April 21, 1925. 1,534,411

L. J. POTTER

METHOD AND MEANS OF COUNTERBALANCING CRANK SHAFTS

Filed Jan. 3, 1924

Fig. 1.

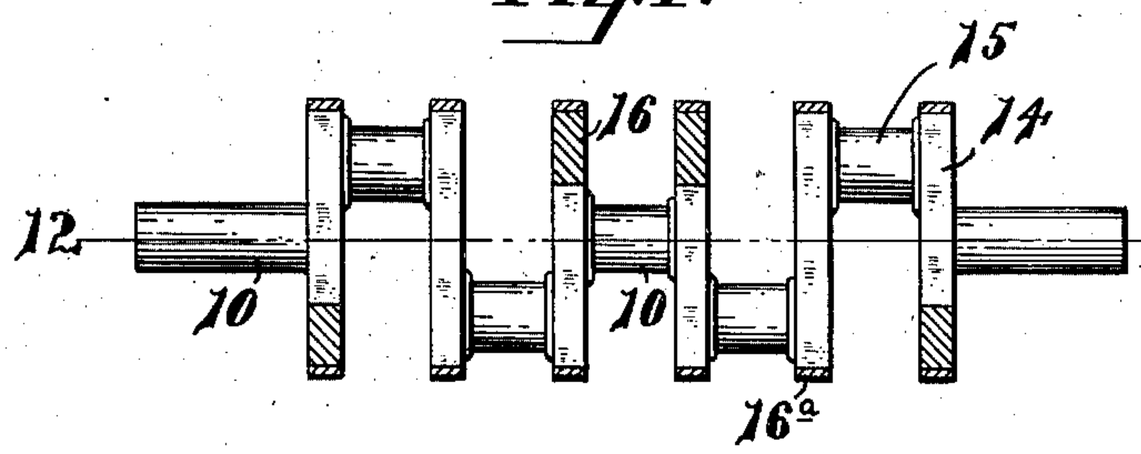



Fig. 2.

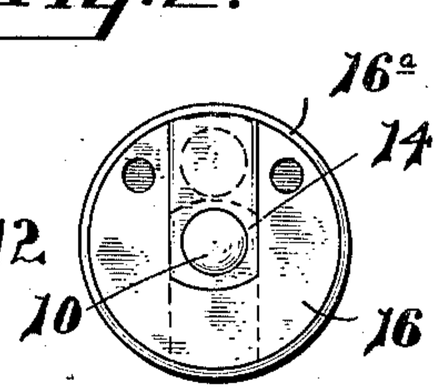



Fig. 3.

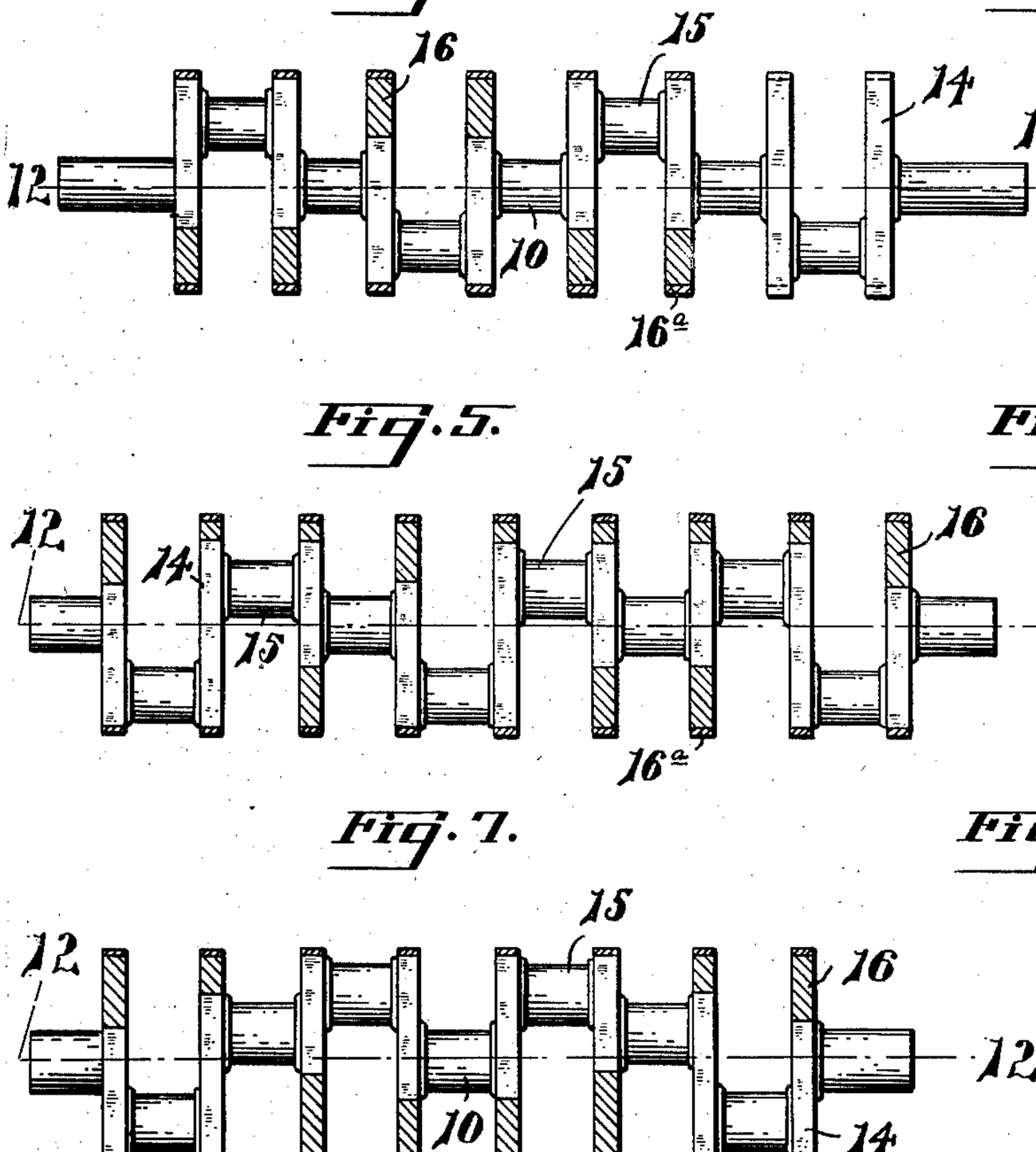



Fig. 4

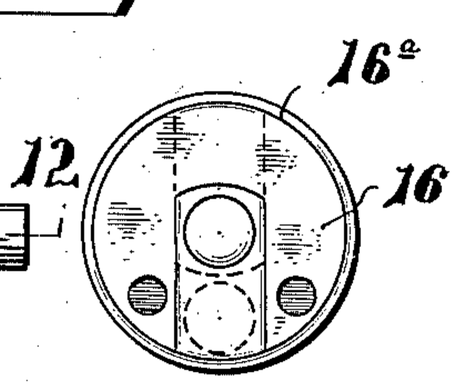



Fig. 5.




Fig. 6.

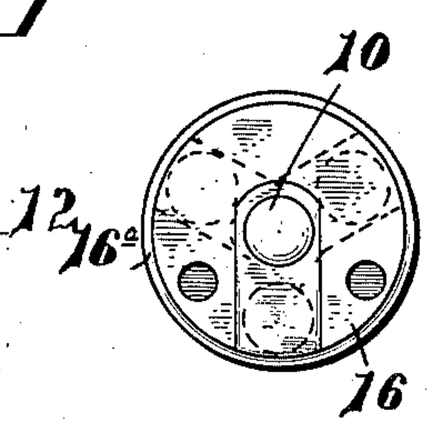
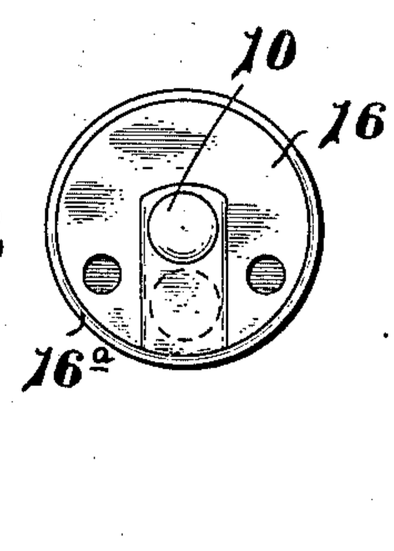



Fig. 7.




Fig. 8.




INVENTOR
LYMAN J. POTTER.
BY.
Dewey, Strong, Symmes & Potter.
ATTORNEYS.

Patented Apr. 21, 1925. 1,534,411

# UNITED STATES PATENT OFFICE.

LYMAN J. POTTER, OF SAN FRANCISCO, CALIFORNIA.

## METHOD AND MEANS OF COUNTERBALANCING CRANKSHAFTS.

Application filed January 3, 1924. Serial No. 684,268.

*To all whom it may concern:*

Be it known that I, LYMAN J. POTTER, a citizen of the United States, residing in the city and county of San Francisco, and State of California, have invented new and useful Improvements in Methods and Means of Counterbalancing Crankshafts, of which the following is a specification.

This invention relates to a method and means of counterbalancing crankshafts.

Prior to my invention crankshafts for multi-cylinder automotive and like internal combustion engines have been counterbalanced with the object in view of eliminating vibration and to increase the efficiency of such engines. In prior methods the inertia and centrifugal force of each crank web and crank pin were taken into consideration and compensated for to overcome the distortive strains which they exert on the crankshaft and thereby place the latter in running balance as well as in static balance. This was accomplished by counteracting the unbalanced centrifugal forces by opposing thereto similar forces applied to the crankshaft as nearly as possible in the same radial plane.

These prior methods have not been universally applied in commercial practice due chiefly to the fact that crankshafts are die forged and no entirely satisfactory means has been produced by which counterweights may be inexpensively applied to crankshafts in a manner insuring that the counterweights will not become loose or fly off when the engine is operating under high speed.

It is the principal object of the present invention to provide crankshafts with counterbalancing means which will be inexpensive to apply to any type of crankshaft, efficient in operation and not liable to become loose or free from the crankshaft.

The invention is exemplified in the following description and illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a view in elevation of a three-bearing four-throw crankshaft with my invention applied thereto.

Fig. 2 is an end elevation of the same.

Fig. 3 is a view in elevation of a five-bearing four-throw crankshaft with my improved counterbalancing means thereon.

Fig. 4 is an end elevation of the same.

Fig. 5 is a view in elevation of a four-bearing six-throw crankshaft counterbalanced according to my invention.

Fig. 6 is an end elevation of the same.

Fig. 7 is a view in elevation of a three-bearing six-throw crankshaft of my improved counterbalancing means thereon.

Fig. 8 is an end elevation of the same.

The crankshafts disclosed in the accompanying drawings are types constructed according to common practice. Each of these crankshafts is formed with bearing portions 10 which are in axial alignment with the longitudinal axis of the crankshaft which is shown in dot and dash lines 12—12 in Figs. 1, 3 and 5. The crankshafts are also formed with the usual radial crank webs 14 which carry crank pins 15. These latter elements lie in radial planes and generally 120° or 180° apart and equal distances from the longitudinal axis of the shaft.

An ordinary six-throw crankshaft with the crank pins lying 120° apart is substantially in static balance. However, these shafts when mounted in three or four bearings are not in running balance. That is, when the shaft is in rotation the centrifugal forces generated pull the shaft in different directions at different points along its length. When the speed of the shaft increases so that these forces can overcome the bending moment of the shaft, each one of these forces will produce shaft deflection and the shaft is no longer in balance. To counteract these unbalanced forces, on each crank web I arrange a counterbalance 16. These counterbalances are in the form of discs placed in a plane at right angles to the axis of the shaft and concentric with respect to said axis.

In applying these discs to the shaft I arrange a rigid retaining ring 16ª the width of the disc and preferably of steel in proper position around the crank web concentric with respect to the axis of the shaft and in plane at right angles to said axis. A plate (not shown) is then placed on the sides of the ring and the space intermediate the ring and the web is filled with an alloy metal in a molten condition. This metal when it hardens forms a bond between the ring and the web and provides the necessary weight with which to counterbalance the shaft.

To compensate for the crank pin, and portions of the webs, I prefer to core out a por-

tion of the metal as indicated at 17 in Figs. 2, 4 and 6.

By my invention I am enabled to counterbalance crankshafts in an inexpensive and effective manner and while I have disclosed my invention as now known to me, it is to be understood that various changes in its formation, construction as well as steps in the method may be made by those skilled in the art without departing from the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A method of counterbalancing crankshafts which comprises filling the space between the webs of the crankshaft and rigid circular bands arranged about the webs concentric with respect to the axis of the crankshafts with material in a fluid condition, and then permitting said material to harden to form a rigid bond between said bands and said webs.

2. A method of counterbalancing crankshafts which comprises filling the space between the webs of the crankshaft and rigid circular bands arranged about the webs concentric relative to the axis of the crankshaft and in a plane at right angles to said axis with metal in a molten condition, and then permitting said metal to harden to form a rigid bond between said bands and said webs.

3. A method of counterbalancing crankshafts which comprises filling the space between the webs of the crankshaft and rigid circular bands arranged about the webs concentric relative to the axis of the crankshaft with metal in a molten condition, coring out a portion of said metal during the molding thereof to compensate for the weight of the crank pins of said crankshaft, and then permitting said metal to harden to form a rigid bond between said bands and said webs.

4. A method of counterbalancing crankshafts which comprises molding disks on the webs of the crankshaft concentric with respect to the axis of the crankshaft and substantially at right angles to said axis.

5. A method of counterbalancing crankshafts which comprises molding disks directly on the webs of the crankshaft concentric with respect to the axis of the crankshaft and substantially at right angles to said axis, and coring out portions of said disks to compensate for the weight of the crank pins of the crankshaft.

6. In combination with a crankshaft having substantially radially extending webs carrying crank pins, of rings arranged around said webs concentric with respect to the axis of the crankshaft and in a plane substantially at right angles to said axis, and metallic fillers between said rings and said webs, said fillers forming a rigid bond between said rings and said webs, said fillers being formed with recesses to compensate for the crank pins on the crankshaft.

LYMAN J. POTTER.