

The Use of Bronze for Valve Snap Rings and Piston Surfaces, and Bull Rings in Large Cylinders, to Prevent Rapid Wear and Cutting of Cylinder and Valve Bushings.

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Undoubtedly one of the most difficult and perplexing problems relating to locomotive operation is the proper and economical maintenance of pistons and cylinder walls, valves and bushings—those parts which, by their proper relation of sizes, and constantly varying relative positions, assume the responsibility for the correct and economical use of the steam which the boiler has generated. In this region may all too frequently be located the greatest spendthrifts on the entire locomotive.

the last 10 years. The extensive adoption of cylinder bushings on modern power indicates the enormous increase in cylinder barrel wear and a desire to save cylinders, which otherwise would soon wear thin. Extended piston rods to carry the weight of pistons in large cylinders are a compromise, and there appears a trend toward their abandonment. Decrease in unit pressure between piston and cylinder walls can only be attained at the expense of increased reciprocating weight and dynamic augment.

Bronze Valve Snap Rings.

Two formulas have been used:

COMPOSITION "A"

Copper	82.96%
Tin	14.66
Phosphor	0.118
Lead	none
Impurities	2.26

Total 100%

COMPOSITION "B"

Copper	80.80%
Tin	5.83
Phosphor	0.10
Zinc	4.54

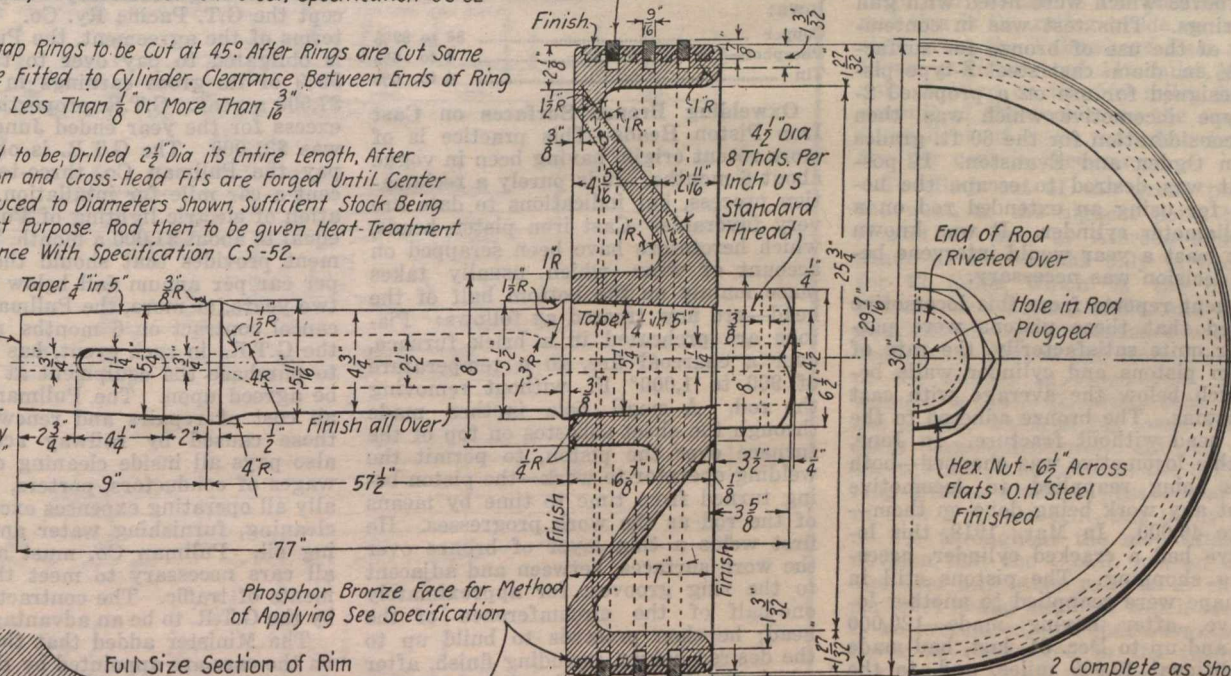
Piston, Cast Steel, Specification CS-14
Bronze Face, Composition as Per Specification CS-12, Sect 8
Snap Rings, Gun Iron, Schedule L-12
Piston Rod, Heat-Treated O.H. Steel, Specification CS-52

End of Snap Rings to be Cut at 45°. After Rings are Cut Same Should be Fitted to Cylinder. Clearance Between Ends of Ring to be Not Less Than $\frac{1}{8}$ " or More Than $\frac{3}{16}$ "

Piston Rod to be Drilled $2\frac{1}{2}$ " Dia its Entire Length, After Which Piston and Cross-Head Fits are Forged Until Center Hole is Reduced to Diameters Shown, Sufficient Stock Being Left for that Purpose. Rod then to be given Heat-Treatment in Accordance With Specification CS-52.

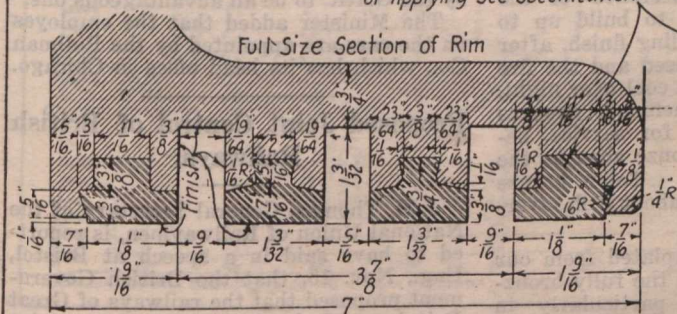
Rod Must be Stamped as Called For on Drawing CA-2929.

Taper of key $\frac{3}{16}$ in 8"



Phosphor Bronze Face for Method of Applying See Specification

Full-Size Section of Rim



Piston, Cast-Iron - Pat No AS-3810

2 Complete as Shown Per Locomotive

Piston Rod	Maximum Wt Rough-Turned and Bored	324 Lbs
	Minimum Wt Rough-Turned and Bored	314 Lbs
	Normal Finished Weight	294 Lbs
Piston and Rings	Normal Finished Weight	544 Lbs
Piston Rod Nut	Normal Finished Weight	21 Lbs
	Normal Finished Wt Piston and Rod Complete	859 Lbs

Common Standard Bronze-faced 29½ in. Piston and Rod, Union Pacific Rd.

Since the introduction of modern outside valve gears has eliminated much of the old-time faulty and lame valve setting, our friends within the cylinder have easily taken first place. At no other point on the locomotive can the losses become so great, or so quickly aggravated, due to rapid cutting and wear; nor has the introduction of superheated steam, with increasing size cylinders, tended to ameliorate conditions.

Cylinder working temperatures, which have so direct a bearing on rate of wear, have increased tremendously in

Cylinder and valve lubrication under increased superheat temperatures is surrounded by many difficulties.

With these facts in mind, the Union Pacific Rd. Mechanical Department, began experiments in 1913 with bronze valve snap rings, and in 1915 with bronze surfaces for pistons. No originality is claimed in this connection, as perhaps many of those present have experimented more or less along similar lines, but the results obtained are worthy of some consideration.

Lead	6.58
Impurities	2.15
Total	100%

Either composition gave good wearing qualities, but composition A has decided advantages in elasticity. We believe, however, that there is room for further improvement in the composition of the most suitable alloy for this purpose.

Valve rings are of the usual L-section for 15 in. piston valves of cast iron, working in gun iron bushings. Information collected in 1915, or previous to the recent rise in wage rates and material,