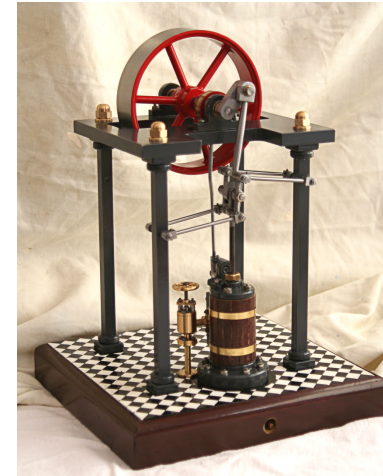


- HELPING DAD -

**A CROSS SINGLE TRUE VERTICAL ENGINE  
A SIMPLE MILL ENGINE**

**BILL OF MATERIAL**

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**Table 1: Threading Tools Required**

Size	Taps	Dies
M 2	2 <sup>nd</sup> and Plug	Yes
M2.5	2 <sup>nd</sup> and Plug	Yes
M3	2 <sup>nd</sup> and Plug	Yes
M4	2 <sup>nd</sup> and Plug	Yes
M5	Yes	No

**Table 2: Metric: BA: Unified Thread Equivalents**

Metric	BA	UN Course	UN Fine
M2	9	1-64	1-72
M2.5	7	3-34	3-56
M3	6	4-40	4-48
M4	3	8-32	8-36
M5	1 or 2	10-24	10-32

**Table 3: Bill of Material**

Part No	Description	Qty	Material	Size	Source
1	Cylinder Assembly	1	Comprising Of:-		
2	Cylinder	1	Aluminum	32mm Dia x 60mm 1 1/4" Dia x 2 1/2"	Model Engineer Advertiser
3	Valve Chest	1	Aluminum	16mm square x 50mm 5/8" square x 2"	Model Engineer Advertiser
4	Front Cover	1	Aluminum	35mm Dia x 50mm	Model Engineer Advertiser
5	Rear Cover	1		1 3/8" Dia x 2"	
6	Cylinder Base Plate	1	Aluminium	60mm Dia x 75mm 2 1/2" Dia x 3"	Model Engineer Advertiser
7	Valve Rod Guide	1	Brass or Aluminium	18mm Dia x 25mm 3/4" Dia x 1"	Model Engineer Advertiser
8	Valve Guide Stuffing Box	1	Brass or Aluminium	10mm Dia x 25mm 1/2" Dia x 1"	Model Engineer Advertiser
9	Piston Valve	1	Silver Steel	6mm Dia x 25mm 1/4" Dia x 1"	Model Engineer Advertiser
10	Valve Chest End Closure	1	Aluminium	10mm Dia x 25mm	Model Engineer Advertiser
11	Valve Rod	1	Silver Steel	3mm Dia x 75mm 1/8" Dia x 3"	Model Engineer Advertiser
12	Piston and Cross Head Assembly	1	Comprising Of:-		
13	Piston Rod	1	Silver Steel	4mm Dia x 100mm	Model Engineer Advertiser
14	Piston	1	Brass or Stainless Steel	20mm Dia x 25mm 3/4" x 1"	Model Engineer Advertiser
15	Connecting Rod	1	Mild Steel	1/4" x 3/4" x 3"	Model Engineer Advertiser
16	Connecting Rod Bearings	2	Brass or Phosphor Bronze	10mm Dia x 25mm 3/8" x 1"	Model Engineer Advertiser

Part No	Description	Qty	Material	Size	Source
17	Cross Head	1	Mild Steel	½" x 3/8" x 2"	Model Engineer Advertiser
18	Piston Rod Guide	1	Brass or Aluminum	10mm Hex x 25mm 3/8" Hex x 1"	Model Engineer Advertiser
19	Cross Arm Assembly	1	Comprising Of:-		
20	Cross Arm Rod	4	Silver Steel	3mm x 13" 1/8" x 13"	Model Engineer Advertiser
21	Cross Arm End	8	Mild Steel	6mm Squ x 160mm ¼" Squ x 6"	Model Engineer Advertiser
22	Cross Head Pin	1	Silver Steel	6mm Dia x 50mm ¼" Dia x 2"	Model Engineer Advertiser
23	Swing Arm Assembly	2	Comprising Of:-		
24	Swing Arm	2	Mild Steel	¼" x 5/16" x 4"	Model Engineer Advertiser
25	Swing Arm Pin	4	Silver Steel	3mm Dia x 80mm 1/8" Di8 x 3"	Model Engineer Advertiser
26	Valve Rod Linkage and Eccentric Assembly	1	Comprising Of:-		
27	Valve Rod	1	Silver Steel	3mm x 120mm 1/8" x 5"	Model Engineer Advertiser
28	Valve Rod Coupling	1	Mild Steel	6mm x 30mm ¼" x 11/4"	Model Engineer Advertiser
29	Eccentric Rod Coupling	1	Mild Steel	6mm x 25mm ¼" x 1"	Model Engineer Advertiser
30	Eccentric Assembly	1	Comprising Of:-		
31	Eccentric Sheath	1	Mild Steel or Brass or Aluminum	32mm Dia x 25mm 11/4" Dia x 1"	Model Engineer Advertiser

Part No	Description	Qty	Material	Size	Source
32	Eccentric Inner	1	Mild Steel or Brass	32mm Dia x 25mm 1 1/4" Dia x 1"	Model Engineer Advertiser
33	Eccentric Outer	1	Mild Steel or Brass	32mm Dia x 25mm 1 1/4" Dia x 1"	Model Engineer Advertiser
34	Pillar Assembly	4	Comprising Of:-		
35	Pillar	4	Mild Steel	3/8" Square 26"	Model Engineer Advertiser
36	Dome Nut	4	Brass or Steel	1/2" Hexagon	Model Engineer Advertiser
37	Rotunda	8	Mild Steel	1/4" x 3/4 x 7"	Model Engineer Advertiser
38	Pillar Base	8	Mild Steel	1/4" x 3/4 x 7"	Model Engineer Advertiser
39	Parallel Bar	2	Silver Steel	4mmDia x 100mm 5/32" x 4"	Model Engineer Advertiser
40	Brass Washer	4	Brass or Mild Steel	20mm Dia x 25mm 3/4" Dia x 1"	Model Engineer Advertiser
41	Stud	4	Mild Steel	4mmDia x 130mm	Model Engineer Advertiser
42	Bearing Stand Assembly	2	Comprising Of:-		
43	Bearing Stand	2	Mild Steel	5/16" x 1 1/2" x 3"	Model Engineer Advertiser
44	Main Bearing	2	Brass or Phosphor Bronze	16mm Dia x 30mm 5/8" Dia x 1 1/4"	Model Engineer Advertiser

45	Crank Shaft Assembly	1	Comprising Of:-		
46	Crank Pin	1	Silver Steel	6mmDia x 25mm ¼" Dia x 1"	Model Engineer Advertiser
47	Crank Web	1	Mild Steel	12mm x 8mm x 35 ½" x 5/16" x 1 ½"	Model Engineer Advertiser
48	Crank Shaft	1	Mild Steel or Silver Steel	8mm Dia x 125mm 5/16" x 5"	Model Engineer Advertiser
49	Valve Stem Guide Assembly	1	Comprising Of:-		
50	Valve Stem Guide	1	Mild Steel or Brass	Cold Drawn 2" x 2" x 1 ¼" Angle	Model Engineer Advertiser
51	Valve Stem Guide Top	1	Mild Steel or Brass	Cold Drawn 2" x 2" x 1" Angle	Model Engineer Advertiser
52	Stop Valve Assembly	1	Comprising Of:-		
53	Top Cover	1	Brass or Aluminum	16mm x 25" 5/8 x 1"	Model Engineer Advertiser
54	Valve Spindle	1	Stainless Steel or Silver Steel	5mm x 40mm	Model Engineer Advertiser
55	Valve Wheel	1	Brass	7/8" Dia x 1" 22mmDia x 25mm	Model Engineer Advertiser
56	Stem Bolt	2	Mild Steel	4mm x 50mm	Model Engineer Advertiser
57	Valve Body	1	Brass or Aluminum	16mm x 25mm 5/8" x 1"	Model Engineer Advertiser
58	Flange	1	Brass or Aluminum	25mmDia x 35mm 1" Dia x 1 ½"	Model Engineer Advertiser
59	Stem Nut	1	Brass or Aluminum	16mm x 25mm	Model Engineer Advertiser

				5/8" x 1"	
60	Pipe Flange	2	Brass or Aluminum	16mm x 25" 5/8 x 1"	Model Engineer Advertiser
61	Air Connection Assembly	1	Comprising Of:-		
62	Feed Pipe	1	Thin Wall Brass Tube	5mm Dia x 40mm	Model Engineer Advertiser
63	Spacer Bush	1	Brass	¼" Dia x ½"	Model Engineer Advertiser
64	Pipe Sheath	1	Thin Wall Brass Tube	3/8" Dia x 1"	Model Engineer Advertiser
65	Pipe Connector	1	Brass	20mm Dia x 25mm ¾" Dia x 1"	Model Engineer Advertiser
			Copper pipe	1/8" x 12"	Model Engineer Advertiser
			Plastic Tube	As used for car windscreen washers	
66	Top Plate	1	Aluminum Plate	10mm x 140mm x 160mm	Model Engineer Advertiser
67	Fabricated Flywheel Assembly	1	Comprising Of:-		
68	Outer Rim	1	Mild Steel Welded Tube	5" Dia x 1/8" Thick x 1 3/8"	Internet Auction Site
69	Hub	1	Hot Rolled Mild Steel	7/8" Hexagon x 3"	Internet Auction Site
70	Spoke	6	Mild Steel	6mm Dia x 400mm ¼" Dia x 16"	Model Engineer Advertiser

72	Base	1	Comprising Of:-		
			Soft Wood Bull Nosed Molding	3/8" x 1" x 36"	DIY Store
			Soft Wood Planed	1/2" x 3/4 x 36"	
			High Density MDF chip board	8" x 8" x 3/8"	
			Plastic Corner Brackets	6 off	
	Alternative Cast Fly Wheel	1	4" Diameter Stuart type cast flywheel		RDG
	Alternative Fabricated Flywheel	1	Comprising of		
	Rim	1	Mild Steel welded tube	100mmDia x 4mm wall x 25mm	Internet Auction Site
	Spoke Plate	1	Mild Steel	100mm Square x 1/4" thick or 100mm dia	Internet Auction Site
	Hub	1	Mild Steel	1"Dia x 1"	Model Engineer Advertiser
	Hub Washer	1	Mild Steel	1"Dia x 1"	Model Engineer Advertiser
	Crank Shaft Spacer	1	Mild Steel	1/2" x 1"	Model Engineer Advertiser
Adhesives used		High Strength Loctite 603 or equivalent			
		Bearing fit Loctite or equivalent			
		Medium Strength Stud Lock			
		Copidex			
		Woodworking Adhesive			

Fasteners				
	M2 Studding (All Thread)	12"	Stainless or Mild Steel	Model Engineer Advertiser
	M2.5 Studding (All Thread)	12"		
	M3 Studding (All Thread)	12"		
	M4 Studding (All Thread)	12"		
	M2 Nuts	30 off		
	M2.5 Nuts	4 off		
	M3 Nuts	15 off		
	M4 Nuts	3 off		
	M5Bolt	1 off		
	M3 C/sunk Cap Screws 30mm long	4 off		
	M3 C/sunk Cap Screws 10mm long	1 off		
	M3 Grub Screw 5mm long	1 off		
	M2.5 Grub Screw 5mm Long	1 off		

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