circular feeds of the miller are disengaged, and only the cross feed employed, the whole platen swinging on the centre pin of the attachment, the platen carriage adjusting itself thereto. Adjustment for locating the milling cutter for the successive cuts on the different edges, is made through the screw on the end of the rod E. The inside edges of the link are open to machining by milling, from the fact that the clearance holes at the end have been previously drilled and slotted. The correct radius is set from the pin on the carriage of the attachment. Following this the oil holes are drilled.

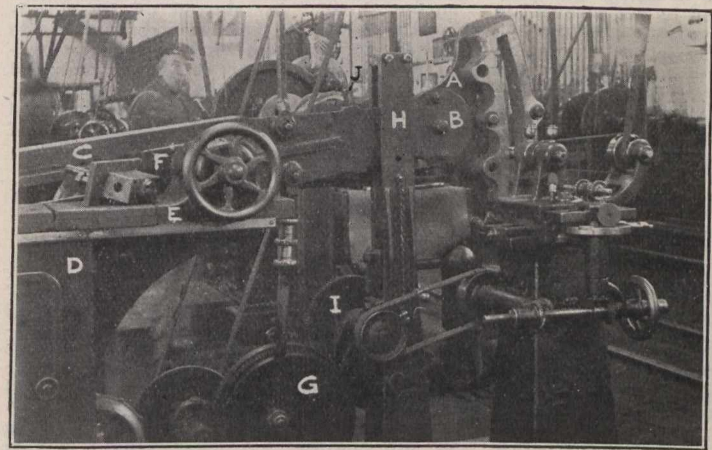

Fig. 6. Grinding to Radius the Inner Surfaces of the Link.

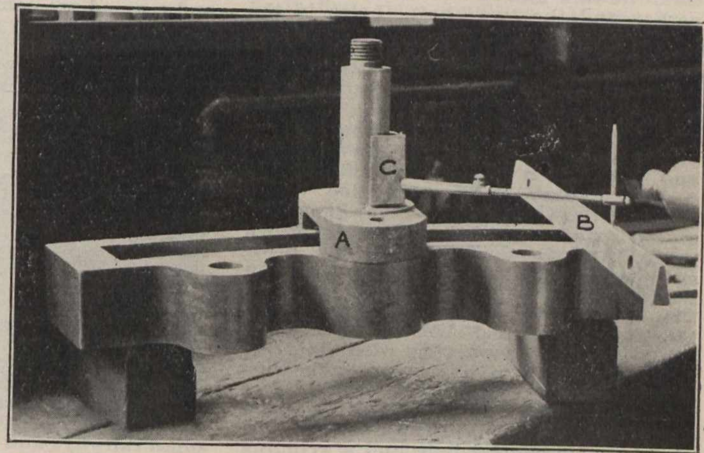

Fig. 7. Testing the Saddle Base on the Link Surface.

The next step is to file the link all over, preparatory to the case-hardening process to which it is subjected on the completion of the filing. The case-hardening tends to warp the link, requiring a subsequent straightening under a press. This is followed by a grinding of both surfaces on a surface grinder. The holes for the eccentric rod pins are then lap ped out, and case-hardened and ground bushings forced into them.

The final operation on the link is that of grinding the inner surfaces to a correct radius. A specially designed machine, the construction of which is

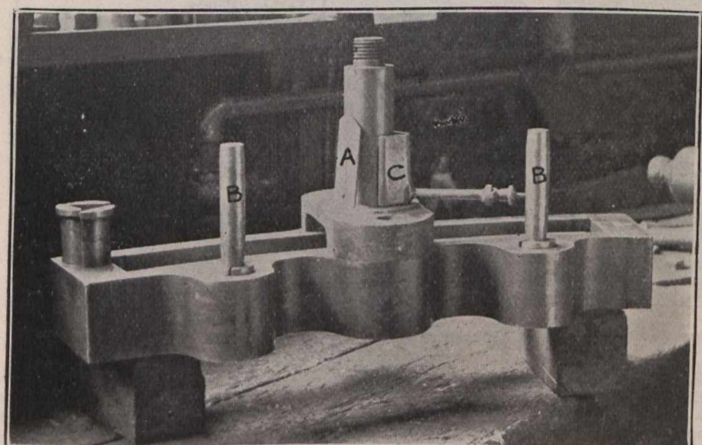

Fig. 8. Locating the Saddle Correctly on the Link.

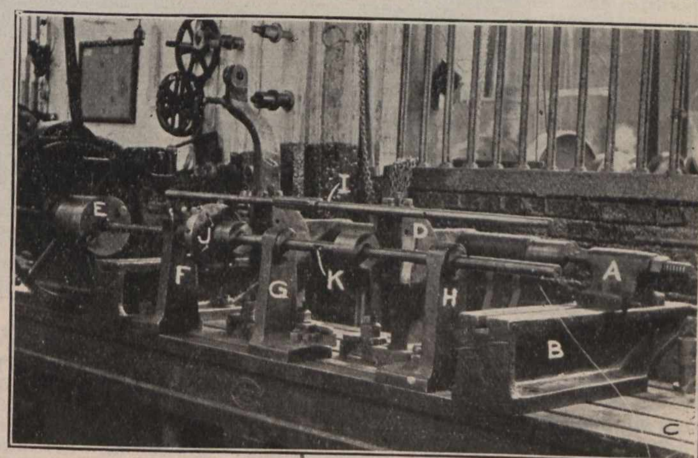

Fig. 9. Machine for Finishing the Tumbling Shaft Arms.

shown in fig. 6, in conjunction with a standard grinder which is likewise shown, performs this operation. On a plate, A, the link to be ground is mounted. This carrying plate, A, is pinned at B to a long slotted arm, C, an arm of the plate A passing back a couple of feet alongside. A stand, D, carries on its upper surface a carriage, E, adjustable along the top in guided ways. Through the centre of the carriage E, there is a pin on which plates F, for clamping the slotted rod C are free to oscillate. The clamp plates, F, are secured to the slotted rod in any position of the carriage E, by the handwheel in front of the carriage. The slotted rod is oscillated by a connecting rod of variable length from the power driven wheel, G, on which any throw of the crankpin may be obtained. The oscillating arm is guided in its movements by the supports, H, between which the arm moves vertically. In the foreground stands the standard grinder, driven from above. The feed, however, is derived from the oscillating arm drive through the train of gears, I, making the speed and feed interdependent.

The oscillating arm and supporting carriage are first set to give the correct radius. The link is then approximately attached as previously mentioned, when, by trial, it will be found that while the radii of the link and machine are the same (from the original setting), the centre for the link arc will probably be slightly above or below that of the oscillating arm. To remedy this, it is not necessary to loosen the link from its supporting plate. As previously mentioned, this plate A, pinned at B, projects back alongside of the arm C, (on the other side of the arm, so not visible). Setscrews, J, through bosses on the rear side of this arm, bear on the end of the plate A, adjustment for coincidence being there attended to.

THE SADDLE is made from a solid forging, and after reaching the machine shop, is turned and milled all over to the form shown in figs. 7 and 8, where it is mounted on the link. In view of the fact that a great deal of wear comes on the pin, that part of the saddle is case-hardened and ground. Following this case-hardening of the pin end, the base is refaced in the lathe.

The next step is that of determining the alignment of the saddle with regard to the ground surface of the radius link to which it is attached. The method of doing this is shown in fig. 7. A saddle, A, is mounted into approximate position on the link. Near one end of the link, a triangular straight-edge, B, made this shape so that it will sit without support, is placed. A form of surface gauge, C, adjustable in two directions, is held against the pin of the saddle on its V shaped base. Each edge of the V shaped base has a small projecting pin, forming the gauge support on the shoulder of the saddle. The arms of the surface gauge are adjusted so that the point just scrapes the top of the straight edge when pressed against the saddle pin and resting on the saddle shoulder. The gauge is swung out in turn to each end of the straight-edge, any error being noted. The straight-edge is then moved across to the other end of the link and this same process repeated. Any variation in height at these four tested points is compensated for by scraping the base of the saddle on the side or corner that will give the required correction.

Locating the saddle is the next operation to require attention, and the method of so doing is shown in fig. 8. This saddle must not only be located midway between the eccentric rod pin holes, it must also have the exact offset over the slot of the radius link. The saddle is first located as close to its correct position as it is possible to do so by eye. The next step is to locate the saddle over the link slot to give the correct offset; this is done by the use of the plate gauge shown standing up against the saddle pin at A. The distance from the right hand edge of this gauge to the centre point of the upper end, is made exactly to suit the offset required. Putting this centering gauge under the saddle against a wall of the slot, and bringing the lathe centre hole of the saddle to fit over the gauge point, places the saddle in its proper location.

This having been accomplished, the centralizing of the link with regard to the eccentric rod pin holes follows. Two pins, B, fit into segmental bushings in the eccentric rod pin holes. These segmental bushings to hold the pins, are made in