Detachable Rowboat Motor Work

By Ethan Viall

SYNOPSIS—A description of some of the more noticeable operations in a shop building small detachable rowboat motors. An unusual method of producing eccentric piston rings by means of a special turret attachment. Turret machine and disk grinder work on cylinders. Seven operations on a flywheel at one setting, most of which are simultaneous. Details of two interesting drilling jigs. A worth while enameling process. Testing and handling the finished motors.

In the building of a portable motor for the propelling of an ordinary rowboat in the same way that a regular motor boat is propelled, a light, compact, easily started, reliable motor is required rather than one in which some of these qualities are sacrificed to produce speed. No effort to build a racing motor, on even a moderate scale, is made by the Evinrude Motor Co., Milwaukee, Wis., in the production of its line of detachable rowboat motors. This company makes a two-cycle motor, weighing 50 lb.,

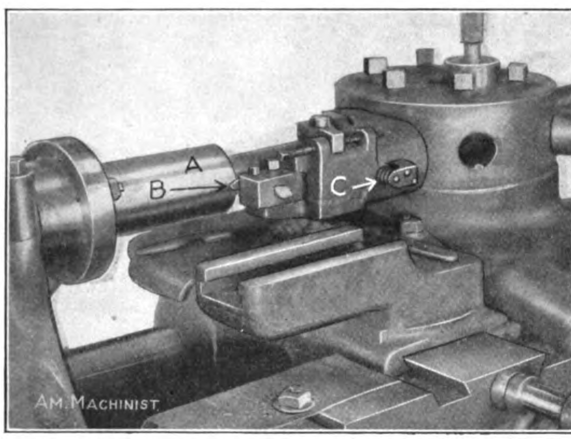


Fig. 1. Turret Lathe Fitted for Turning Piston Rings

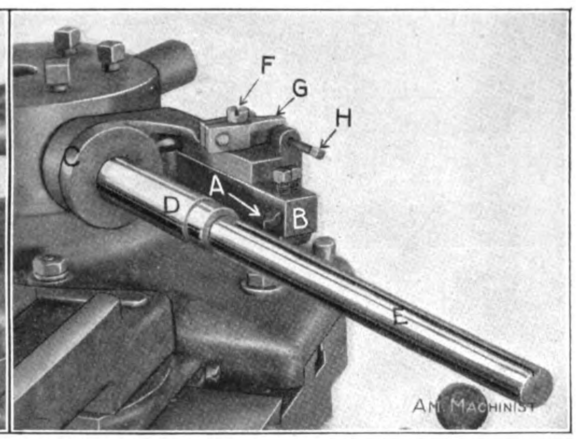


Fig. 2. Details of Eccentric Turning Attachment

that is easily carried, gives little trouble, and will propel a common rowboat at the rate of seven or eight miles an hour.

Owing to the fact that the parts of the motor are small and light, and that the motors are used mainly by those who know little or nothing regarding the mechanism, very careful workmanship and good material must go into every part, and this, together with the simplicity of the design, is aimed to make the device as reliable and foolproof as possible.

A large proportion of the factory methods of production, is just good, uptodate shop practice, similar to that found in scores of other first-class motor factories, but some of the operations that are a little out of the ordinary are described in this article.

Boring and Turning Piston Rings

The castings or pots, from which the piston rings are made, are cast with a flange on one end, so that they may be easily clamped to a faceplate in a turret lathe, as shown at *A*, Fig. 1. The inside is first bored out concentric, with regular boring tools held in the turret, and then the outside is turned eccentric, with an interest-

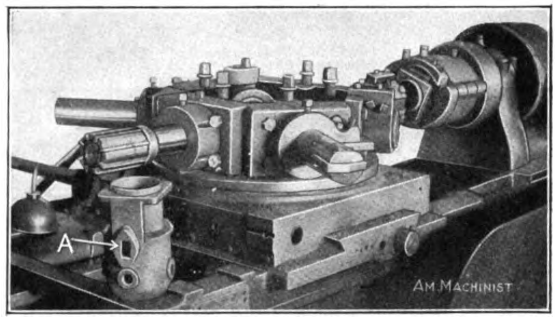


Fig. 3. Boring, Reaming and Facing Cylinders

ing turret fixture, shown in position in the engraving. The turning tool *B* is carried on a bar pivoted near the middle, the inner end of which is pressed against a cam by the spring *C*. The construction and operation of this device, will be more clearly understood by reference to Fig. 2.

In this engraving the turning tool is shown at *A*, set into the end of the swinging bar *B*. The opposite end of this bar is pressed against the cam *C*, by means of the spring previously referred to. The cam is keyed solidly to the bar *D*, the inner end of which is set into a bearing in the fixture, so as to be free to revolve. A keyway or spline *E*, is cut in the outer pilot end. The faceplate holding the ring casting has a keyed pilot hole in it, through which the splined end of the bar *D* is thrust.

When the turret fixture is in cutting position, the turning of the lathe spindle drives the bar and cam with it, giving the cutting tool the motion desired. The amount of eccentricity turned may be varied to a certain extent by adjusting the pivot pin *F*, which is eccentric. To hold this pin in whatever position it is set, a clamp *G* is placed on it, the tail of which is held between two set-screws like *H*. As will be noted, a slot is cut in the top of the pivot pin, in which a screwdriver may be used, to facilitate setting.

Cylinder Work

Cylinders are bored and reamed, and the flanges machined, on the type of machine shown in Fig. 3, after which they are ground out in a Heald grinder. One of the machined cylinders is shown at *A*, and another is in the holding fixture on the spindle nose. This holding fixture is the simple box-and-cover type frequently used.

The flanged boss *A*, Fig. 4, is faced off on a Besly disk grinder, the cylinder casting being held on the expanding plug *B*, over which the bore fits. This plug is expanded by turning the handle *C*, which draws in a taper inner plug and expands the outer.

Machining Flywheels

The small flywheels are cast with four holes through the web, and are practically finished all over at one setting. As shown in Fig. 5, which is a view taken looking down on the machine, the flywheel is clamped to the driving plate by means of two bolts through holes in the web. The two tools in the cross-slide holder *A* turn each side of the rim at once. Tool *B* in the turret fixture, roughs off the rim, and is immediately followed by tool *C*, which finishes it. While this is going on, the drill *D* is going through the hub. When the drill is in the proper distance, tool *E* starts to turn the outside of the hub. This is followed by the facing tool *F*, which finishes the end of the hub. Stop *G* indicates the distance to feed in to make the hub the right length.

This method saves a number of handlings used in former ones.

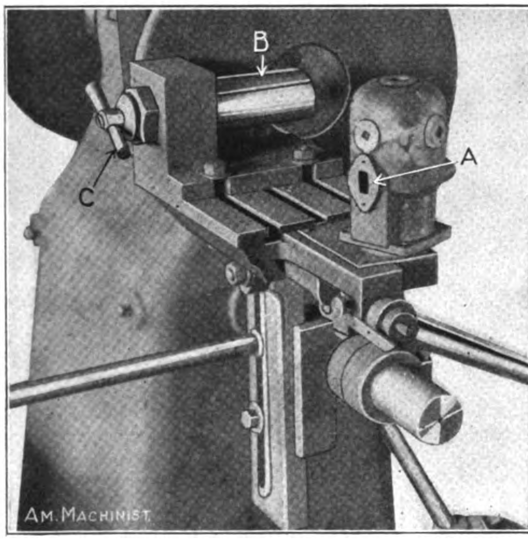


Fig. 4. Special Disk-Grinding Fixture

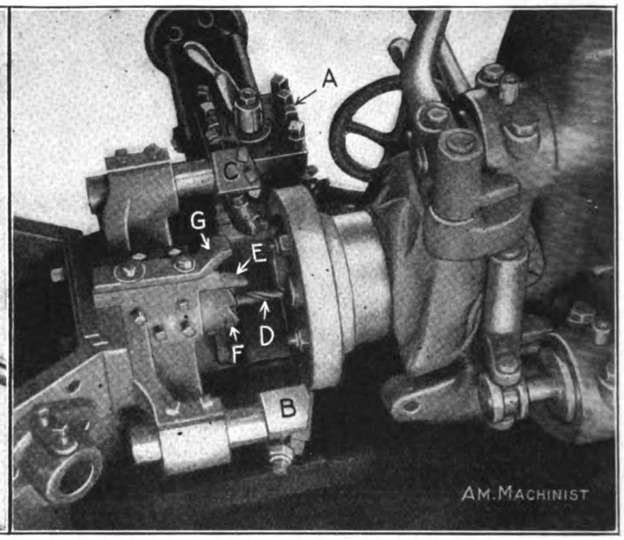


Fig. 5. Tool Layout for Machining Flywheels

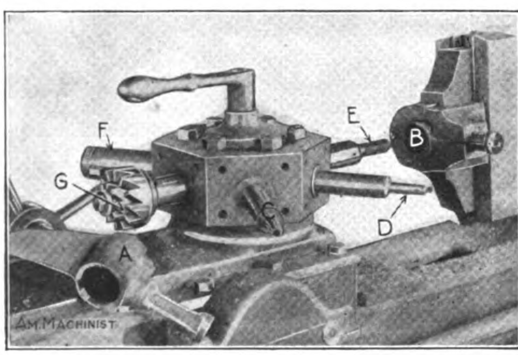


Fig. 6. Boring Gear Housings

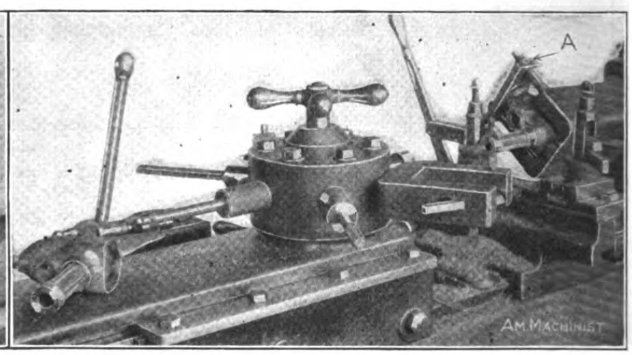


Fig. 7. Second Operation on Gear Housings

Machining Gear Housings

The bronze gear housings, in which the bevel gears that run the propeller are set, are a combination of housing and rudder, as shown at *A*, Fig. 6. The rudder not only helps to steer the boat, but, being in front of the propeller, acts as a guard for it against rocks or other obstructions in the water.

The gear-housing casting is held in a universal, two-jawed chuck, fitted with special formed false jaws, as shown at *B*. The small hole at the back is rough- and finish-bored with tools *C* and *D*, and tapped with tap *E*.

The large part is bored out with the tool *F*, and the end counterbored and faced with the tool *G*.

The housing next goes to the machine shown in Fig. 7, where it is located on a plug in the holding fixture over which the counterbored hole fits. A strap clamp *A*

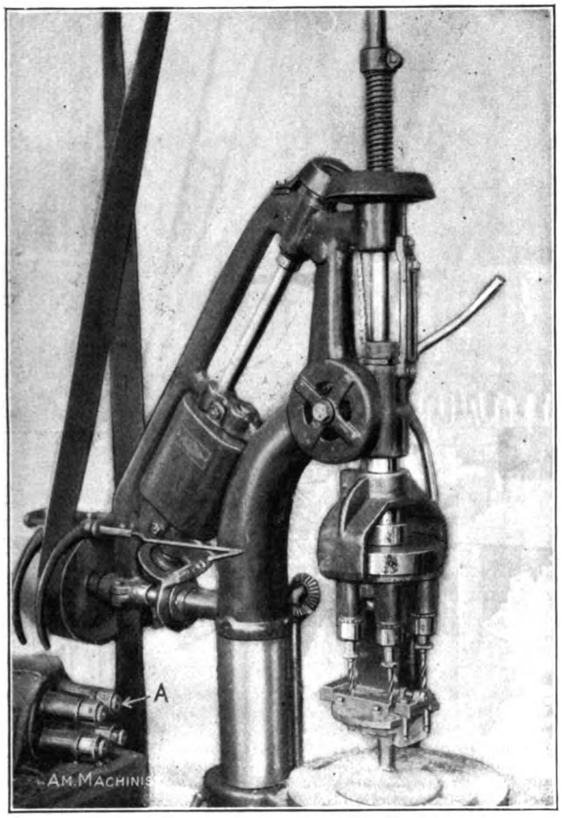


Fig. 8. Special Drilling Machine with Multiple Head

holds it in place. This method of locating makes the center distances correct when the shaft hole is bored. In this machine, not only is the shaft hole bored and reamed, but the outside of the piece is turned and faced.

Drilling Crank Cases

The five screw holes in crank cases are drilled at once, in the machine shown in Fig. 8. This machine was built on special order for the Evinrude company by the Barnes Drill Co. Several jobs besides the one illustrated are done on this machine, and a four-spindle drilling head is shown at *A*.

The drilling jig used to hold the crank case is shown in Fig. 9, and two of the crank cases at *A* and *B*. The crank case is first bored, faced and counterbored. The bored-out hole in the bearing of the case fits down over the plug set into the center of base *C*, as shown. The drilling jig is then set in place. In order to locate the jig properly, the plug that holds the crank case projects some distance above it. A bushed hole in the jig fits over this plug. Two pins, *D* and *E*, are carried on a slide *F*, which is pulled inward by spring *G*, locating the jig correctly with regard to the part which is at right angles to the flange.

Bracket Work

The brackets used to clamp the motor to the stern board of the boat are held in a jig and drilled in the four-spindled machine shown in Fig. 10. The two holes, *A* and *B*, are for clamping-screw holes, and need not be absolutely correct in spacing, so only cast-in spots are used to guide the drill.

The tapping of the clamping-screw holes is not done

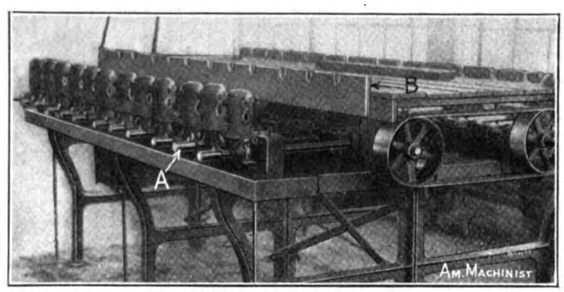


Fig. 12. Special Testing Stand for Running in Main Assembly

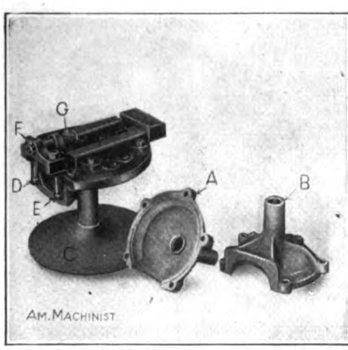


Fig. 9. Jig for Crank Cases

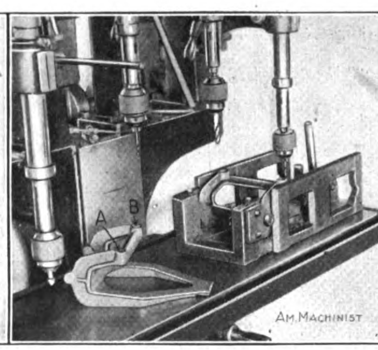


Fig. 10. Drilling Motor Brackets

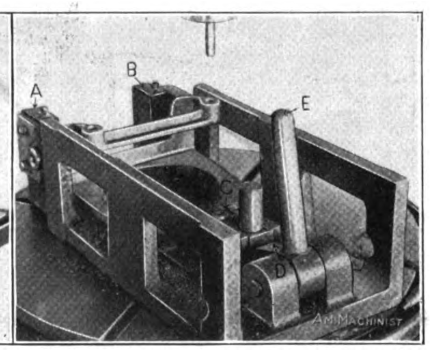


Fig. 11. Bracket Jig for Tapping Screw Holes

in this machine, but the same jig is used to hold the casting, the operator simply setting it under the spindle of a tapping machine, as shown in Fig. 11.

This engraving shows the method of locking the bracket into the jig. The bracket is set into the jig against the pieces *A* and *B* at the back. The slide *C* is pushed inward so as to butt against the end of the bracket, and bring the two drill bushings over the work. The slide is then locked in place by the cam *D*, operated by the handle *E*.

Running In and Testing

The cylinders and pistons with rings in place are lapped in, using special bases, for about ten minutes, giving the parts a beautiful finish and fit. The abrasive is all carefully removed, and the cylinders placed on their own bases, and run for about two hours in machines like the one shown in Fig. 12, which holds 24 cylinders, or 12 on a side. The individual motor shafts are driven from the main shaft by bevel gears and short cross-shafts. Caps like *A* are placed over the outer ends of the shafts to protect the operators, and a hinged board *B* drops down to protect them from the bevel gears.

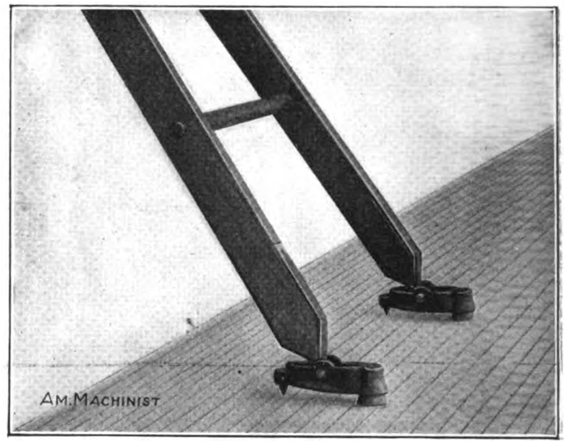
After being run in, the cylinders, crank cases and other parts are enameled by spraying with DeVilbiss vaporizers under hoods. The parts are then dried on special truck racks, in a large room heated with exhaust steam, as shown in Fig. 13. This saves a great deal of handling and trouble, as the enameler simply places the pieces on a rack as soon as he has finished them. Then when the rack is full, it is run into the drying room. When dry, it is run from there to the assemblers.

After being completely assembled, the motors are placed with the propellers in tanks of water, as shown in Fig. 14, and run under their own power for about 20 minutes.

The finished motors are placed about six at a time, on trucks as shown in Fig. 15, where they are easily run to the shipping department as needed.

Safety Ladder Feet for Concrete and Iron Floors

Often a ladder equipped with sharp-pointed or spiked feet will slip on a concrete or iron floor, though holding perfectly on a wooden one. To provide ladder feet that will hold under any conditions, the Eastman Kodak Co. has designed the style shown in the illustration. This consists of castings hinged to the ladder legs as shown. Each casting carries a spike at one end and a rubber pad at the other. The spike will hold on wood or dirt surfaces and the rubber on surfaces where the spikes would slip; the two make an ideal combination that needs no adjusting when setting the ladder. The spikes used are threaded horseshoe calks of a type easily purchased in the open market, and the rubber pads are standard, large-sized crutch tips.



Safety Ladder Feet

The following recipe for waterproofing leather is suggested by the "Mechanical World." Apply a mixture of 4 parts castor oil and 1 part raw India rubber, by weight. Heat the oil to 250 deg. F., then add the rubber, cut into small pieces. Gradually stir until the rubber is completely dissolved, and then pour into a vessel to cool. This waterproofing treatment leaves the leather soft and pliable.

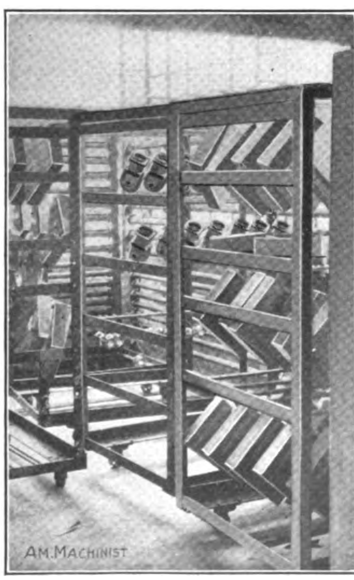


Fig. 13. Drying Room and Trucks

Fig. 14. The Final Test

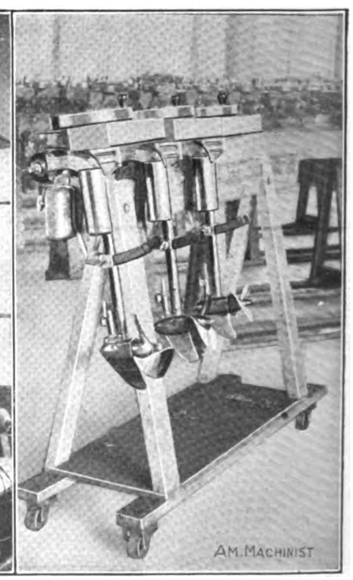


Fig. 15. Motors Ready to Ship