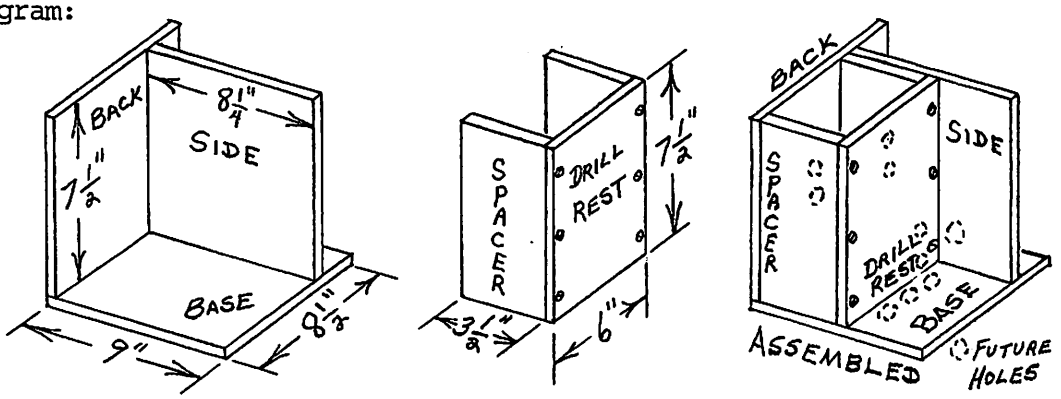
John B. Johnston, The Faraday Center, 103 Creamery Rd., Livingston Manor, NY 12758
(845) 439 - 4706

The rotator - has always been a very useful piece of apparatus in the physics classroom, especially in the study of mechanics. However, the commercial versions are quite expensive. A less expensive alternative that may be as useful is presented here. It requires a corded electric hand drill, a Variac, and a homemade, wooden platform. The design and construction are simple so people can easily assemble it. Possible uses will be discussed later.

A lot of corded drills may be available as users transition to cordless; inquire around. Just be sure the bearings are not badly worn. The dimensions of the platform may need to be changed depending on the size of the drill you finally choose. My "rotator" is a 3/8" B&D (2.5 amp., 1-1200 rpm) drill; however, any good 3/8" drill should work well enough.

The platform should be "universal", so the chuck can be horizontal or vertical depending on its use. Most rotators are quite heavy and resist movement. This alternative is light-weight and moves easily; thus, for safety, it must be clamped down. My design offers extra areas on the edges for safe clamping. I have also added "finger holes" as a handle to better hold the platform up in the air for special purposes. 3/4" plywood and coarse-thread #6 x 1 5/8" drywall screws should provide enough sturdiness for the platform's construction. Follow the plan in the diagram.

Diagram:



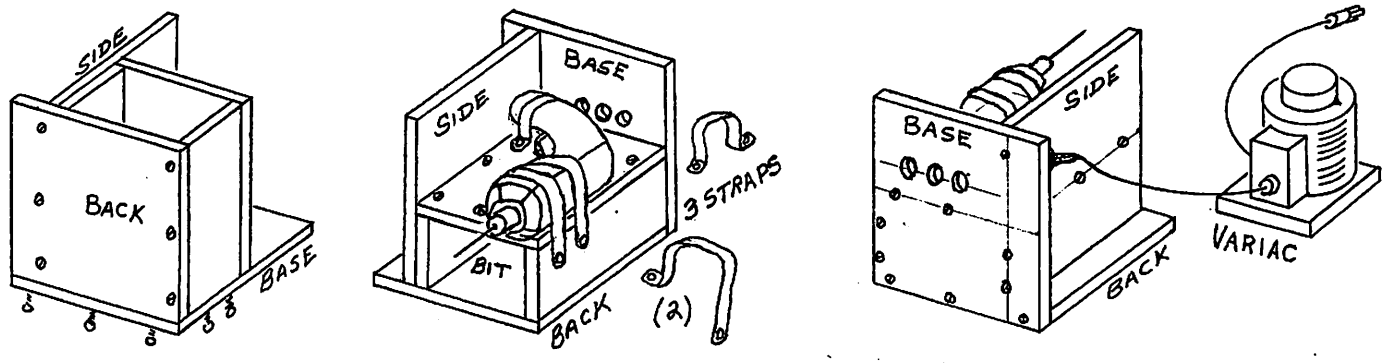
base: 8½" x 9"

back: 8½" x 7½"

side: 8¼" x 7½"

drill rest: 6" x 7½"

spacer: 3½" x 7½" (2)

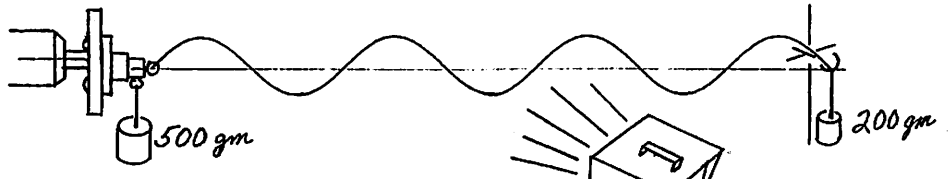


Assembly: Cut out the 6 pieces of plywood; delay the use of glue. Attach the "back" on the "base" with 3 screws. Attach the "drill rest" on the 2 "spacers" with screws. Slide the "drill rest" assembly up against the "back", even with the front of the "base" and add screws. Position the "side" up tight against the "back" and the"drill rest" assembly. Use 3 screws on the long edges to fasten all parts together. Lay the entire platform on its "back" and place the drill (with ¼" bit) on its side on the "drill rest"; align the bit parallel to both sides of the "drill rest". Add a shim (small wood block) under the drill handle so the drill body is flat on (against) the "drill rest". Decide on the cord hole location and its size in the "side". 3 steel straps (3/4" steel hanger strap) are needed to fasten the drill to the "drill rest"; make up the straps as follows. To measure the strap length accurately, use a tailor's flexible tape measure. Cut and bend the straps to fit the drill snugly. This may be done by cutting and/or bending the straps a little "short" to provide tension when tightened down. (I add a strip of innertube rubber under the steel strap to protect the drill's finish.) Bend the 4 tips; 2 tips remain straight. With the drill in place, press the straps around it and mark the bolt holes to be drilled. Six ¼" x 1¼" carriage bolts are to be used. At the same

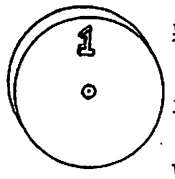
time, locate the three 3/4" dia. "finger holes" (handles) in the "base", just above the "drill rest" edge; these "holes" allow you to easily hold the rotator upside down for some demos. Neat holes are best drilled on a drill press; back out the screws to free the boards if necessary. Reassemble and bolt down the drill in place. If everything is properly aligned and tight and no further adjustments are needed, you can disassemble and add glue to all joints but only as a final step. You may feel that the glue is unnecessary, that the screws are good enough; that's OK.

Now you have a versatile rotator platform. With the drill's trigger locked in the "full on" position, add the Variac for speed control (rpms). Bring on the clamps and accessories, and let the fun begin! Below are some of my favorite accessories. (P) means "purchased".

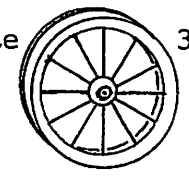
(a) standing waves (harmonics) - an old CENCO eccentric (P) with 7½' of 1/8" dia. braided, nylon rope and a Winsco #E-77 strobe light (P)



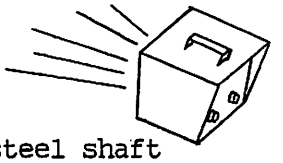
(b) timing (synchronization) - 10" dia. discs with 5/16" steel shafts



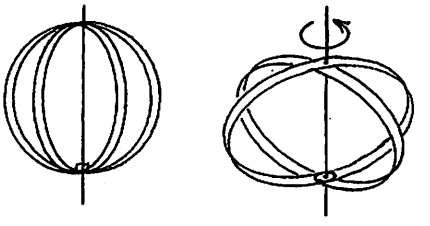
¼" masonite painted flatblack with a white "1"



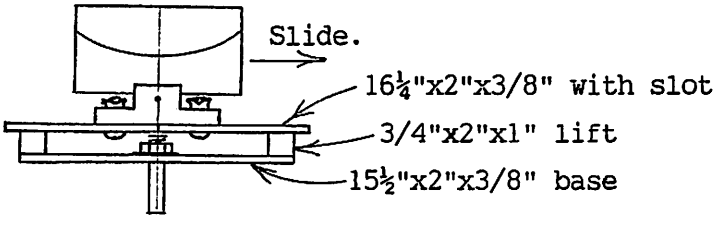
3/8" plywood wagon wheel on 1/8" masonite back, 12 yellow spokes on flatblack



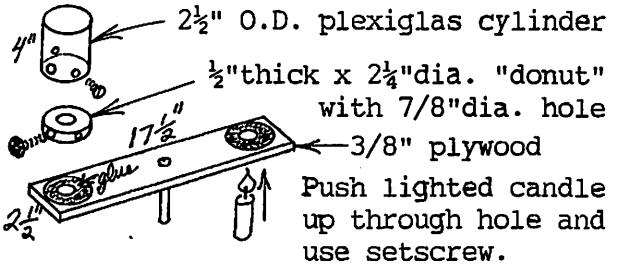
(c) variable g (planetary deformation) 8" dia. hoops on a shaft (P)



(d) centripetal accel. ($a_C=v^2/r$) the accelerometer (P), 5/16" steel shaft



(e) the candle flame paradox usually 2 flames, 5/16" steel shaft



(f) centripetal force ($F_C=mv^2/r$) - amusement park rides (3) 5/16" steel shafts