Clutch & Transmission

Hudson & Ali W.
Part One: The Clutch
THE ENGINE SPROCKET IS ATTACHED IN THE BACK TO THE FLYWHEEL (NOT SHOWN; WITHIN THE CASE) AND PROVIDES POWER TO THE SYSTEM.

THE THING IN BLUE IS ACTUALLY A COLLECTION OF MANY DIFFERENT PARTS THAT TOGETHER FORM THE CLUTCH BASKET, WHICH IS WHERE THE CLUTCH IS LOCATED.

The pressure plate is pressed by three springs so that it pushes together the driving plate and the driven plates, located within the clutch basket, causing them to rotate together.

The springs naturally push on the plates, and are forced to slacken by a push rod (not shown), which is pushed by a lever controlled by riders pulling on the clutch cable.
These six objects constitute the innards of the clutch basket: three ‘driving plate’ alternating with three ‘driven plates.’
Each driving plate has eight protruding teeth.

These teeth fit into the recessed teeth of the clutch basket.

This ensures that all three driving plates ALWAYS rotate with the clutch basket.
The teeth on the inside of the driven plate fit into the recessed teeth on the shock absorber, which in turn rotates the transmission (on the other side of the bottom end).
Shock Absorber

Acts as the base layer for the clutch basket.
The driving plate (at right) have four sections made of cork (one of which is outlined in purple). This means that when the springs on the pressure plate are in their default position of pressing the driving and driven plates together, the friction created by the cork quadrants on the driving plates forces all six plates to rotate in unison.

**HOWEVER!**

When the rider pulls the clutch handle, a push rod relaxes the pressure plate and allows the transmission to STOP rotating, EVEN THOUGH the engine is still running.
Clutch Side of the Bottom End
Part 2: The Transmission
THE JOB OF THE TRANSMISSION IS TO SHIFT THE MOTORCYCLE.

TORQUE ENTERS THE SYSTEM VIA THE GREEN ARROW, WHICH IS INDIRECTLY POWERED BY THE FLYWHEEL VIA THE CLUTCH BASKET.

TORQUE EXITS THE SYSTEM VIA THE RED ARROW, WHICH IN REALITY HAS A CHAIN ATTACHED TO IT THAT LINKS UP WITH AND MOVES THE REAR WHEEL.

'MAIN SHAFT'

'LAY SHAFT'

FIXED ATOP THE SHAFTS ARE ROTATING GEARS CALLED 'SPROCKETS.'
EVERY PIECE WITH THE SAME COLOR ALWAYS ROTATES WITH ALL OTHER PIECES OF THE SAME COLOR.

IN OTHER WORDS: ONE RED THING MOVES, ALL RED THINGS MOVE.
Which gear is selected is determined by which sprockets are ‘engaged,’ which create paths the torque follows.

The colored paths indicate the causal progression of torque.
The second sprockets on both the main shaft and the lay shaft can move right or left and fix themselves into the gear directly adjacent to them.

Each of the two have grooves on either side, called splines. These fit into the larger sprockets on either side, a process called ‘dogging.’

When the one sprocket is dogged to another, the two sprockets are locked together, which means they rotate at the same rate.
SECOND SPROCKETS!

**This is what the second gears look on their lonesome**

**The exterior teeth on both sides of the second gear fit into the recessed teeth on the adjacent sprockets**

**This is what that process looks like.**

**When the gears are 'locked' together like this, the two sprockets rotate together.**
These are the selector forks. They fit above the main and layshaft, and fit into the sides of the second gears on each shaft. They control the movement of the second gears.

This is what the selector forks look like in place. The rod is attached to the inside of the engine case, ensuring that the forks move along the same, consistent line.
The compact plate moves the two selector forks. It has two channels that move each fork individually. The compact plate is moved by the gearchange quadrant (not shown), which has two prongs that fit into the numbered holes. The gearshifter pedal moves the gearchange quadrant.
1: The torque enters the mainshaft and travels to the first sprocket,
2: gets transferred to the fourth sprocket on the layshaft,
3: which is locked to the second sprocket of the layshaft,
4: which rotates with the first sprocket on the layshaft,
5: which rotates the fourth sprocket on the mainshaft,
6: which is connected to the output sprocket.

The sprockets highlighted in orange will rotate, but that rotation doesn't affect the system in any way.

We took out the output sprocket for clarity.

Everything in blue is part of the causal progression of torque: in this setup, one blue thing moves, they all move.

This sprocket is dogged to the left, locking 2 & 4 together.
<table>
<thead>
<tr>
<th>Gear</th>
<th>Mainshaft (# of teeth)</th>
<th>Layshaft (# of teeth)</th>
<th>Ratio</th>
<th>Total Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>29</td>
<td>16/29</td>
<td>256/841</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>25</td>
<td>4/5</td>
<td>64/145</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>20</td>
<td>5/4</td>
<td>20/29</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>16</td>
<td>29/16</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Ratio = the # of spins that the clutch basket will rotate per one rotation of the output sprocket**

<table>
<thead>
<tr>
<th>Engine sprocket</th>
<th>= 19T</th>
<th>Rear Wheel Specs: diameter = 18 inches circumference = $\pi(d) = 56.55$ in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch basket</td>
<td>= 48T</td>
<td></td>
</tr>
<tr>
<td>Gearbox</td>
<td>= 17T</td>
<td></td>
</tr>
<tr>
<td>Output Sprocket</td>
<td>= 54T</td>
<td></td>
</tr>
</tbody>
</table>

Output Sprocket to Gearbox: 54T : 17T → clutch rotates at about \( \frac{1}{3} \) the speed of the gearbox

Engine to Clutch: 48T : 19T
Part 3: Assembly

THE GEARCHANGE QUADRANT IS INSTALLED AND READY TO MOVE THE COMPACT PLATE

THE COMPACT PLATE, INSTALLED AND READY TO MOVE THE SELECTOR FORKS

THE SELECTOR FORKS, INSTALLED AND READY TO MOVE THE MAIN AND LAY SHAFT

THE IS THE TIMING SIDE OF THE BOTTOM END OF THE ENGINE
The lever of the clutch operating lever assembly is pulled by the clutch cable (on the handle bars) and pushes the pushrod, releasing the clutch.

The kickstarter lever (in reality outside the next casing) is attached to the end of the layshaft.

The gearchange pedal (in reality outside the next casing) is attached to the end of the gearchange quadrant, and is moved with the foot.