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REF: Engine Mechanicals - Sub-07F

Liquid Drag vs Fluid Drag

Liquid Drag

This is an this example of 'liquid drag' (as opposed to fluid drag, our real life medium). [1)]
Consider a 5 gal pail of latex & paint mixer that gets powered from your electric hand drill.

What's the difference between liquid and a fluid?
In this example, it's that a liquid is non-compressible (oil).
A fluid is compressible(air or air-oil).

Stick the mixer in the middle of the pail about 1/2 way to the bottom in the center of the paint mass.
Hit the trigger and the drill wants to twist out of your hand (liquid drag on the mixer).
As the mixer accelerates the paint, the drag reaction at the drill gets less.
And you can see the paint moving fast around the mixer and slow at the pail wall.

Eventually you steer the mixer near the wall to get that stuff mixed and an important change happens.
The reaction at the drill gets less, the drill speeds up and the paint near the mixer speeds up with it.
But the rest of the paint away from the mixer stops moving (as if its hanging in it's own 'miniature sump' away from all the commotion.

That explains the less reaction force on the drill.
You're moving less than the full 5 gal now (and moving that small amount better with less drag) even though the amount in the pail is unchanged.
This is important to understand.

Summary so far:
You're mixing the dickens out of 1/2 gal and cutting 4-1/2 gal out of the picture.
And that 1/2 is really moving and it's taken less force to move it because your moving less.
(less volume don't jive with the density-not volume- as in above)
It's exactly the same if now you change to a 55 gal drum.
1/2 gal going fast but 54-1/2 not moving.

So the addition of a sump (containment area) allows a greater quantity of oil (paint) to be present in the case (pail) without any extra drag.

Some of that oil is able to drop out of suspension so it can separate into the sump.
Once the used oil gets sump trapped things are going good.
But there are drag losses geting it to the sump as it flies outward off the rods.
Some will land on the inside of the case near & on the parting seam.
Some will travel down the inner walls of the wheels then fly off to the case wall.
Some will fly up under the pistons where it needs to eventually find its way to the case wall also.

In this chaotic environment, gravity isn't going to do much to drain it down to sump when there are giant flywheels whizzing 1/8“ from this case walls.
The wheels are going to set up a following flow on the walls.
The better the following flow, the less oil in commotion. That's good.

But good movement is because of good dragging.
But drag is bad.
Good dragging sucks power.
So does not dragging because the oil is slow moving.
Oil is now making the fluid more dense.

And what if you got no sump like 99.99% of 76< motors?
This kind of drag is the main liquid drag.
Its a 'no win' situation.
A robbing Peter to pay Paul situation.

Fluid Drag

Above, we've touched on the idea that oil in the flywheel cavity of the cases probably creates a drag on the rotating lower end, robbing power.
And the amount of oil probably affects the amount of drag.
More oil = more drag and causes it to increase the density of the fluid.
Fluid, not liquid.

This drag is like the drag that makes running in a swimming pool so difficult.
This drag is sometimes the only drag that gets considered.
The idea that 'the dryer the better' don't paint the whole picture.
That drag is smaller than the power used up to physically 'pump' the oil-air fluid as the motor spins.
The more dense the fluid, the more power is lost to pumping it.

No matter the density of this fluid, its the action of the pistons that moves it from the flywheel cavity.
On 76< motors, logically the way to accomplish this is to open the breather valve as the pistons fall so the max amount of 'fluid exhaust' occurs.
Then close the valve as pistons rise.
77> motors have a reed valve or umbrella flapper that accomplishes the automatic opening and closing of the 'fluid exhaust port'.
And it is not adjustable.

In this example when the valve closes, then the piston rise creates a giant vacuum in the case.

(with the vacuum being greatest at the highest point of piston travel)
Just after this highest point the pistons start to fall again.
This is when the valve opens again. (max exhaust right?)
This vacuum sucks the previous expelled fluid back into the case resulting in the crankcase not actually getting dry.

77> engines deleted the timed open and closed breather valve as is in 76< motors.
The camchest is always open to the flywheel cavity with a one way valve between the motor and the outside environment.
The slang term “FooFoo” comes from the annoying sound that it makes when it gets clogged up with oil residue. [2)]

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1)
Dr Dick of the XLFORUM
https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-era-specific-and-model-specific/ironhead-sportster-motorcycle-talk-1957-1985/122424-breather-diagrams/page2?t=1204854&page=2
2)
IronMick of the XLFORUM
https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-era-specific-and-model-specific/ironhead-sportster-motorcycle-talk-1957-1985/128453-crankcase-breathing-cycle/page3?t=1332902&page=3