MINI WORKSHOP ON A BICYCLE

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Some basic hand-tools and simple machine tools are required for developing prototypes, maintaining equipment, making models for hobby centres and even for day-to-day household repairs. Those who like to enjoy the charm of working with their own hands often face the problem of grinding, turning, facing, coil winding, drilling, etc. These are very common operations required for a small job. School children generally work on light sheet metals and wood (which can be easily fabricated) while making their own models. They also require similar operations to be done on those. Those who are to set up models on electricity (low voltage) will not like to work with torch cells if other source of electricity is available. This is due to various difficulties with the torch cells. Schools and hobby centres having electricity supply can use motorised units for fabrication works. For a typical rural situations, we then have to think of some mechanically driven implements. For designing school science equipment, we have encouraged the use of common indigenous materials which are available everywhere. The power, generated at the bicycle pedals, can solve some of those problems nicely. Bicycle is available everywhere. Only some attachments are to be fitted in it to serve the purpose.

Power Developed at the Bicycle Pedal

The average effort that is generally given at the pedal by the cyclist is 15 kg. At moderately high speed, the pedal is rotated at 66 R.P.M. Taking the pedal radius [illegible]0 mm-

HP generated = $\frac{2\pi NT}{75 \times 60}$ where N = R.P.M

T = Torque in kgm

$= \frac{2\pi \times 66 \times (15 \times .18)}{75 \times 60} \cong$ 0.24 (Nearly)

Attachment to utilise the Power at the Pedal in Cutting, Grinding, etc.

Drawing No. 1 shows the power transmission arrangement. Attempts in arranging the pulleys have been made in such a manner that a very high R.P.M. may be obtained at the chuck. Thus, if the pedal rotates at the 66 R.P.M., the chuck will rotate at

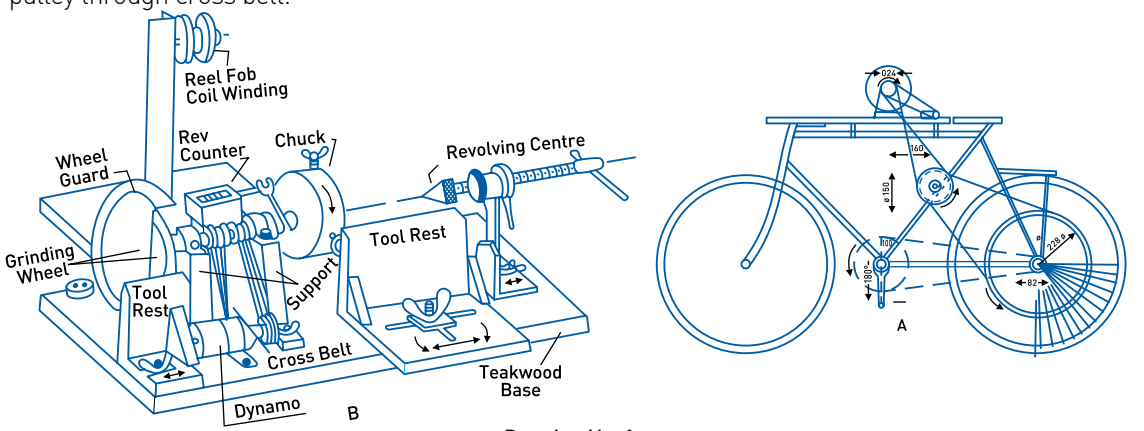
$66 \times \frac{100}{41} \times \frac{228}{75} \times \frac{75}{12}$ = 3058 R.P.M.

Considering a slip of 5% on each belt the R.P.M. at the chuck will be –2700 R.P.M.

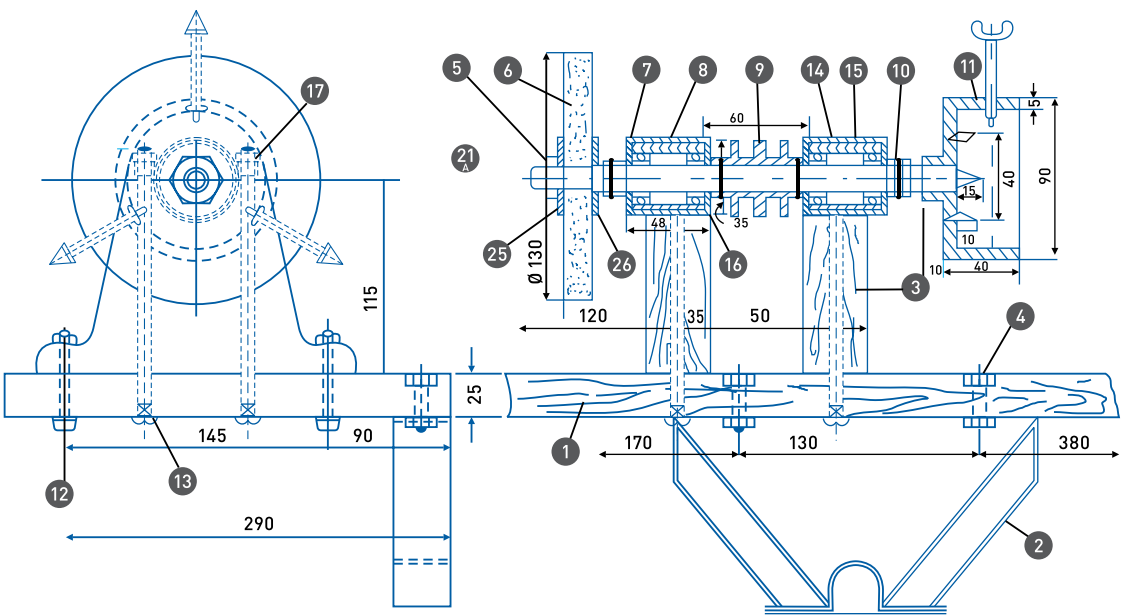
Drawing No. 1 shows that a sheet metal rim of 228 mm radius is fitted to the rear wheel. This

rim is fixed in position with the help of thin wires wrapped around the spokes. The compound pulley at the frame is rotated by the rim through the open belt and the 24 mm diameter pulley on the main spindle is rotated by the compound pulley through cross belt.

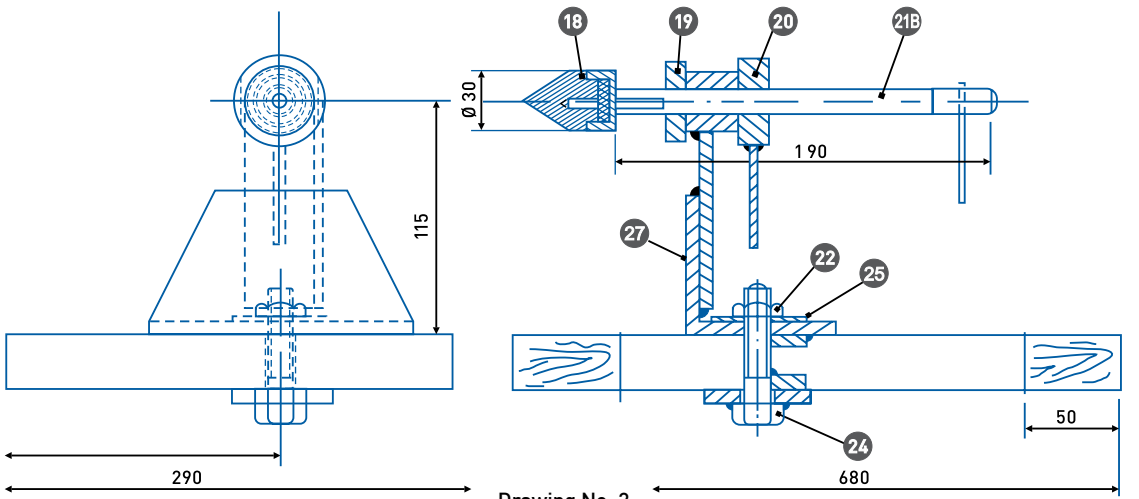
Two supports are to be fitted on the horizontal pipe of the bicycle frame. On these supports, a teakwood base with the chuck-tail stock assembly will be mounted. Drawing No. 1 shows (from the left): plug point, the grinding wheel



Drawing No. 1



Drawing No. 2



Drawing No. 3

17.	Nut	M.S.	2	Plated
16.	Ball Bearing	M.S.	2	No. 6002 15
15.	Bush	M.S.	2	
14.	Spacer	M.S.	2	
13.	Stud M6×150	M.S.	4	Plated
12.	Nut Bolt M6×50	M.S.	4	
11.	Chuck	C.I.	1	
10.	Bush	M.S.	2	
9.	Pulley	M.S.	1	
8.	Bracket	M.S.	2	Black Paint
7.	Cover	M.S.	2	Plated
6.	Grinding Wheel		1	150 ø /
120×20				
5.	Nut M12	M.S.	1	Plated
4.	Nut & Bolt M6×30	M.S.	4	Plated
3.	Support Block	Wood	2	Green Paint
2.	Bracket	M.S.	2	Black Paint
1.	Base Wood	Teak	1	Green Paint

Drawing No. 4: Bill of Materials

Item	Description	MAT	No. off	Remarks
34	Bicycle Dynamo		1	
33	Revolution Counter	6 Digit	1	
32A&B	Tool Rest	Wood	2	Painted
31	Cycle			22/24
30	Rim	M.S.	1	Plated
29	Pulley	Wood	1	Green Paint
28	Bracket	M.S.	1	Black Paint
27	Bracket	M.S.	1	
26	Washer	M.S.	1	
25	Washer	M.S.	1	
24	Bolt with Washer	M.S.	1	Plated
23	Washer	M.S.	1	Plated
22	Nut M12	M.S.	1	
21 B	Tail Stock Screw	M.S.	1	Plated
21 A	Shaft	M.S.	1	
20	Nut with Handle	M.S.	1	Plated
19	Nut	M.S.	1	Plated
18	Revolving Centre	M.S.	1	with 8 mm Ball Bearing

with guard and tool rest, wooden supports for the spindle, revolution counter for coil-winding, cross belt connection to the compound pulley, open belt connection to the dynamo, the chuck, the tool rest for turning, facing, etc. and the tail stuck with the revolving centre. The two tool rests can be adjusted as shown and the tail-stock can be moved back and forth for long and short jobs. The details of the chuck, the tail stock, the bill of materials can be seen in Drawing Nos. 2, 3, 4 respectively.

Operation

The arrangement is suitable for wood-work. On one side, the log is to be held in the chuck either on the centre and two pins (Drawing No.2) or by screwing in the three screws depending on the size of the log; on the other side, the revolving centre will be pressed on to the log by means of screw and nut (Drawing No.3). The cycle is to be supported on its stand, so that the rear wheel is lifted from the ground. The tool rest is to be adjusted to the desired position and fixed in this position by the fly-nut. First few pedals will overcome the inertia of the whole system and after 15-20 pedallings, the fly-wheel action of the chuck will be observed. The operator will hold the tool with both hands, rest it on the tool-rest and advance it towards the job held between the centres. The grinding operation is comparatively easier. While winding coils, the spindle is to be rotated at a lower speed and the revolution will be read from the revolution counter. For all these operations, the operator will sit on the carrier and pedal with his legs.

The dynamo will produce electricity. While peddling, if a bulb is connected to the plug-point on the base, it will glow brighter with higher speed of peddling.

Salient Features

(a) All the attachments are detatchable.

(b) All the parts are easily repairable/replaceable.

(c) The extra pulley on the main spindle may be utilised for transmitting this motion to any desired equipment set-up.

Understanding Mechanics

The power transmission can be a lesson for the students. This can also be accompanied by calculations of mechanical advantage and velocity ratio, etc. This simple and indigenous arrangement may motivate many to think on similar lines and in addition help develop basic skills in handling machine tools.