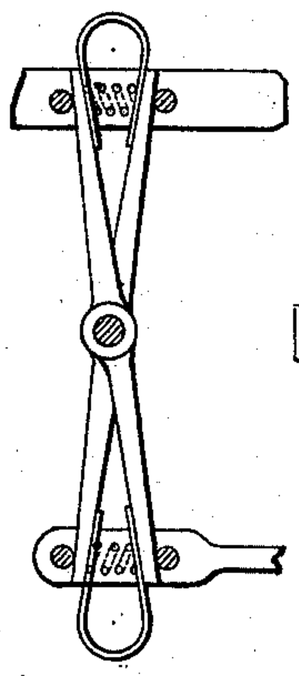


Fig. 1b.

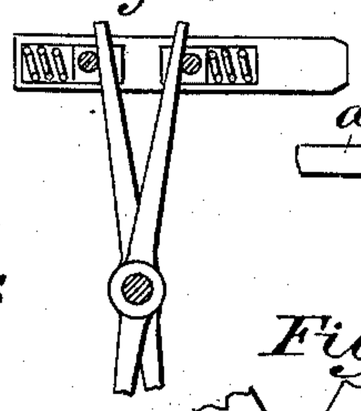


Fig. 3.

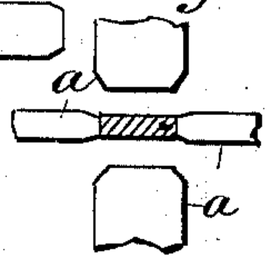


Fig. 4.

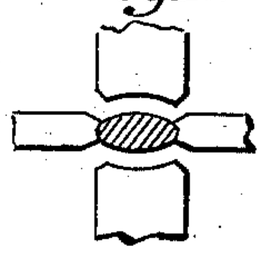


Fig. 5a.

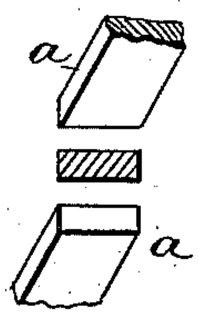


Fig. 6.

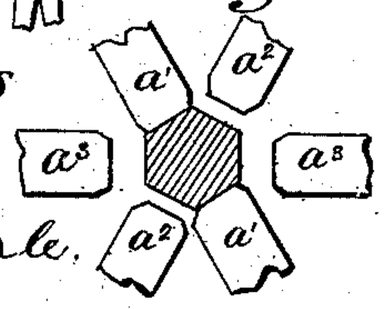
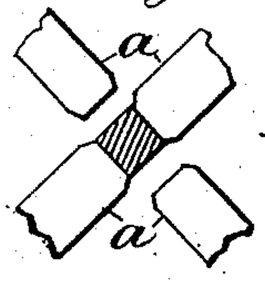


Fig. 5.



Witnesses

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By Thomas Drew Stetson

Attorney

UNITED STATES PATENT OFFICE.

ERNST HAMMESFAHR, OF SOLINGEN, GERMANY.

POWER-HAMMER.

SPECIFICATION forming part of Letters Patent No. 535,446, dated March 12, 1895.

Application filed April 20, 1892. Serial No. 429,981. (No model.) Patented in Switzerland March 5, 1892, No. 5,115; in France March 5, 1892, No. 219,896; in England March 5, 1892, No. 4,409; in Belgium March 5, 1892, No. 98,664; in Italy March 31, 1892, LXVI, 404, and in Austria-Hungary September 30, 1892, No. 2,390 and No. 2,412.

To all whom it may concern:

Be it known that I, ERNST HAMMESFAHR, a subject of the Emperor of Germany, residing at Solingen-Foche, in the country of the Rhine, Prussia, Germany, have invented a certain new and useful Improvement in Power-Hammers, (which has been patented in the following foreign countries: Austria-Hungary, September 30, 1892, tom. 42, folio 2,412, and tom. 25, folio 2,390; Great Britain and Ireland, March 5, 1892, No. 4,409; France, March 5, 1892, No. 219,896; Belgium, March 5, 1892, No. 98,664; Italy, March 31, 1892, volume 66, No. 404, and Switzerland, March 5, 1892, No. 5,115;) and I do hereby declare that the following is a full and exact description thereof.

My improvement is intended mainly for forging iron and steel in a heated condition, and I will describe it as thus applied. I use the term "hammer" in this paper to indicate the assemblage both of the hammer or hammers proper which strike and shape the hot iron with the parts which operate and guide such parts. I provide for operating pairs of hammers, each member striking the article simultaneously with a corresponding blow from the opposite member of the pair, the hammers of each pair approaching and receding simultaneously. I can work three pairs or a greater number. I prefer for ordinary work two pairs. I arrange to have one pair retreat while the other pair is striking its blow. I operate by parts adapted to yield elastically to sufficient extent not only to allow for imperfections in the workmanship and want of absolute co-incidence in the motion of the driving parts with those of the hammers, but also to allow the hammers to follow the yielding metal as the latter is reduced without requiring any adjustment of the mechanism. The elasticity also allows the hammers when driven at a high velocity to move farther and strike harder than would be otherwise practicable with a given throw of the cranks or other impelling means.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a side elevation showing the hammers and their guiding means with a portion of the means for actuating them. Figs. 1^a and 1^b are elevations partly in section showing modified forms of the spring connections. Fig. 2 is an elevation corresponding to Fig. 1, showing more fully the mechanism for actuating the hammers, which latter are shown only in dotted lines. Fig. 2^a is an end elevation of a portion. Fig. 3 is a cross-section through a flat bar, with the adjacent ends of suitable hammers therefor. Fig. 4 represents corresponding parts with a bar of elliptical cross-section. Fig. 5 is a corresponding view showing a rectangular bar and hammers therefor, with the hammers working in inclined paths. Fig. 5^a is a corresponding view showing the hammers arranged obliquely for certain purposes. Fig. 6 is a corresponding view, showing a bar of iron being treated of hexagonal section, with the adjacent ends of six corresponding hammers. Fig. 7, partially attached to Fig. 1, is a cross-section through one of the hammers and its guiding means on the line *s*—*s* in Fig. 1. Fig. 8 shows a modification in the means for working one of the pairs of hammers. Fig. 8^a shows another modification. This figure shows the adjacent ends of two pairs of hammers.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

In this power hammer couples or pairs of dies or striking faces placed opposite each other are moved together from opposite sides, the hot iron or other piece to be worked to compress, stretch, forge or in any other way work the same without using any fixed anvil. In the figures are represented a number of instances showing how such a power hammer may be worked with four dies moved by the ends of levers *n* which turn on pivots *n'*, and are operated by means of suitably guided yokes or connecting pieces *p*, which I will term cross-heads. These cross-heads are moved through elastic connections from links *q* operated by cranks *r r'* on the shafts *c*, *c'*, the two cranks being coupled by beveled gear c^3. The cross-heads *p* move each pair of dies alternately asunder, and toward each other. I work at such velocity that the dies by the

elasticity of the springy levers *n*, *o*, receive such an oscillation that a sufficient stroke is obtained under all conditions. The eccentrics or cranks may be arranged for adjustable lift.

Fig. 2ª shows one of the cranks *r'* with the pin adjustable radially in a slot in the crank so as to vary the throw. The elasticity in the connections allows the dies to yield so that they may vibrate more or less than the throw of the crank. The connections to each die in a pair have a practically uniform elasticity. The die which is nearest to the crank receives its motion not directly from the crank but through the adjacent rocking shaft *n'* which is provided with two sets of elastic arms, both on the side toward the die. One set of elastic arms, that shown in the figures, communicates the motion from the cross-head *p* to the rocking shaft *n'*. Another pair of elastic arms, which are similar and exactly in line with the first described set, communicate the motion back again from the shaft *n'* to the die. That die is by this means moved elastically.

The die which works opposite to the one just described receives an equal motion through a connection which is equally elastic. This is effected by the cross-head *p*, which communicates its motion through elastic arms *o* to the rocking shaft *n'* which is farthest from the crank, and this rocking shaft in turn communicates the motion to its proper die through another set of elastic arms which extends from the shaft *n'* in the opposite direction to the arms *o*. These are indicated in dotted lines in Figs. 1 and 2. It follows that the two dies of each pair are actuated to an equal extent and with an equal amount of elasticity in the connections.

The levers *n*, *o*, may be made in different ways elastic, or there may be added provisions for making the connections of the levers to the hammers yielding or springy. The levers themselves may be made of single or of many plates of spring steel, as shown in Figs. 1 and 2; or springs may be inserted between the lever arms, as shown in Fig. 1ª; or the (pivots) cams on which the levers engage may be placed in springy bearings, as shown in Fig. 1ᵇ.

Either the levers *n* or the levers *o*, may be made rigid if other parts be made springy. Special springs *d* may be applied for re-inforcing the strokes as is represented in Fig. 1, on the right hand side. The lift of the hammers may be adjusted by varying the lengths of the levers *n*, or *o*, or by varying the lengths of the cranks to forge flat-edged, oval or otherwise shaped pieces of unsymmetrical cross-section, as shown in Figs. 3 and 4. Such a power hammer may also work horizontally, or, according to requirement, the hammers may be arranged for oblique hammering, as shown in Fig. 5. Moreover the hammers being adjusted obliquely may work for file cutting, as shown in Fig. 5ª. For this purpose the hammers may be formed with cutters, or have suitable cutting tools inserted. In this way square, flats, oval, half round, &c., files may be cut simultaneously on two or four sides. Rods of any form of cross section for any purpose may be forged, stretched or ornamented. The number of dies may also be increased, and by means of six or eight dies working by couples properly succeeding each other, there may be six or eight side pieces worked without anvil, as shown in Fig. 6. In such case, firstly the couples of die *a'*, *a'*, then the couples of dies a^2, a^2, then a^3, a^3, and so on, will successively approach together and retreat. On the other hand, if the number of dies are to be reduced, one pair may be put out of use by disconnecting a wheel, or taking off one connecting rod. The machine can be worked successfully with only one pair of dies. The moving of the dies may, as shown in Figs. 8, and 8ª, also be effected by springy rods n^2, or by springy pull or push hoops n^3, which arms engage the dies, and are moved by a common connecting rod. If the rod *q*, be pushed forward in the direction of arrow I, the well guided dies *a*, are moved in the one and the other direction from off the work-piece, in order, by the return movement of the rod *q*, through its drawing action, and under the influence of the spring power of the parts n^2, n^3, to strike at the same time against the work-piece.

I claim as my invention—

1. The combination with two or more pairs of opposing hammers, of spring connections between opposing hammers of a pair, a separate mechanism for each such pair to transmit power thereto, and connections between the mechanisms of different pairs arranged to bring them forward in succession, substantially as described.

2. The combination with a pair of opposing hammers, of a rock shaft for each hammer, a power driven reciprocatory part common to the hammers of the pair, an arm of each rock shaft connected with the said reciprocatory part, and an arm of each rock shaft connected with its corresponding hammer, one or more springs being arranged to form part of each of the rock shaft connections through which the power is transmitted from said reciprocatory part to the respective hammers, substantially as described.

In testimony whereof I have hereunto set my hand, at Solingen-Foche, this 24th day of February, 1892, in the presence of two subscribing witnesses.

ERNST HAMMESFAHR.

Witnesses:
WM. ESSENWEIN,
RUDOLPH FRICKE.