

KEYSIGHT: COMPUTER VISION INSPECTION OF VALVE SPRING ASSEMBLIES ON ENGINE HEADS

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PROGRAM

The movie describes a computer vision program used to inspect valve spring assemblies on engine heads for the presence of valve spring cap keys. A missing key can cause considerable engine damage as the assembly will ultimately come apart, dropping the valve onto the piston. At the automatic inspection station, the engine head is moved past a linear-array camera which takes a 64 by 64 pixel picture of the area near each valve spring assembly center. The program first finds the center of each assembly and then checks for the presence of both keys. The center is found by: (1) obtaining a thinned edge array (which has considerable circular symmetry) from the picture intensity array, and (2) finding the vertical and horizontal axes of symmetry. The inspection involves examination of the intensity profile along the circumference of a circle which passes through the center of the expected key location. The keys vary significantly in brightness, but they are always brighter than the hole formed by the absence of a key. KEYSIGHT, which inspects 400 heads per hour at assembly line speeds, has demonstrated cost effectiveness and high reliability.

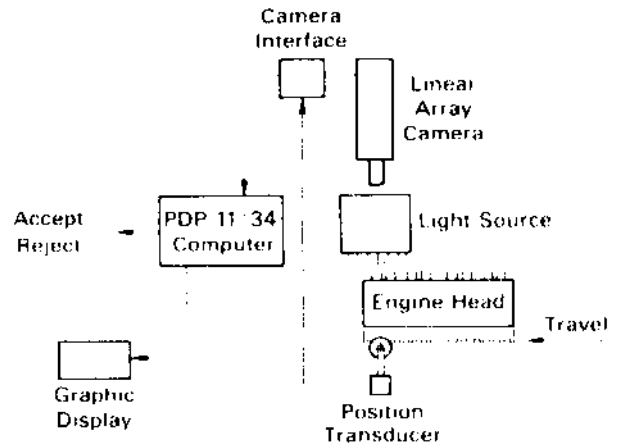


Fig. 3. KEYSIGHT system.



Fig. 1. Engine head with eight valve assemblies.

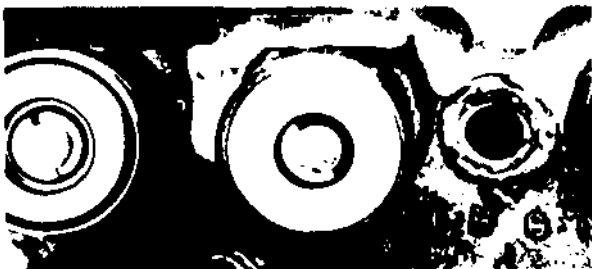


Fig. 2. Two valve spring assemblies.
 Left assembly is good (both keys present).
 Right assembly is bad (one key missing).

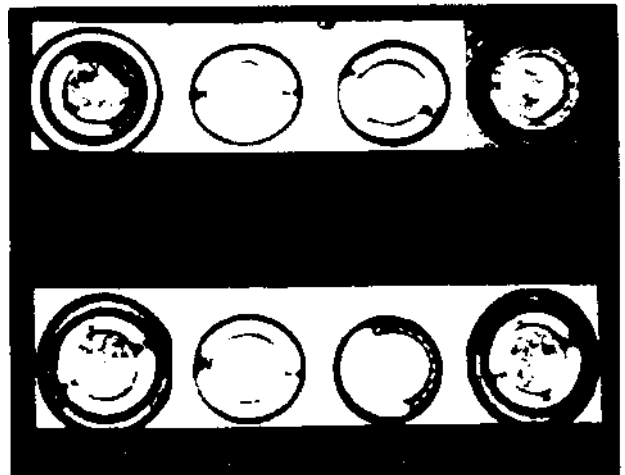


Fig. 4. Result of inspecting engine head (eight assemblies). Star is plotted at assembly center and dashed circle through keys. This bad engine head is automatically dumped onto a repair track where missing keys are inserted later.