 July 15th 1945: Single-Acting Engine suitable for High-Temperature. An attempt at Ultimate Design. See p. 106

Requirements:—

1: Minimum clearance; and steam-tight
2: good Isolation of Inlet-steam; Good Isolation of Crank-Case (vacuum)
3: Minimum Radiation, & Conduction Losses, with minimum & neat Insulation.
4: Simple Arrangement, for Cheap Manufacture & Maintenance.
5: Low Cylinder-Wall & Piston-Ring Temperature: Jacketed if
6: High Expansion-Ratio, (see p. 102).
7: Standard Connecting-Rods, & Bearings.
8: No Cam-Shaft, nor Gears. (?? why not ??)

[Study Ajax Marine-Engine

Charles F. Keen: 2661 East Washington Blv'd, Madison 4, Wis

Items | Notes & Calculations for his Steam-Car: Instalation of Doble Boiler | Remarks

A Feed-Pump Capacity & Engine-Consumption:—

1: For Doble model F Boiler, what capacity & size of Feed-Pumps? Use following data furnished by Mr. Keen:— His letter of June 25th 1948 600 psi Boiler Press. Is 13¼" the Rolling radius? Probably 600 =

a: Stanley Engine "(10 hp)": 3¼ Bore x 4¼ Stroke, geared 34:41 to 26½ Dia Drivers. Assume Engine Inlet-Steam to be 700°F.

b: Car weight = 2,800 lbs; assume 3,000 lbs with driver, etc.

c: Grade-Tests:

	Miles/Hr.	Steam-Chest Press.	Cut-Off (assumed)
2° = 3½%	45 to 50	250	⅓
5° = 8¾%	25	350 to 375	⅓
7° = 12¼%	15	350 to 375	⅓

2: Total-Resistance: Assuming .015 R.R. & No R Air & no acceleration for 12¼% grade = 45 lbs R_R + 367 lbs R_G = 412 lbs total R.

3: On 12¼% grade, assume leakage through Engine cancels the volumetric-deficiency: i.e., cu. displacement net = 100%.

a: 3¼" Bore = 8.296 Sq in. x 4.25 Stroke = 35.28 cu in/stroke, x 4 strokes = 141 cu in x ⅓ Cut-Off = 47 cu. in. Net /Rev.

b: Steam @ 375 psi (390 psi abs) & 700°F (sic) = 1.6916 Cu. ft./lb.

c: 15 mi/hr: 13¼ R-Rad, or 26½" R-Dia (sic) x π ÷ 12 = 6.94 ft/rev & for 5,280 ft (1 mile) = 760 revs/mile x 41/34 = 916 Eng. Revs/mi so, @ 15 mi/hr. Engine speed = ~~230 Rpm.~~ Say 229 Rpm.

d: 47 cu. in./rev (net) x 229/~~230~~ = 10,763 cuin/min ÷ 1,728 = 6.229 cuft/min

OR: 24.916/~~28~~ Cu. ft./mile ÷ 1.6916 cuft/lb = ~~14.73~~ 14.74 lbs/mile

(÷ 8.33 = 1.77 gals/mile (approx.)) x 27.82 cuin/lb = 410 cuin/mile

If 90° feed = .016~~8~~ cuft/lb. or .036~~8~~ lbs/cu. in.

.0161 cuft/lb. = 27.82 cuin/lb. = .0359 lbs/cuin

4: His present Feed-Pumps: ~~⅝ Dia x 4" Stroke~~ geared from back-axle @ 13.168; 760 Axle revs/mi x 17/68 = 212½ revs/mi

His letter of June 9th 194~

Items | Remarks.

cont 4: a: Present Pumps make 212½ Revs/mile.

b: 5/8" bore = .3068 Sqin x 8" Stroke (2 pumps)/rev = 2.45 cu in. (2.4544 cu in.)
x 212½ = 522 cu in/mile ÷ 27.82 cu in/lb = 18.75 lbs/mile
@ 100% Vol. Eff.; x say .85 = 15.93 net lbs/mile, or Say 16

5: On a 12¼% Grade @ 15 mi/hr. Engine requires 14¾ lbs/mile. Pumps can deliver @ 85% Vol. Eff. a total of 16 " " , (1.92 gals/mi)
thus giving a surplus of 1¼ lbs/mile. Barely enough.
On a heavier grade, with higher Steam-Chest Pressure; or with a lower Steam-Temperature @ Engine; Pumps would be too small. However, they should be OK for present use.

B Diagram of Feed-Water Circuit & Control-Wiring:—

1: Recomend regular Model F Normalizer with Greyhound Control-Box; viz, One pump cuts-in direct from the Pressure-Control (Bus-Bar), & the other (plus Normalizer) cuts-in from Temperature-Control (top-switch, Normally-Open). Made him a diagram of system, and of Control-Box Adjusting-Procedure.

2: a:

C Rebuild of ~~Stanley~~ Engine 3¼ x 4¼ — JAN 11 1949

1: Piston-Rod: Assume 500 psi x 8.3 Sqin { Say 9/16-18 thrd = .494 Sqin. = 1924 Sq in. = 24,600 psi; 4,150 lbs load.
~~Say ½-20 thrd. Say ¾" Dia = .92 Sqin.~~ Say ⅞ x ⅞ = .76 Sqin.
= 5,200 lbs/sqin.
300 psi x 8.3 = 2490 Say 3,000 lbs; Say ¾ wrist-pin. & say
4,800 psi = .625 Sq in. = 8.375 Say ⅞ long.

D: New V Compound for his new Steam-Car! — MAR 4- 1949

1: 2¼" HP, 4½" B, x 3½" Stroke, geared 2:1, = 1,500 Rpm @ 60 mi/hr.
2: Engine to be bolted to Torque-Tube (no universal-joints), and rubber-suspended between Boiler & Dash, under hood.

E Conference with Keen re present program:— — JUN 5 - 1949

1: New Cross-Compound: Same size as in "D" above; but on axle with cylinders at rear like Ⓐ on p. 3 (23-1-35) of "Chassis" — Feb 7th 1950 Dropped him Poor pay.