Automating Hand Cranks
CCFG Ignite 2018

FIRST: GOOGLE ELECTRICAL SAFETY BEFORE PLAYING WITH ELECTRICITY.
I do not in ANY WAY promise your safety if you follow my instructions. I have no idea what I'm doing, I just watched youtube videos and read forums and muddled through until this worked. So be warned: it's ON YOU to be sure what you're doing is safe!

Version control:

1. Version 1: I tried to connect the controller power ends with wire to a DC jack so that I could plug in the AC adapter into the jack, but the jack kept shorting out. I did very briefly get this to work, but then it shorted again.
2. Version 2: I dumped the DC jack idea and cut off the end of the AC adapter and just screwed the wires from the adapter directly to the controller.
3. Version 3: co-worker pulled off my first soldering attempt and helped me get it better and added the heat-shrink wrap for extra safety.
4. Version 4: unscrewed the motor wires from the controller and swapped them so that the knitting machine handle would be turned the other way.
5. Version 5: prototyped a 3D part to hold the motor, was told by husband and roommate it wasn't going to work, idea abandoned.
6. Version 6: went to home depot and bought a lot of parts to try and build a stand to hold the knitting machine and the motor to the end of a table, please see "Building the Stand".

"Make the motor work" parts list:

1. DC motor speed controller (potentiometer is just that knob controller)
    a. https://www.amazon.com/RioRandTM-Upgraded-6V-90V-Motor-Controller/dp/B00F839VNQ
    b. details from amazon if that product link doesn't work anymore:
        i. Working Voltage: DC 6V - DC 90V (Ultra wide working voltage)
        ii. Control Power: 0.01 - 1000W(Max current :15A)
        iii. Static Current: 0.005A (Standby)
        iv. PWM Duty Cycle: 0% -100%
        v. PWM Frequency: 15Khz
        vi. Voltage control:0-5v(Voltage -mode control ,can use PLC to control the motor speed directly)
        vii. With power reverse connection protection, has complete protection from overvoltage, 20A to quickly fuse the ceramic fuse ,can use PLC voltage to control directly.

2. 24V DC Adapter
    a. technically what I ordered was this:
        i. https://www.amazon.com/gp/product/B00J8CG86G
        ii. what actually came was this:
            1. https://www.yoycart.com/Product/551656755828/
    b. details in case neither of those links work anymore:
        i. Input: 100-240VAC 50/60Hz
        ii. Output: 24V 1A
        iii. the size of the end doesn't matter if you're going to cut it off like I did
3. Motor
    a. what I bought: uxcell 24V DC 60 RPM Gear Motor High Torque Electric Reduction Gearbox Centric Output Shaft
        i. https://www.amazon.com/gp/product/B01KTZXYHG
    b. details in case that link doesn't work anymore:
        i. Part Number a16071400ux0604
        ii. Item Weight 7 ounces
        iii. Package Dimensions 5.1 x 3.5 x 1.6 inches
        iv. Item model number a16071400ux0604
        v. Size Centric Output Shaft
        vi. Color 24 Volt/60RPM
        vii. Material Metal, Electronic Parts
    c. I was tempted, after setting this up, to get a faster one, but I haven't tried that yet.
4. Wire
    a. I got 22 gauge: https://www.amazon.com/gp/product/B008CFELUK
5. Solder
    a. I got 60/40: https://www.amazon.com/gp/product/B008CFELUK
6. 3D printed part: https://www.tinkercad.com/things/96w1sFIaa2Q
7. **OPTIONAL**: heat shrink plastic tubes: https://www.amazon.com/Shrink-Tubing-532pcs-innhom-Ratio/dp/B06ZXRLPTZ
8. **OPTIONAL**: electrical tape

Putting it together:

1. Take the AC adapter and cut off the end and strip off some of the plastic from the wire.
2. Wrap the positive wire around the screw of the controller that's labeled "Power +".
3. Wrap the negative wire around the screw of the controller that's labeled "- Power".
    a. Honestly I had no idea which was which. To figure it out I had my friend hold the motor and one of the wires against one of the ends of the motor, plugged the adapter in, and then I pressed the other wire to the other end of the motor. When nothing happened we unplugged and switched the wires and it worked and we went from there guessing that the configuration when it worked meant the wire pressed to + was positive and - was negative.
4. Cut off a piece of your 22 gauge wire and strip a bit of plastic from either end. I used about a foot, which was probably too much, but at the time I had no idea how long to make it. About 6 inches is more than enough, in retrospect.

    a. Solder one end of the wire to the - part of the motor and then connect the other end to the speed controller by wrapping the exposed wire around the screw on the controller labeled "Motor +" (YES, we're wiring - on the motor to + on the controller and vice versa, because - to - and + to + makes the motor turn the knitting machine backwards, which still technically works, but then the numbers run backwards, and I didn't like that in v. 3 so I swapped them and it ran the knitting machine the right way. **By the way, connecting the + end of the motor to the - end of the controller and vice versa is ok, but you HAVE TO connect + to + and - to - when connecting the controller to the power source. Crossing the wires from the power to the controller will at best just not work and at worst break the controller.** Or maybe start a fire! Who knows! I don't! Reminder: GO TO SOMEONE ELSE FOR REAL SAFETY TIPS.
5. Between the wire and the motor is where my co-worker added the heat shrink wrap in v. 3. This is optional. It worked without it, but it's objectively safer to add it.
6. Cut a second piece of wire (same co-worker recommended making it shorter than the first one so that if the wires pop off they're not the same length and touch and short circuit and start a fire or something), strip some plastic from either end, solder one end to the + part of the motor and screw in the other end to the controller where it's labeled "- Motor".
7. Put the 3D printed part on the motor.
8. Connect the 3D printed part to the knitting machine.
9. Plug it in, and it runs!

It was at this point I partied hard!! ...until I realized that I was still going to have to stand there and hold the motor! Crap!

So I was on to the next project:

Building the Stand

Stand Parts list:

1. two pieces of wood approx 18" long x 2" wide x ¾" tall
2. one piece of wood approx 6 ½" long x 11 ½" wide x ¾" tall"
3. one piece of wood ??* long x 2" wide x ¾" tall
4. 7 screws (I used #8 x 1 ¼")
5. galvanized tab tape ¾" wide
    a. pinched this around the motor and got it to hold using a wing nut and pan head screw - both #10 - 24, the screw was 1" long
6. some clamps to hold the stand to your table

??* = I used a dremel to carve out a sort of U shape (I'm really bad at freehand drilling like that, so "sort of" is a generous description.) This piece, at its shortest point, is about 3 11/16" and at it's longest its about 4 ¼"

Put them together as in this picture: