The Austin Film Library—Silent Film Commentary.

HERE'S TO POWER

The commentary below is substantially that recorded in the "sound" edition of this film.
It will be found useful as a basis for any lecture or talk to accompany the "silent" film.

SOHO, BIRMINGHAM, 1797

In a small factory at Soho, Birmingham, mechanical power was made possible through the engineering genius of a pioneer—*James Watt.*

HORSES PROVIDED THE STANDARD OF POWER

James Watt estimated that horses exert a pull of one hundred and eighty pounds each, at one hundred and eighty feet per minute. That is the horse power we know to-day—thirty-three thousand foot-pounds per minute.

NIAGARA'S SIX MILLION HORSEPOWER

The thirteen million cubic feet of water that pass down Niagara's vast cataract every minute represent nearly six million horsepower.

FOUR HORSEPOWER

A rowing eight develops approximately four horse-power—half-a-horse power each man for a spell of twenty minutes, whereas the normal man's maintained output is only one-eighth of a horsepower. To travel rapidly with leisure, the modern man adds to his own power that of the motor car, which, being so familiar to-day, will serve to show how horsepower is created.

THE BIRTH OF POWER

We are witnessing the very birth of power. On the test beds, newly assembled engines, previously still, miraculously spring into life.

MILLING THE ROUGH ENGINE CASTING

But before this dynamic quality becomes manifest, much careful workmanship is necessary. The engine begins as a rough casting on which seventy-four machining operations have to be performed. The first of these consist of milling the various faces.

These milling operations ensure that the end covers, bearings, water branches and numerous other components can be correctly fitted to the unit. Twenty-three milling cutters make quick work of these preliminaries. As the cutters remove unwanted metal, the cylinder block becomes presentable.

ROUGH BORING THE CYLINDERS

The cylinders are bored with a first rough cut on a four-spindle machine in which the cutters are accurately piloted into the bores.

DRILLING THE CASTING

Multi-spindle drills next come into play, first drilling the bottom facing of the casting with twenty-four drills all operating in unison.

There are quite a number of drilling operations, and all must be made with equal precision. The eight spindle machines that drill the valve ports and holes for valves and tappet guides are grouped for control by a single operator. These drills work together and are virtually one huge machine, with all the spindles feeding down until their cut is finished, when they automatically withdraw.

FIFTY-THREE HOLES DRILLED AT ONCE

But the most spectacular of these multi-spindle tools is that which simultaneously drills fifty-three holes in both ends, one side, and the top of the engine casting. The drills advance from four sides and complete the operation in under two minutes. Very similar is the subsequent tapping operation, except that the taps, having cut the thread in each hole, reverse their motion and screw their way out.

GRINDING THE TOP AND BOTTOM FACES

After many more milling, drilling and boring operations, the top and bottom faces of the cylinder block are ground. Several blocks at a time are held in the magnetic bed of the surface grinder and travel under the large grinding wheel. This enables the final and most important machining operation of all to be of extreme accuracy.

FITTING THE STUDS

The cylinder head studs are rapidly fitted by means of an electrically driven tool.

FINE BORING THE CYLINDERS

The last operation is to fine-bore the cylinders with a diamond-hard cutter, making over four hundred revolutions for every inch it moves down the cylinder wall. It cuts to an accuracy of one-and-a-half ten-thousandths of an inch.

GAUGING THE CYLINDERS

This accuracy is verified by a pneumatic micrometer, any variation detected by the air jet in the gauging plug being magnified up to nine thousand times in the reading given by the liquid column. One ten-thousandth of an inch error would show almost an inch of movement in the liquid. By these careful tests, consistent power out put is assured.

TURNING THE AUSTIN CRANKSHAFT

Reel 2

Next to the cylinder block, the most important component is the crankshaft, which converts the thrust of power into rotation. First, the journals, and then the crankpins of the rough forging are turned. Designed solely for this work, the lathes are of very heavy structure to ensure that crank pins and journals will be in correct relative location.

DRILLING OILWAYS

The oilways are drilled on a special machine controlled by hand and very rapid in action. The operator skilfully feeds the drills forward and then withdraws them, repeating the action until the passages are complete.

GRINDING AND LAPPING

Crankshaft machining concludes with grinding to ensure uniformity of piston stroke and thereby balance of power. The smooth finish imparted by the grinding wheel minimises internal friction. Lapping then provides a superlative finish, giving a mirror-like surface to the journals and crankpins.

BALANCING THE CRANKSHAFT

The finished crankshaft is scientifically balanced. Whilst rotating on this delicate machine, the slightest vibration is recorded on the dials. The unbalance is determined by the extent to which counterweights must be moved to secure vibrationless running.

BALANCING THE CLUTCH AND FLYWHEEL

All the rotating parts must be vibration-free, so the clutch assembly is similarly balanced, and unwanted metal removed by drilling. The flywheel is rendered perfect on a special machine using a sensitive spirit-level and a counter weight for the output of power must be smooth at all speeds.

MACHINING AUSTIN PISTONS

The initial thrust of energy is exerted on the pistons, which must be made to the same degree of accuracy as the cylinders in which they work. The aluminium piston castings are turned in a high-speed lathe with three separate cutters operating together. For the gudgeon pin hole, only diamond boring will give the precision required. Then follows the drilling of the oil drain holes, speedily performed. A diamond tool is again entrusted with the final sizing operation, giving superb finish to the outer diameter.

ANODISING PISTONS

Lastly, a special anodising process gives the piston an exceedingly hard surface, which resists wear and retains the lubricant. Accuracy, plus hardness, plus lubrication, equal long life.

MACHINING CONNECTING RODS

But the modern car engine incorporates many other components, valves, connecting rods, tappets, crankshafts, and so on. The machining of the connecting rod forging begins with milling. Before the big end is split, to form the cap, it is broached. The powerful cutter in this machine is impelled by hydraulic pressure. The final operation is to grind the big-end so that the bearing shells fit perfectly and are in alignment with the gudgeon-pin hole.

UPSETTING VALVES

Valves, which begin as a steel bar, are produced by an upsetting process, electrical energy, and hydraulic pressure combining to create a mushroom of glowing metal. Still glowing, this is quickly stamped into a valve head to be finished by grinding. In this way, one hundred-and-eighty valves an hour are produced from one machine.

MACHINING CAMSHAFTS

The rough camshaft forging is turned on a special lathe. Controlled by master cams nine cutters operate at once to form the correct profiles on the shaft. For grinding, the cut is controlled by moving the camshaft towards or away from the grinding wheel.

All the components of the power unit are produced with equal care and verified by expert inspection. The lift of the cams is scrupulously checked.

GAUGING PISTON RINGS

Every piston ring is inspected for circularity by rotating it in a special gauge in front of a band of light which is completely obscured throughout the revolution if the ring is true. The diameter and gap of every piston ring is measured by pushing it up a tapered bore until the gap closes. The distance it has moved then indicates its size.

TESTING OIL PUMPS AND TESTING TAPPETS FOR HARDNESS

The oil pump, when assembled, is tested for performance on a machine capable of operating sixteen pumps at a time. It verifies that each pump can deliver fully the pressure required.

Tappets are checked for hardness, an indentation by a diamond point being recorded as a hardness reading on a dial.

GAUGING PISTONS

The pistons must equal the cylinder bores for accuracy so they also are gauged on the pneumatic micrometer. Then they are weighed and selected in sets, so that balance is still further assured. The connecting rod, and piston assemblies are checked for alignment. Nothing must be left to chance if power in plenty is to be achieved.

MARSHALLING THE COMPONENTS

Now the separate components have to be marshalled together ; they come on conveyors which connect up all the production lines, so that there is no delay between production and assembling.

ASSEMBLING AUSTIN ENGINES

On the assembling track, the cylinder block is equipped with its valves, valve springs and then the camshaft. Into the inverted casting goes the crankshaft to be followed by the connecting rods—for power depends upon study limbs. When the oil pipes and pump are in place, the oil-tray and reservoir enclose the crankcase.

With the engine upright, the gasket and cylinder head are soon fitted. Water branches, manifolds and all the remaining parts follow, and at last a complete engine is ready for your car.

TESTING AUSTIN ENGINES

More power has been created and this newly-found vitality is measured in the engine test. There we find that from one small engine comes power in plenty—no less than twenty-five brake-horse-power at four-thousand revolutions per minute—to give you speedy travel as you take to the road and drive so carefree in your lively and dependable Austin car.

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