

Freshman Seminar: The Art and Science of Motorcycle Design



2009-10 (FRS 108) ; 2010-11 (FRS 102) ; 2011-12 (FRS 104)



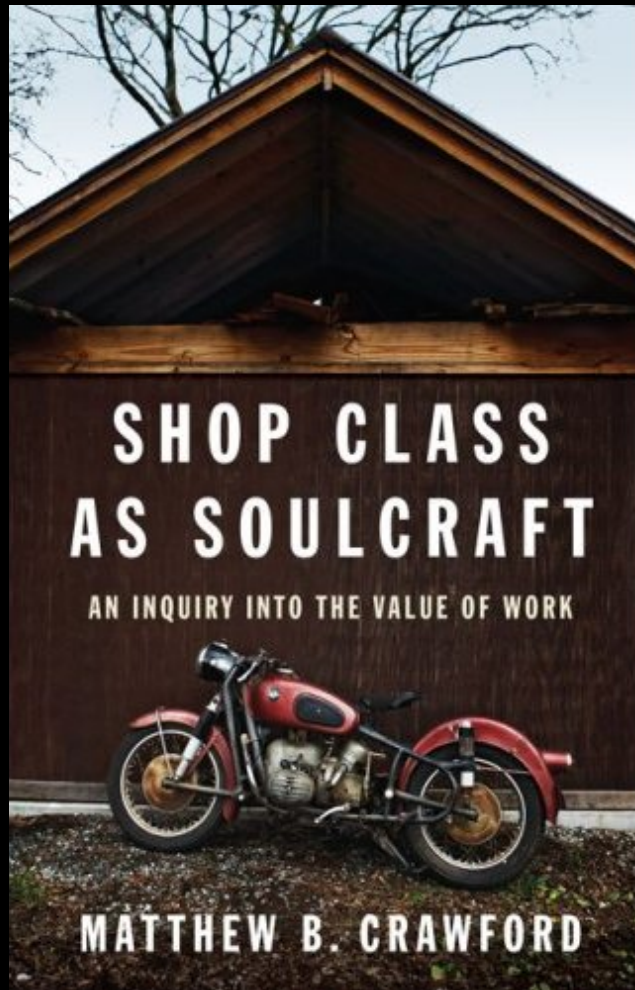
Tiger Cubs were in production from 1954 – 1968. It was a very popular learner bike and off-road bike that was not subject to road tax.

Triumph: TIGER – TIGER CUB – TIGRESS

.... In the beginning

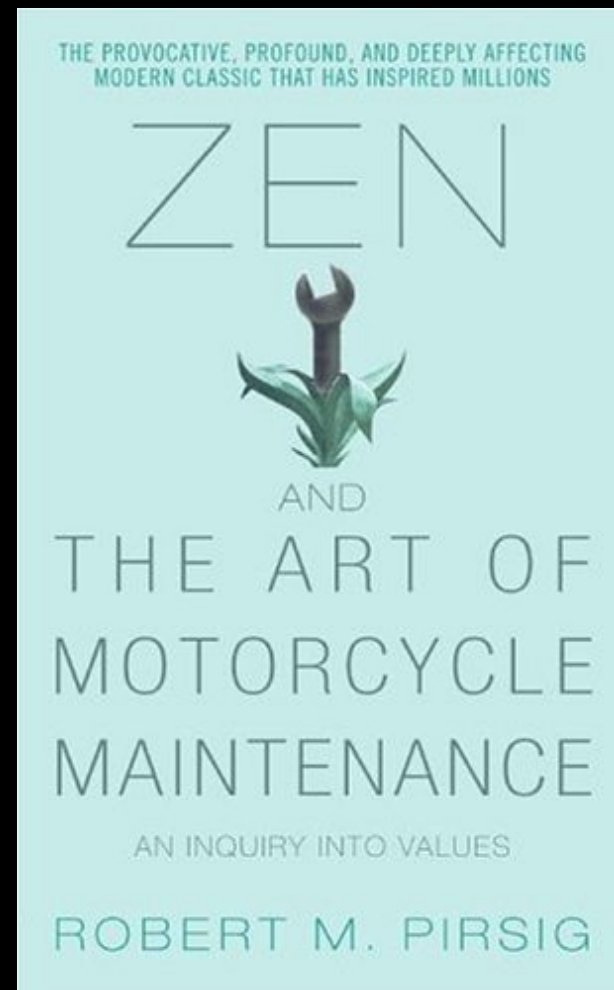


“The surgeon's judgment is simultaneously technical and deliberative, and that mix is a source of power. This could be said of any manual skill that is diagnostic, including motorcycle repair.” SCAS p. 25



“A washing machine, for example, surely exists to serve our needs, but in contending with one that is broken, you have to as what *it needs*.” SCAS p.16

"The overall name of these interrelated structures, the genus of which the hierarchy of containment and structure of causation are just species, is *system*. The motorcycle is a system. A *real* system." ZAMM p.101



A motorcycle is an engineering system, but what is engineering?

STRUCTURES	-	Frame
MACHINES	-	Engine
NETWORKS	-	Spark
PROCESSES	-	Combustion

And all components must work together.
Motor vehicles integrate industries.

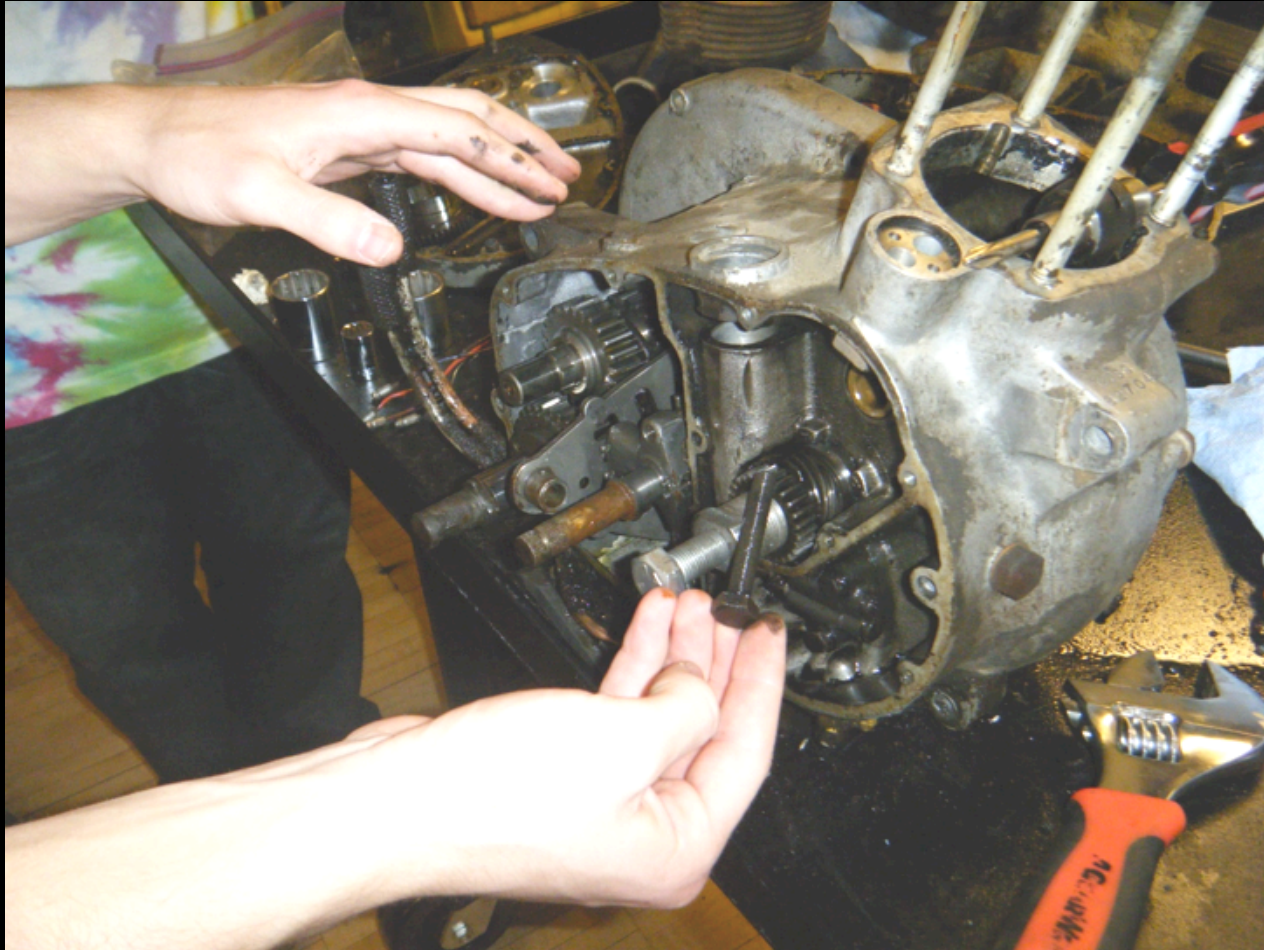
We study evolution of motorcycle design and compare performance. Consider horsepower – Tiger Cubs have 200 cc engines, but 1958 is 10 Hp and 1965 is 14 Hp. Why are they different? – Better breathing and more RPMs – $\text{Hp} = \text{Force} \times \text{Velocity}$



Tubular frame, swing-arm rear suspension, front fork suspension, and single “lung” 4-stroke engine

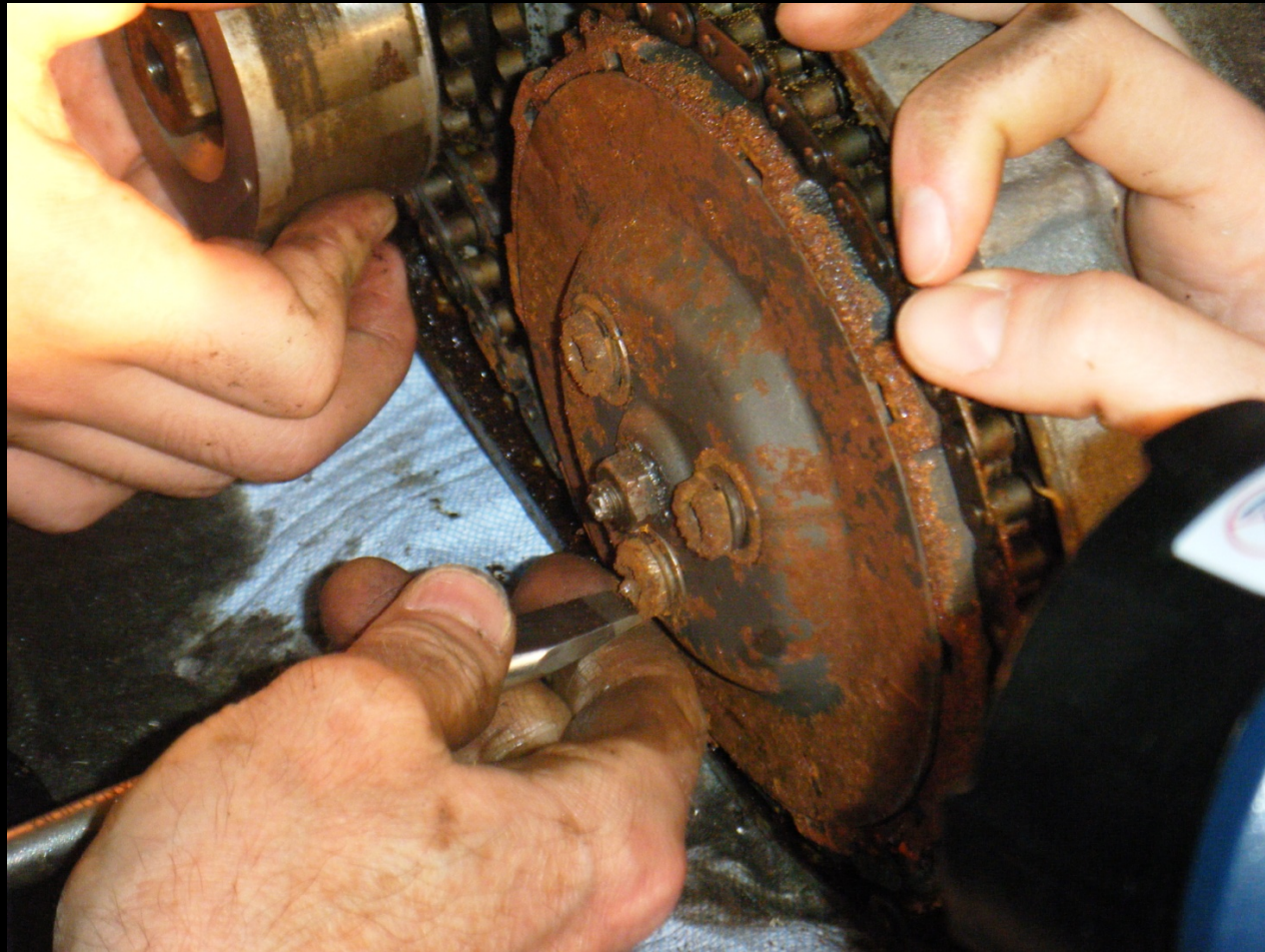


Take it apart, inspect for wear, clean and repair everything









FRS 108 “Clutch Team”



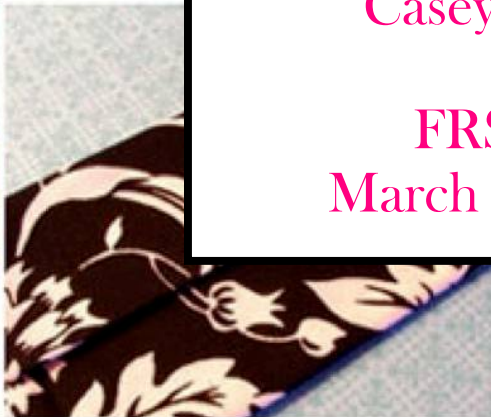


CLUTCH



Kristyna Smith
Megan Skalbeck
Victoria Cadiz
Casey Cortes

FRS 108
March 3rd, 2010





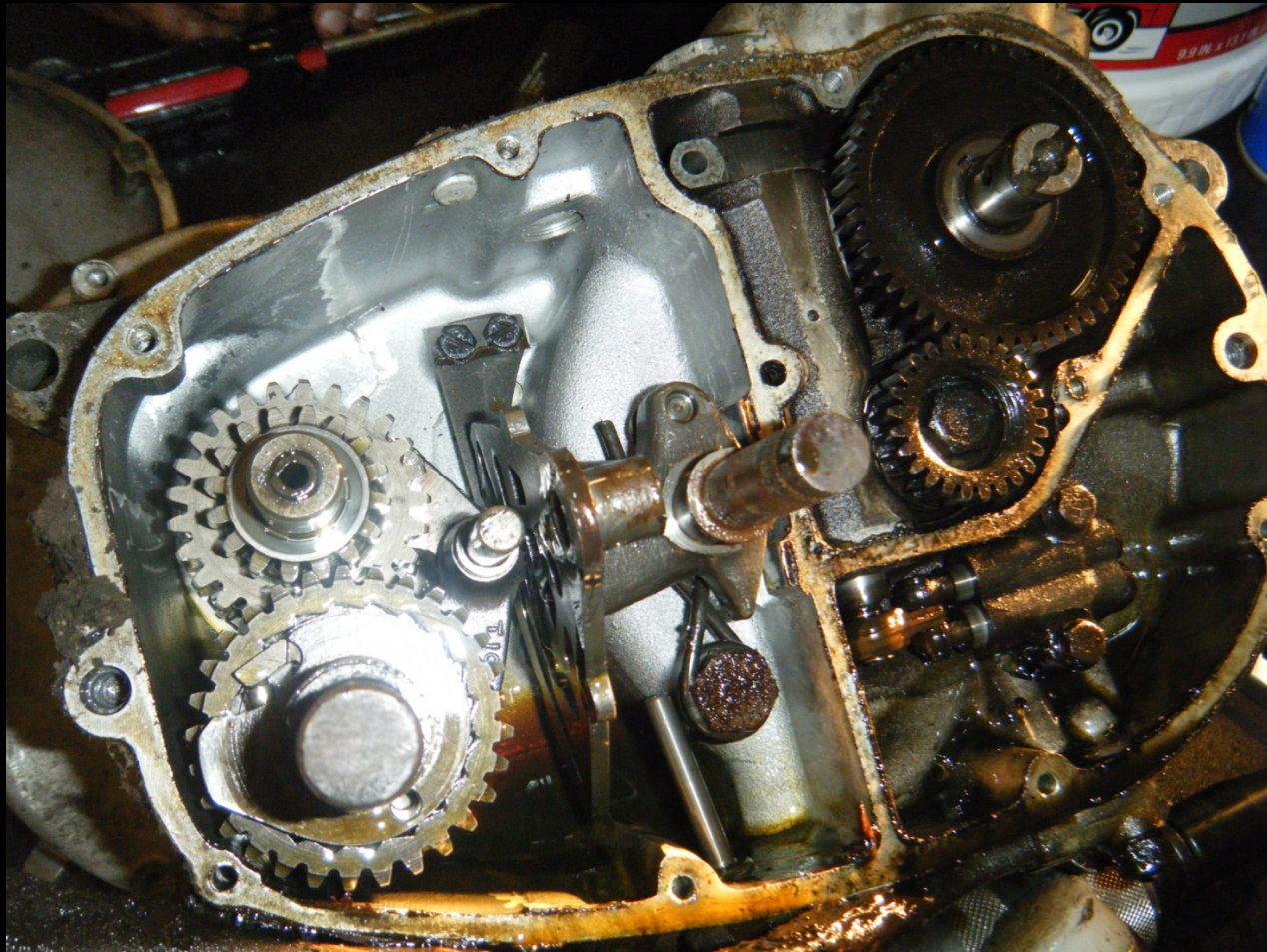
"I've a set of instructions at home which open up great realms for the improvement of technical writing. They begin 'Assembly of Japanese bicycle require great peace of mind' ... (T) here's a lot of wisdom in that statement." ZAMM p.164

"'But they're (the assembly instructions) are from the *factory*.' John says. 'I'm from the factory, too' I say 'and I know how instructions like this are put together. You go out to the assembly line with a tape recorder and the foreman sends you to talk to the guy he needs least, the biggest goof-off that he's got, and whatever he tells you - that's the instructions.'" ZAMM p. 165





An Artistic View of Our Transmission – FRS 102 “Trans” Team





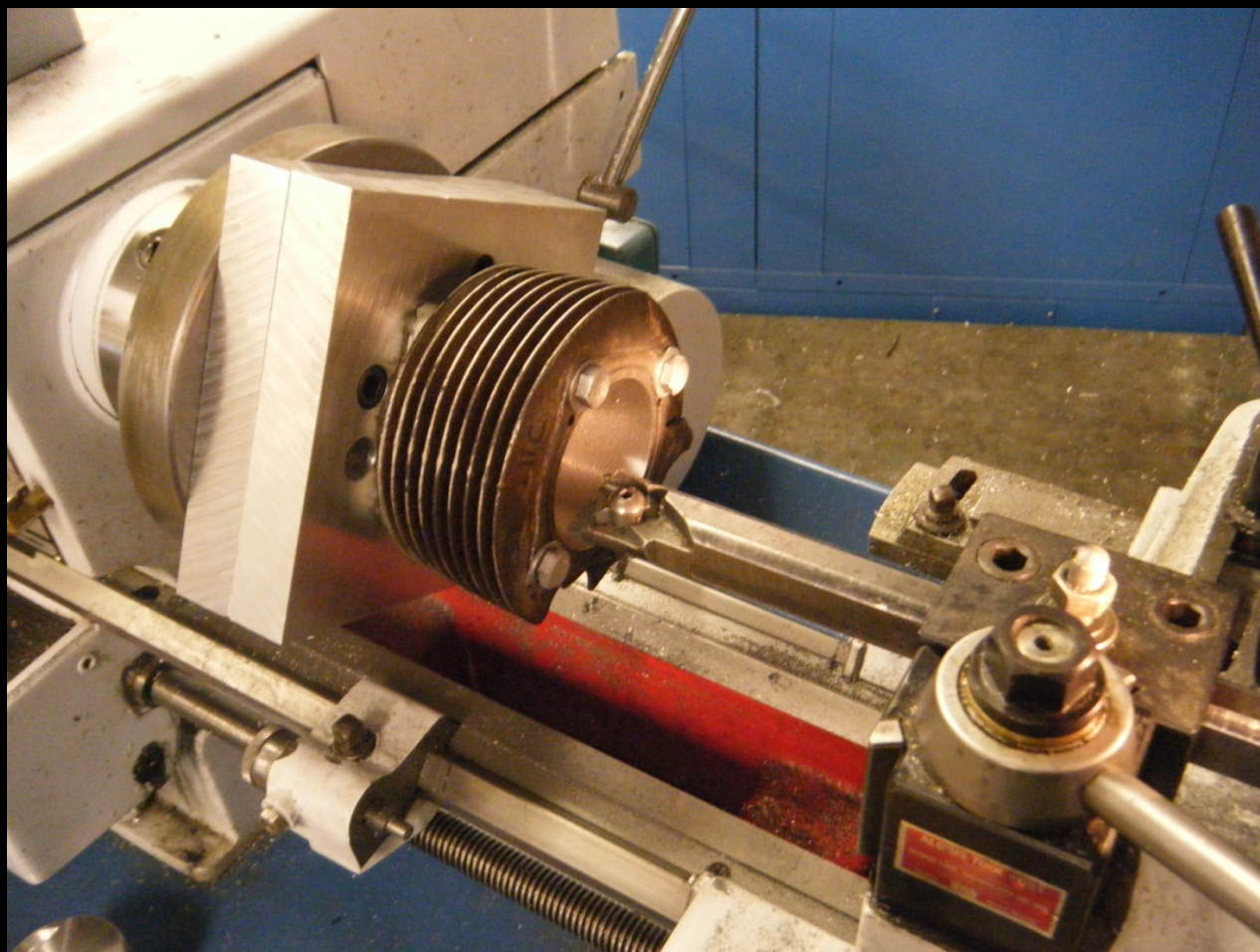
K'NEX TRANSMISSION

and

CLUTCH TESTBED

“Top End” Team



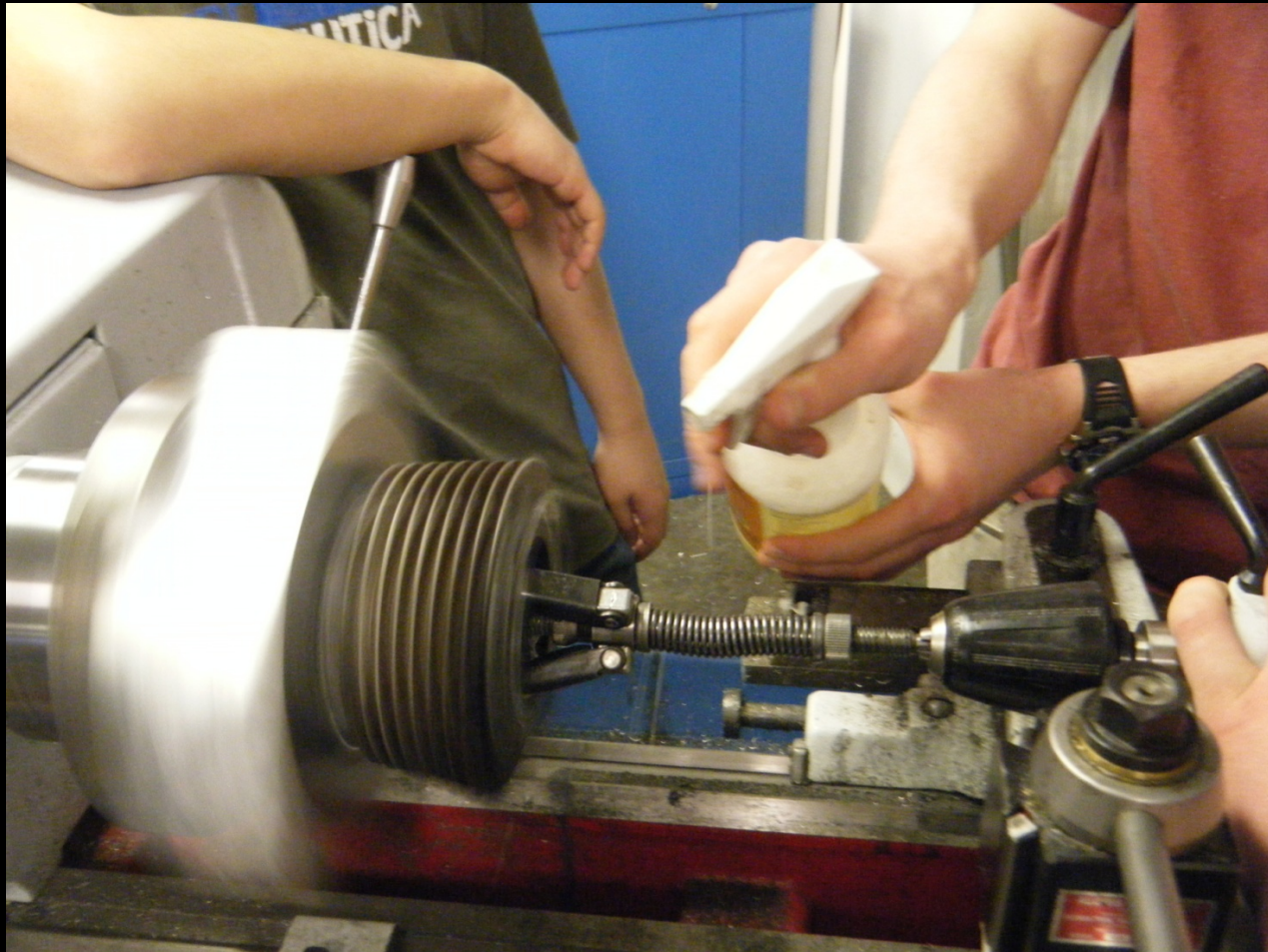


Barrel Bore Video

Why re-bore? – wear, barrel not cylindrical

What we did – measure, add .020", measure, hone

Stock barrel – 63mm dia. x 64mm stroke











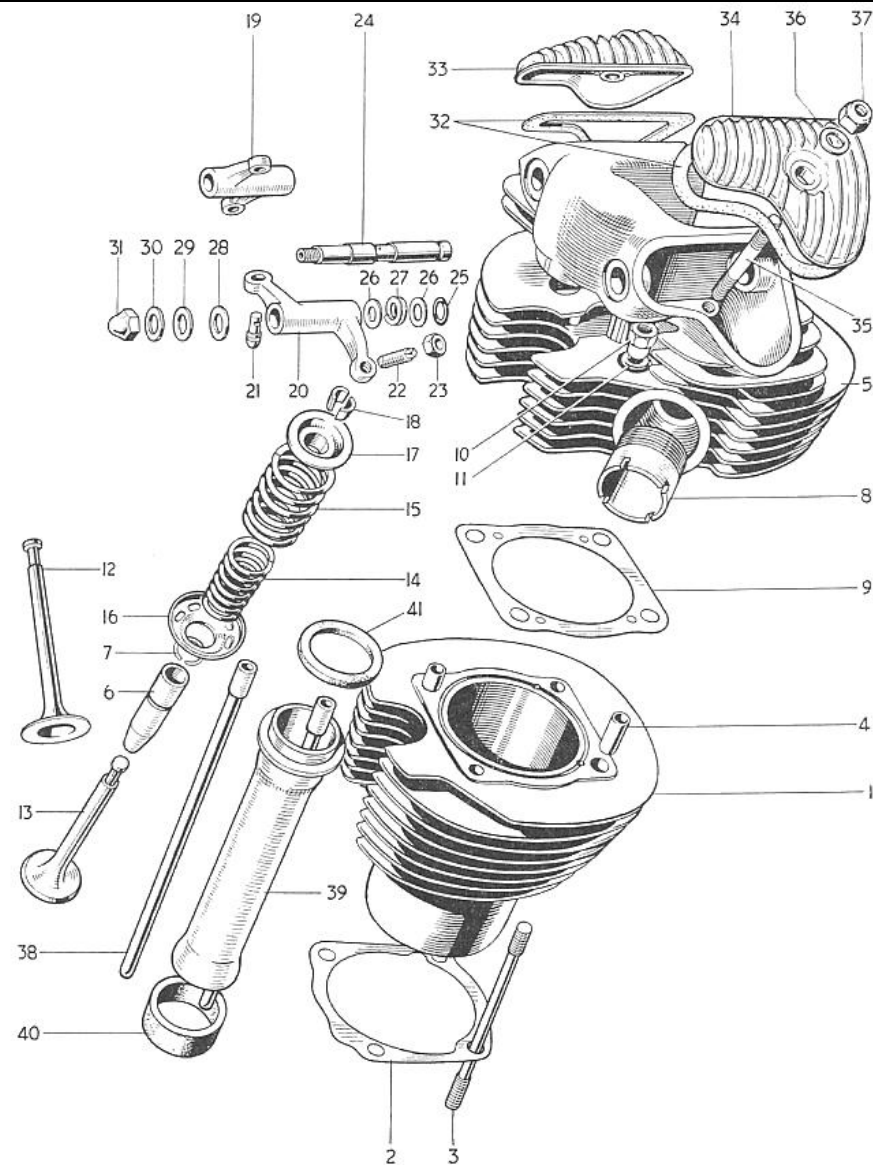
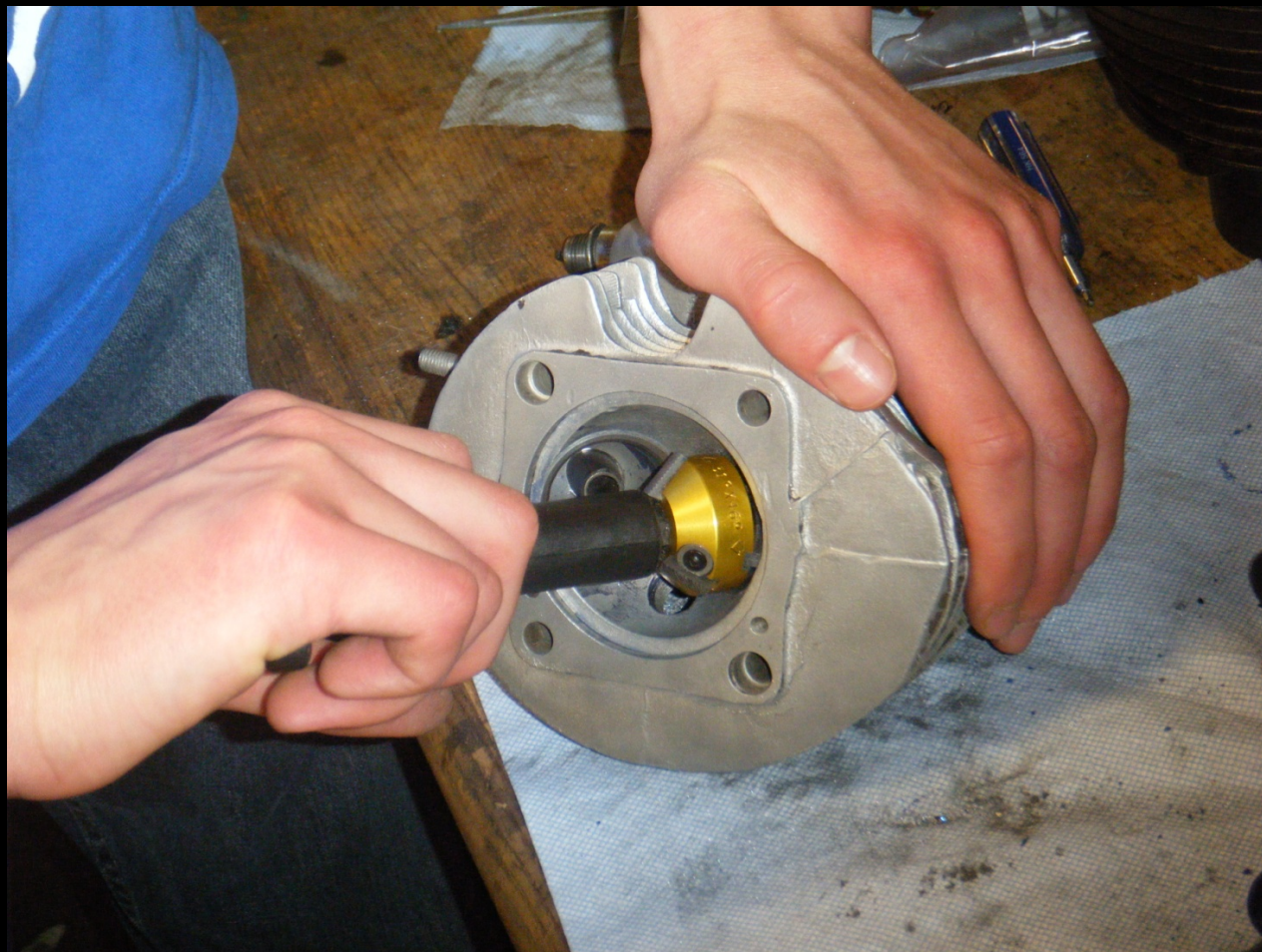
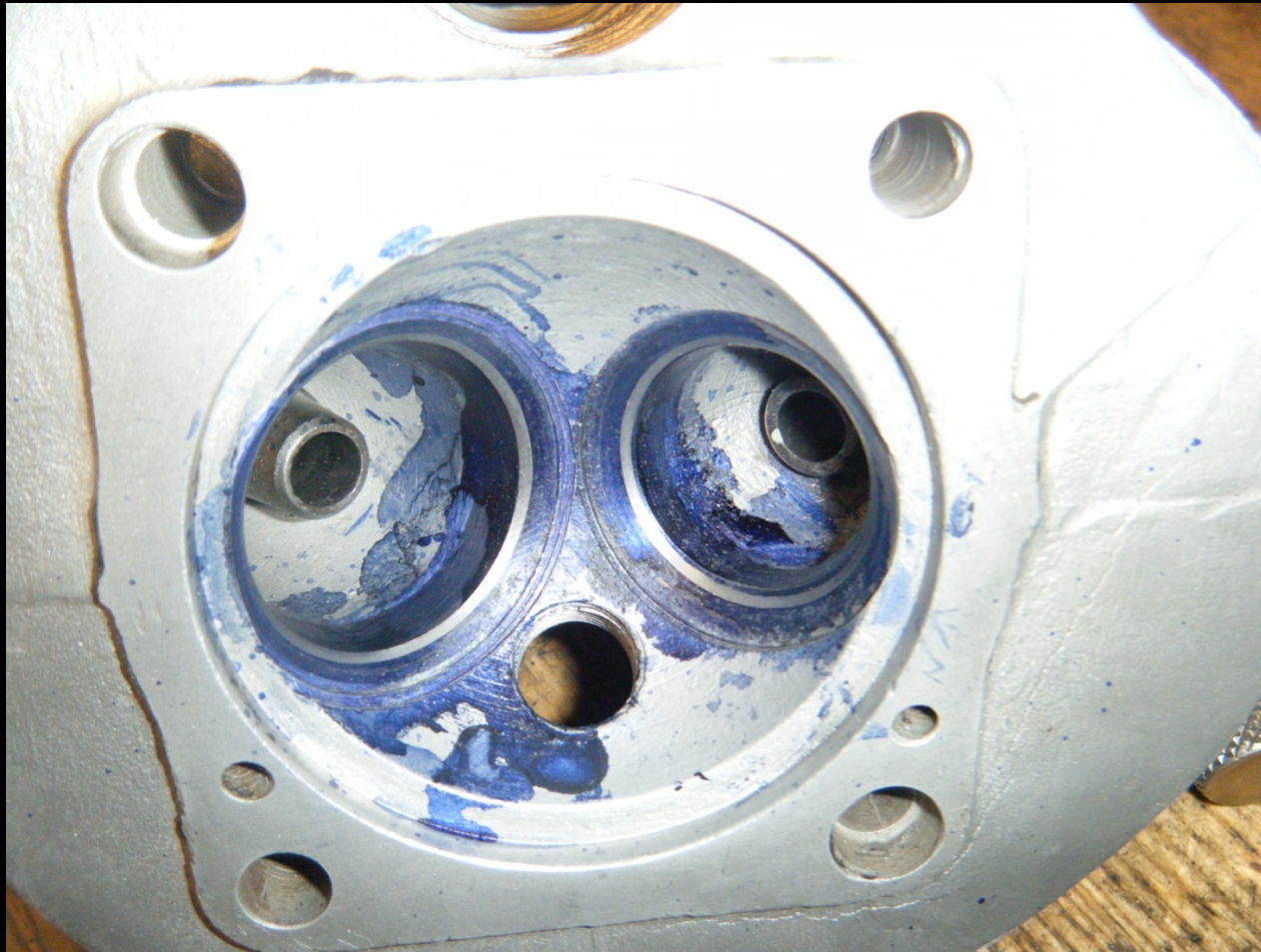


Fig. 3. CYLINDER BARREL AND HEAD







“Frame, Fork, and Wheel” Team









Mid-semester interlude – learn how to drive our Model T





Re-Assembly









Ready to Roll



Start your engines – not so easy



Rides around the Parking Lot



"... pistons and wheels and gears all moving at once, massive and coordinated" ZAMM p.87

Ask the experts ...



Prof. Arnold
(MATERIALS)



Prof. Smits
(FLUIDS)



Prof. Ju
(COMBUSTION)

*"The Tiger Cub is a winner
all the way"* says **ROGER VANDERBECKEN**

Trials and Scramble Champion of Belgium,
a great Triumph rider and enthusiast who
competes in all the leading events on the
Continent.



**TIGER
CUB**

200 c.c. T20

Easily the most popular 200 c.c. lightweight today. For value, economy and safe, easy handling, there is nothing to equal the four-stroke O.H.V. "Tiger Cub." First choice of the rider who wants "real motorcycling" at lowest cost.

**SPORTS
CUB**

200 c.c. T20S/S

Patent Nos. 723073, 684685

Exhilarating to ride on the road and readily adapted to most forms of competition, the "Sports Cub" has earned an enviable reputation for speed, reliability and superb handling in tough events like the Belgian Lamborelle Trial and the Scottish Six Days. This is the model for the man who wants to get to the top quickly.

Flat sports type handlebar available if required.





FRS 102 Bike (1963) before Restoration



FRS 102 Bike (1963) after Restoration