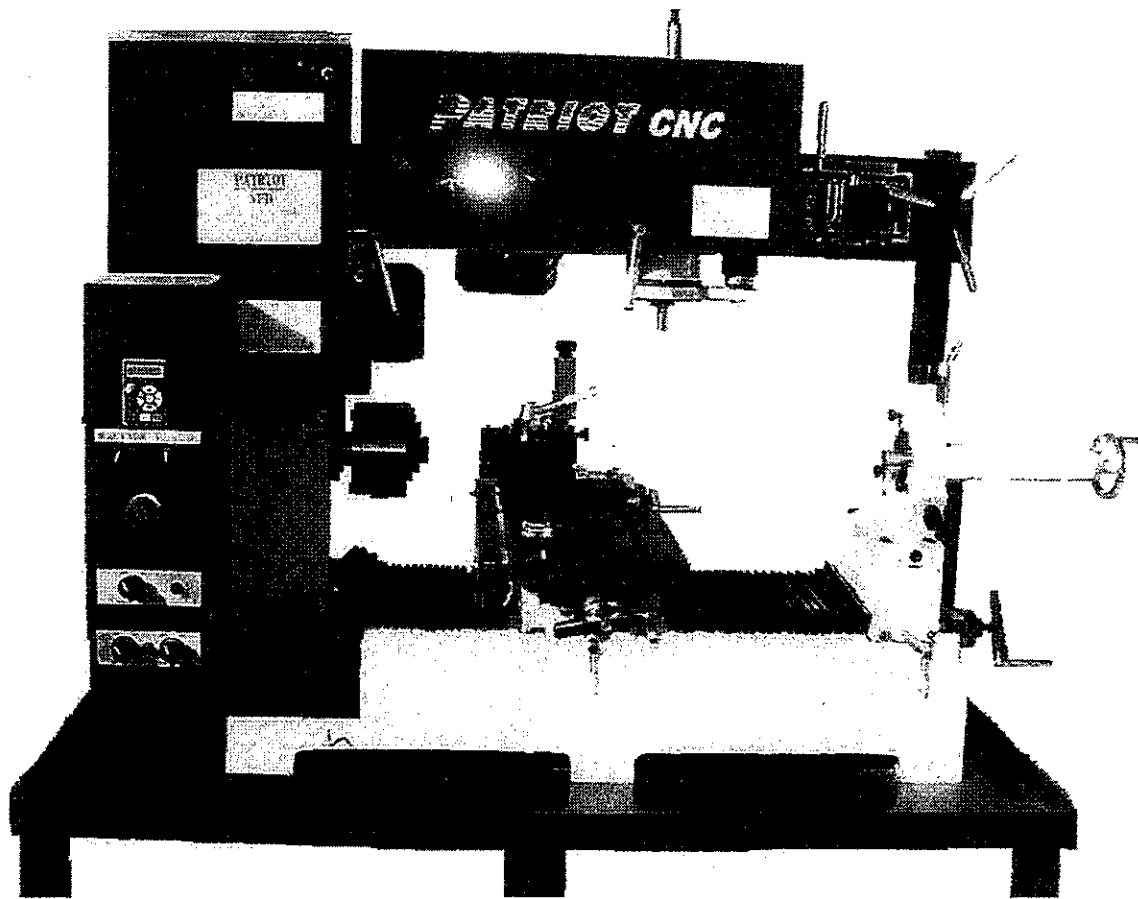


SHOPMASTER™ PATRIOT™ VFD™

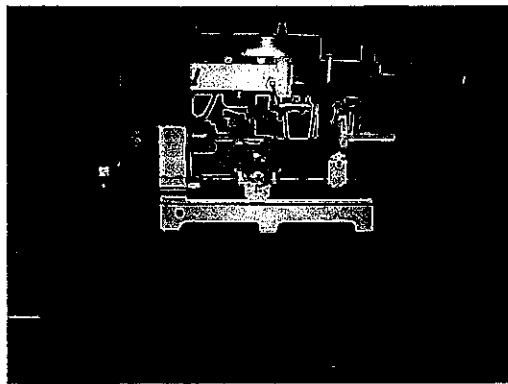
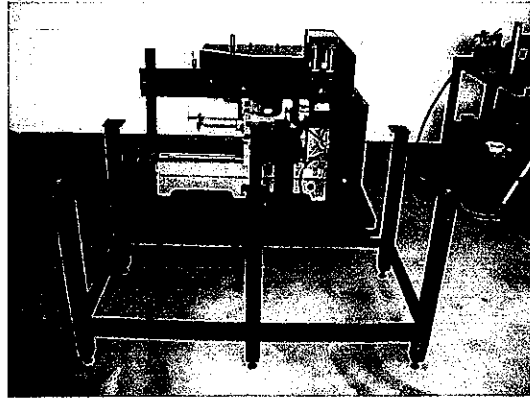
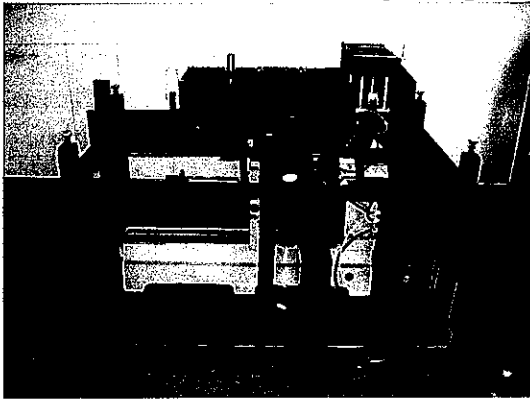
OWNERS MANUAL



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PREPARATION OF YOUR BENCH

1. After removing the wood crate, set it aside.
2. The bench legs are mounted upside down on the bench top. Remove the 12 bolts holding the bench legs in place and lift the leg assembly straight up and off the bench top. (requires 2 people)
3. Turn the leg assembly over so it is resting on the leveling pads.
4. Using your forklift or hoist, raise the machine up and move the leg assembly under it and lower the machine down onto the legs.
5. Align the holes and get all 12 bolts started by hand, then tighten. If you plan to use a coolant system, it would be a good time to seal around each bolt with some silicone sealant.
6. Once in place, screw the leg adjusters out until the machine is resting solidly on them and continue adjusting until your unit is level.



SAFETY RULES FOR THE PATRIOT VFD

WARNING -- DO NOT ATTEMPT TO OPERATE UNTIL YOU HAVE READ THOROUGHLY AND UNDERSTAND COMPLETELY ALL INSTRUCTIONS AND RULES CONTAINED IN THIS MANUAL. FAILURE TO COMPLY CAN RESULT IN ACCIDENTS INVOLVING FIRE, ELECTRIC SHOCK, OR SERIOUS PERSONAL INJURY. MAINTAIN YOUR OWNERS MANUAL AND REVIEW FREQUENTLY FOR CONTINUING SAFE OPERATION AND INSTRUCTING POSSIBLE THIRD-PARTY USER.

1. KNOW YOUR PATRIOT MACHINE

For your own safety, read the owner's manual carefully. Learn it's application and limitation as well as the specific potential hazards peculiar to this tool.

2. NEVER ATTEMPT ANY OPERATION OR ADJUSTMENT IF THE PROCEDURE IS NOT UNDERSTOOD.

3. KEEP GUARDS IN PLACE AND IN WORKING ORDER.

4. REMOVE ADJUSTING KEYS AND WRENCHES.

Form habits of checking to see that keys and adjusting wrenches are removed from the PATRIOT before turning on the machine.

5. DON'T USE IN DANGEROUS ENVIRONMENT.

Don't use the PATRIOT in damp or wet locations or expose it to rain. Keep work area well illuminated.

6. DO NOT REMOVE DRIVE COVERS WHILE IN OPERATION.

7. DON'T FORCE TOOLS.

It will do the job better and be safer at the rate for which it was designed .

8. WEAR PROPER APPAREL.

No loose clothing, gloves, neckties, rings, bracelets, or jewelry to get caught in moving parts. Non-slip footwear is recommended. Wear protective hair covering to contain long hair.

9. ALWAYS USE SAFETY GLASSES.

Every day eyeglasses only have impact-resistant lenses. They are NOT safety glasses.

10. SECURE WORK.

Always secure your work to the table with clamps or vise- NEVER attempt to hold a part by hand.

11. DON'T OVERREACH

Keep your balance and proper footing at all times.

12. MAINTAIN TOOLS IN TOP CONDITION.

Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.

13. DISCONNECT TOOL FROM POWER SOURCE.

Before servicing and when changing accessories such as bits or cutters .

14. AVOID ACCIDENTAL STARTING.

Make sure switch is in "OFF" position before plugging in cord.

15. USE RECOMMENDED ACCESSORIES.

Consult the owner's manual for recommended accessories. Use of Improper accessories may be hazardous.

16. CHECK DAMAGED PARTS.

Before further use of the PATRIOT, a guard or other part that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function-check for alignment of moving parts, binding of moving parts, breakage of parts and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

17. DIRECTION OF FEED.

Only feed work into a cutter against the direction or rotation of the cutter.

18. NEVER LEAVE YOUR PATRIOT RUNNING UNATTENDED.

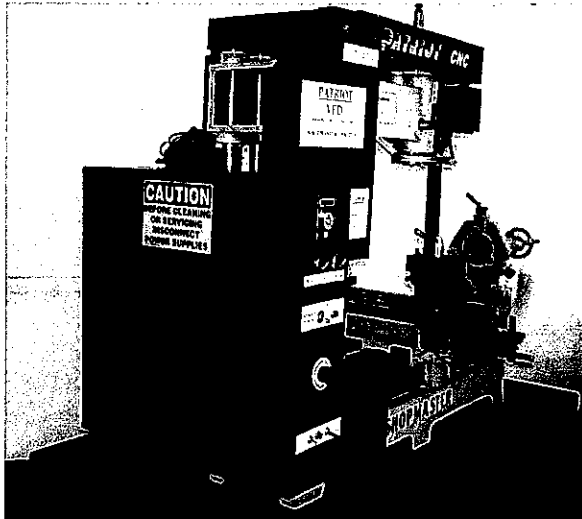
TURN POWER OFF.

Don't leave the machine until it comes to a complete stop.

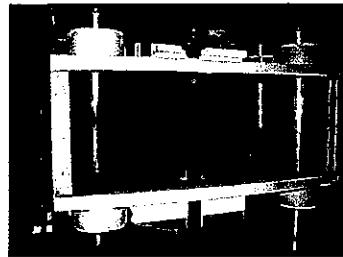
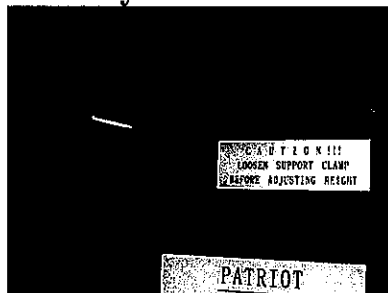
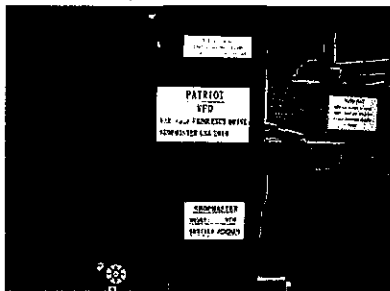
19. NEVER PERFORM AN ABNORMAL OR LITTLE USED OPERATION WITHOUT STUDY AND USE OF ADEQUATE BLOCKS, JIGS OR FIXTURES.

SHOPMASTER PATRIOT CONTROLS

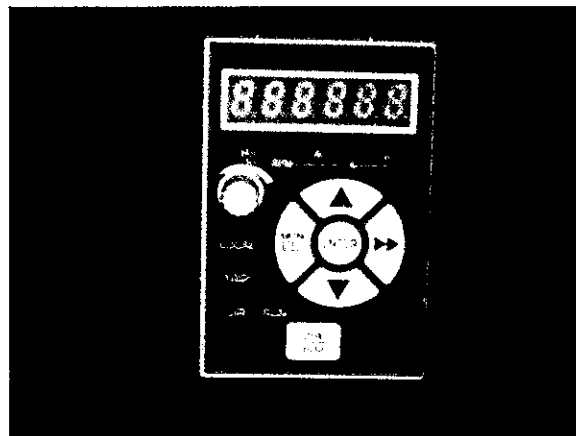
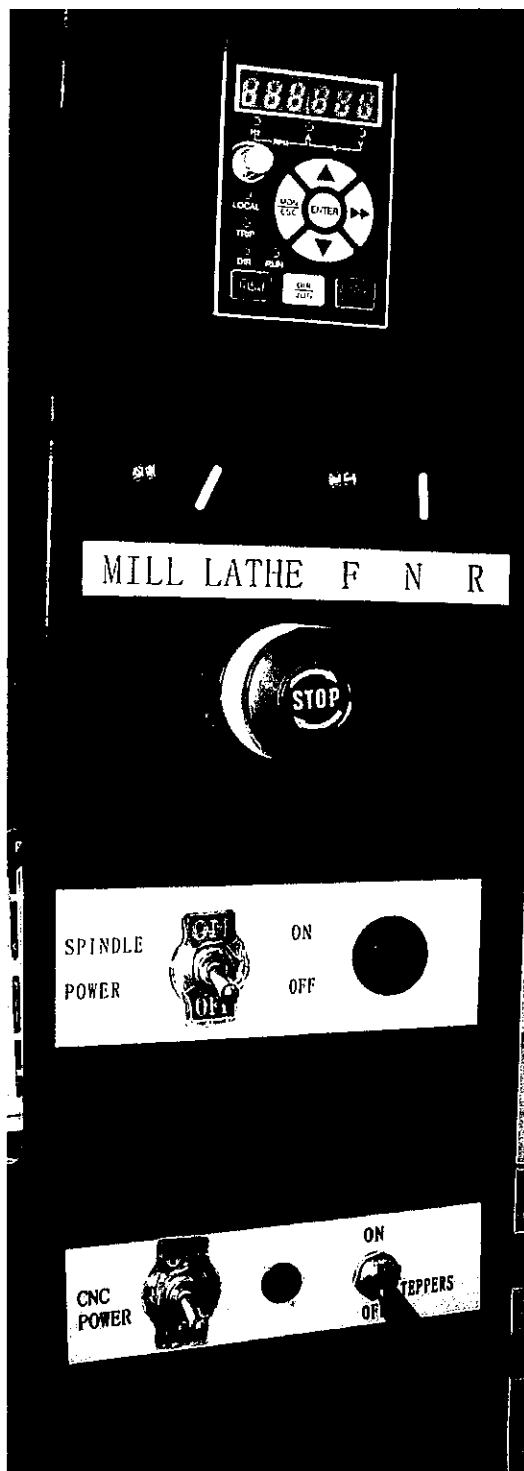
Take a few minutes to familiarize yourself with the location of the various controls on your machine. This will make using your PATRIOT much easier when you are ready to operate the machine.



This is the housing for the CNC electronic drivers. When you order your machine, we will install the CNC system.



This front cover contains your name tag and warning label for the mill lift mechanism. The square head shaft drives a set of helix gears to raise and lower your mill head assembly. The handle which attaches to the square head with a set screw is shipped in your box of parts.



The front panel of the machine contains the main electronic control switches and the VFD control panel. The VFD control panel is located at the top and has the keyboard for selecting the various parameters of the VFD Inverter. The inverter is pre-set at the factory, tested and ready to run when you receive the machine. When the power is applied, there will be a 2 second delay, and then the display will read all zeros. At this time you can select lathe or mill via the switches just below the panel as well as forward or reverse for the spindle direction. Simply by turning the small knob clockwise you can adjust the speed of your spindles. The display will read from 0-75 Hz. At 75 Hz, your spindle will be turning at about 1500 RPM. A simple rule of thumb for knowing your RPM is $5\text{Hz} = 20\text{ RPM}$. Please refer to the .PDF version of the VFD manual for explanations of the many functions of this device. We suggest that you not change any of the factory settings until you become 100% familiar with the machine and its functions. If for any reason the factory settings become lost, you may find the codes in this manual.



Below the VFD control panel you will find the selector switches for Lathe or Mill and another switch for spindle direction with choices of Forward-Neutral- Reverse. If you want to turn the spindles off without doing a full shut-down, simply put the direction switch in Neutral position. The Lathe-Mill selector switch engages a relay inside the metal housing, so you will hear an audible snap as the switch is engaged.

Below these switches is the Emergency Stop (E-Stop) switch. This switch turns off all power to the machine functions in an emergency situation. Simply push the button in and all power is cut off. To re-engage power, turn the switch knob clockwise.

Caution: Before re-engaging the E-Stop, put all other switches in the OFF position and turn the VFD speed control knob fully counterclockwise.

Below the E-Stop is the power switch for the VFD inverter. Beside the switch is a red indicator light to make you aware when the power is on.

Below the VFD power switch is the CNC power switch and a red indicator light. To the right of the indicator light is the engage-disengage switch for the stepper motors. When operating the machine manually, disengage the steppers to prevent them from sending current back into the Gecko drives.

NOTE: Early machines serial # 09116 thru 09917 and 10001 thru 10022 had a rocker style VFD power switch at the top of the housing above the VFD control panel and were not equipped with the E-Stop switch.



At the end of the machine you will find a large steel cover with a warning tag and a hole aligned to the lathe spindle. Behind this cover you will find the VFD inverter, the backs of the various switches, the lathe-mill selector relay, the CNC power supply and the electronic threading module.

CAUTION: These components are operated by high voltage. If you are not competent in electrical work, DO NOT open this cover panel.

The panel is deliberately designed with 6 attachment bolts, 4 of which are recessed to discourage unauthorized entry.

The VFD inverter takes your household single phase 220 volt current and converts it to 380 volt 3 phase out put. It also allows you to vary the frequency of the current and thereby vary the speed of your spindle motors. The remote VFD panel on the front of the machine is connected to the VFD Inverter by a ribbon cable. The inverter has an internal cooling fan.

The 3 phase current goes from the inverter to the magnetic contactor (relay) and is sent to either the lathe or mill motor from the selector switch on the front panel.

To the left of the relay is the CNC power supply. This unit converts your 220 volt household current to 48 volts DC to power the CNC system. The power supply also has an internal cooling fan.

To the left of the power supply is the G540 Gecko drive CNC module, which takes the 48 volt DC and out puts step and direction signals to your stepper motors. Below the Gecko drive is a third cooling fan designed to pull hot air out of the enclosure.

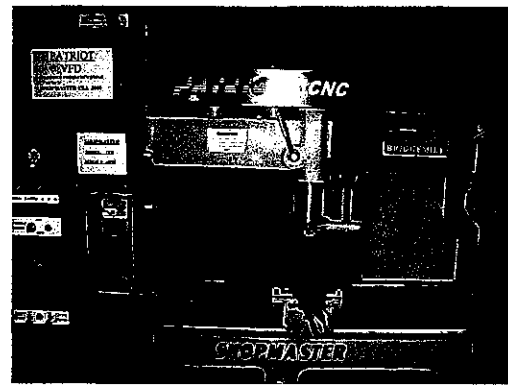
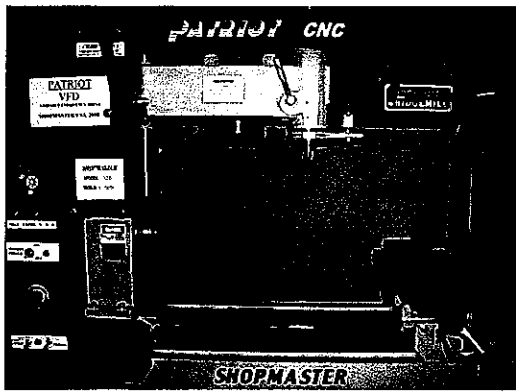
On the outside and at the rear of the sheet metal housing is the output side of the Gecko drive. Here you will find the 4 output ports for your stepper motors as well as the parallel port cable which connects to your computer. A small slide switch is marked " charge pump" leave this in the ON position. Its function is explained in the CNC Setup instruction portion of this manual. Notice that each output port also has a "trim" adjuster. DO NOT adjust these- they have been pre adjusted to match your stepper motors.

There are also 2 lites-

A green lite marked " power" and a red lite marked " fault"

Under normal running, the green lite will be on. However, should a cable come loose the red lite will come on. Also the red lite will be on if you disengage the stepper motors with the switch on the front panel.

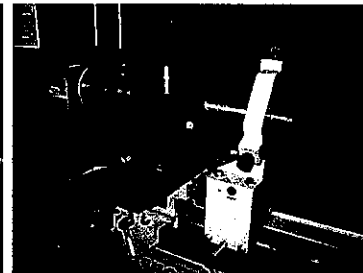
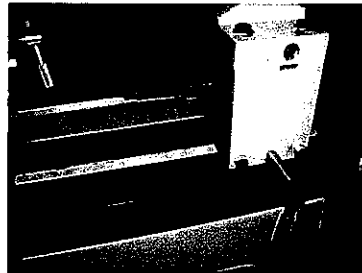
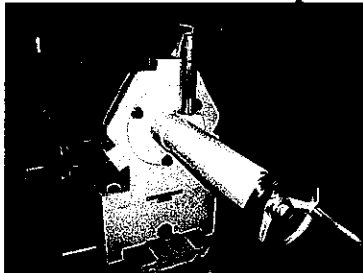
On the lathe drive pulley you will find a round magnet epoxyed in place. This magnet passes in front of a sensor as the pulley spins and sends a signal to the Gecko drive each time the spindle makes one rotation. In your MACH III software there is a threading wizard. This software calculates the spindle speed in relation to the stepper feed rate to allow you to cut various thread pitches. Even as the spindle slows under cutting loads, the software will adjust the stepper speeds to maintain the proper feed rate.



This is the main mill head casting The mill head assembly can be raised and lowered a total of 8". The mechanism consists of a 4 column support plate which holds the head moved by an acme screw activated by the CNC program or the handle on the motor. Beneath the mill belt cover you will find the drive belt for your mill spindle.

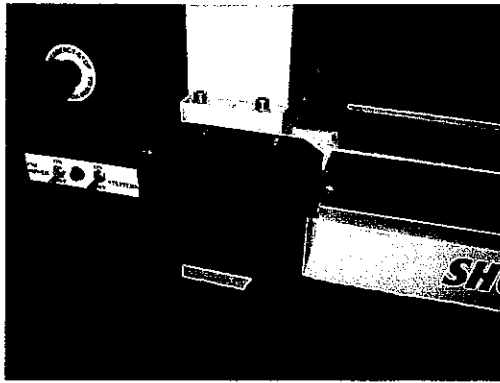
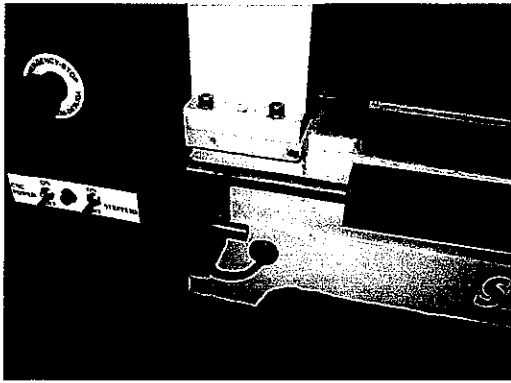


Locking these handles solidifies the mill head once you have set the desired height of the mill. CAUTION- read the warning label and ALWAYS loosen these locks before adjusting the height of the mill. The three handles are packed in the wood box of tools.

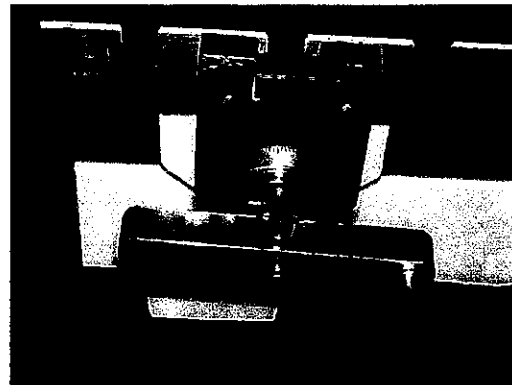
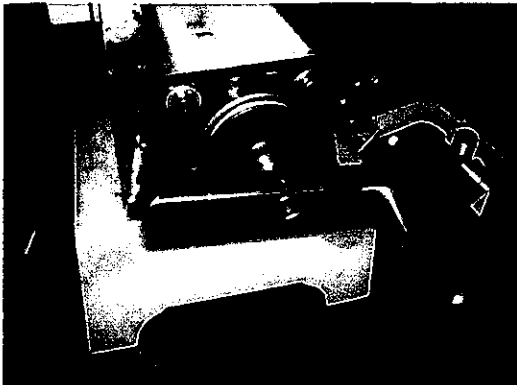


The PATRIOT tailstock assembly is unique in several ways. It combines the traditional tailstock functions with those of a steady rest. The entire long barrel assembly of the tailstock can be removed with 3 bolts to reveal the steady rest function. The tailstock itself has a full 6.25" barrel travel for those deep hole drilling operations. The handle has a dial for your depth measurements. The tailstock can be offset for cutting long tapers in the lathe.

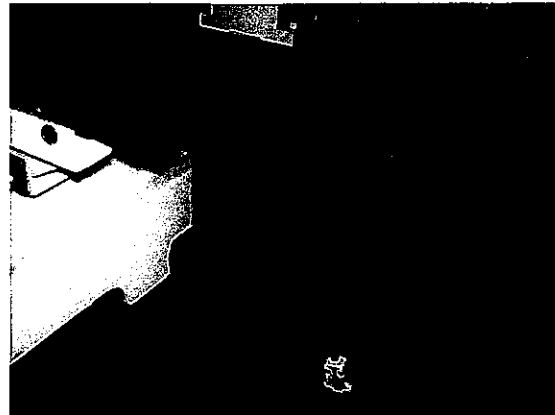
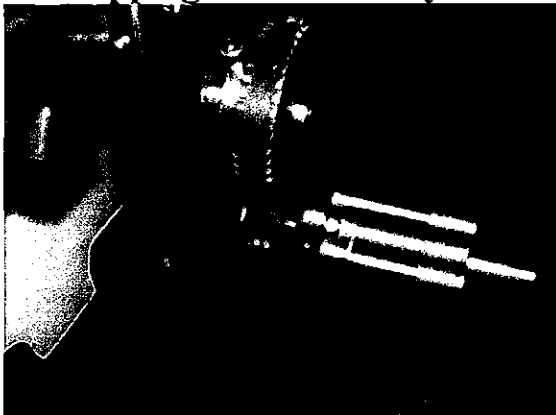
NOTE: From serial # 12001 on, the X leadscrew is in the center of the Main base casting and the mill head shield is larger.



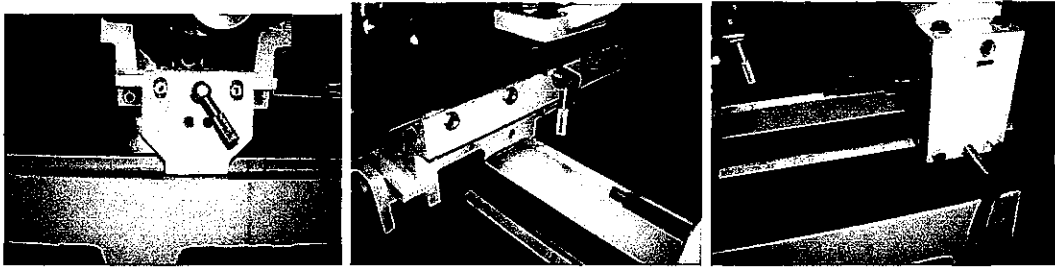
At the lathe end of the machine casting is the X axis CNC drive assembly. Covered by a metal shield, inside is the drive pulley and motor mounting bracket. The bracket has slotted holes for adjusting the X axis cnc drive belt tension.



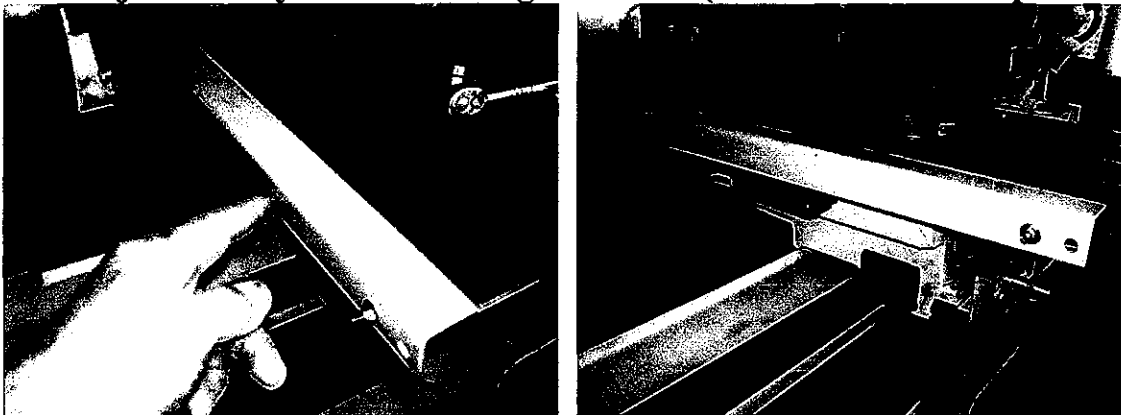
The left picture handle drives your X axis carriage toward and away from the lathe chuck. Use this handle for manual positioning or fine motions. The dial is divided into 0.001" increments and is full floating for easy zero setting. The lock nuts are used to set the preload on the ball screw thrust bearings which are located on each side of the steel mounting plate. One set is covered by the lead screw shield, while the other is recessed into the dial assembly. The right picture handle moves your cross slide table toward and away from you. It has the same dial calibration and thrust bearings. Both handles are removed for shipping and found in your box of tools.



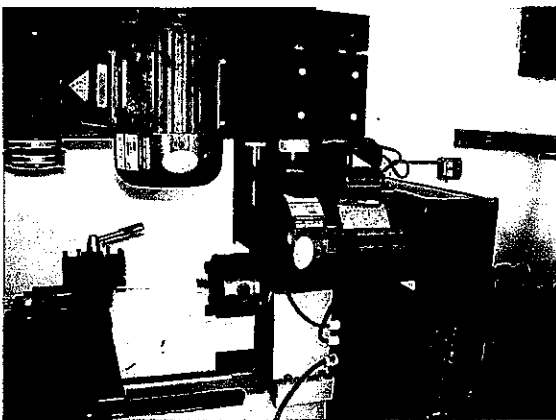
On the opposite end of the cross table is the CNC motor bracket. The motor mounts here and is covered by a sheet metal shield.



The handle in the left picture locks your main carriage travel. The center picture handle locks the cross slide travel and the right picture shows the tailstock lock handle. All the motions are adjustable by means of the gib screws (4 shown in center picture)

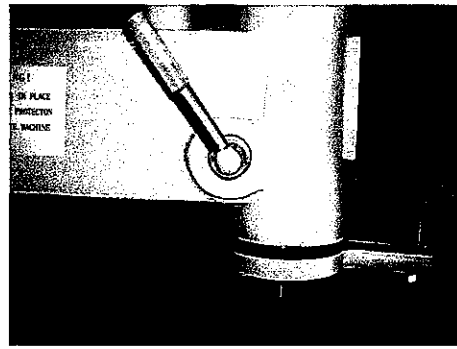
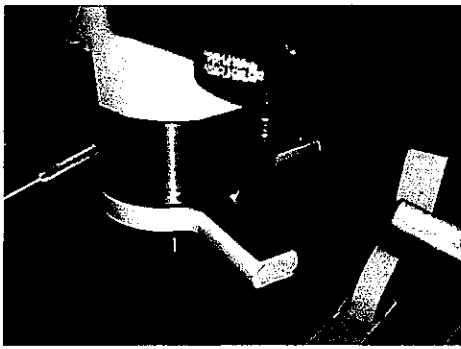


This heavy shield is designed for the installation of the DRO on the Y axis. All the holes are drilled and tapped at the factory for easy, professional installation. The shield is made of heavy gauge steel and painted to match the machine.

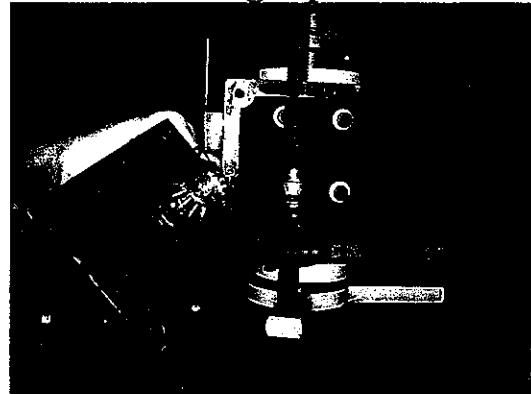
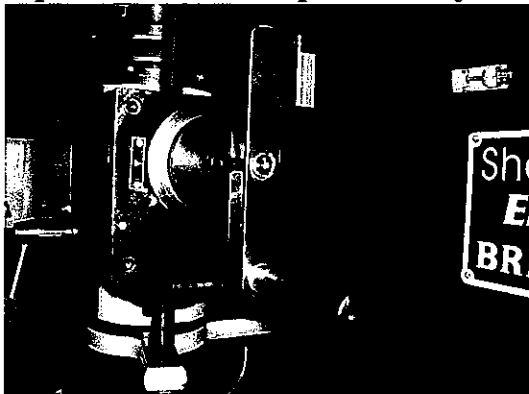


These are your spindle drive motors. The vertical mounted one is for the mill and the horizontal one is the lathe. Both motors are mounted high to prevent contamination from chips and fluids. Both motors are identical 1 hp 3 phase induction design. Each is mounted on a steel plate with slotted holes for adjusting the drive belt tension.

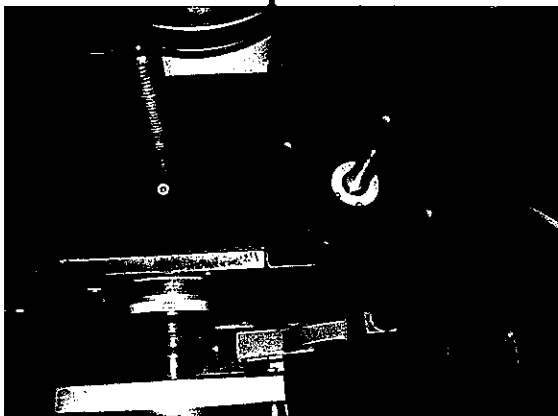
Early production machines serial # 09116-09917 have the lathe motor mounted on the end of the machine.



This is the Z axis drive plate. It consists of a 2 piece “sandwich” with a top plate around the quill and a lower plate. The 2 pieces are held together by bolts and when tight they clamp solidly around the quill. The plate has 2 “arms” one toward the rear for the DRO scale and one attached to the Z axis ball screw for moving the quill up and down. The quill is locked in position by the handle in the right picture.

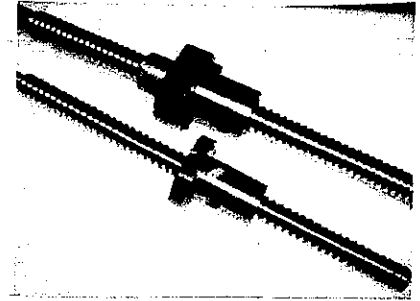
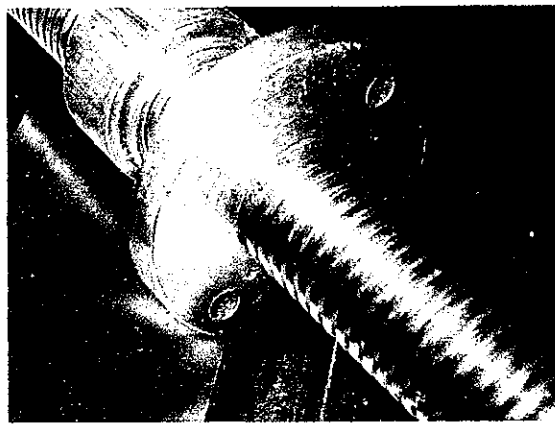


The quill motion is controlled by either the manual handle as shown in the left picture or the CNC drive motor. The manual handle has a dial calibrated in 0.001” increments and drives the quill down via a pair of bevel gears. The dial is fully floating for easy zero setting. The dial shaft has a pair of thrust bearings which are pre-loaded with the lock nuts just as on the X and Y.



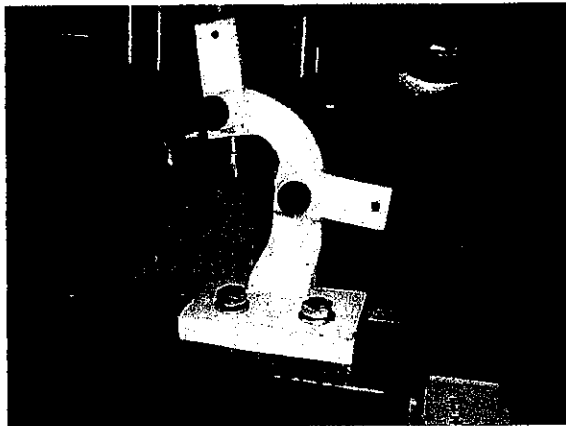
The CNC motor is mounted within the gearbox and drives the ball screw by a tooth belt.

Serial # 12001 on do not have the bevel gear drive. The handle is mounted on the stepper motor. The mill lift is controlled by the A axis CNC motor and the manual lift handle is attached to the stepper motor.



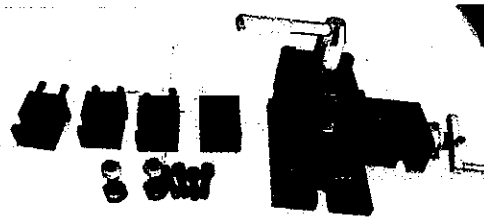
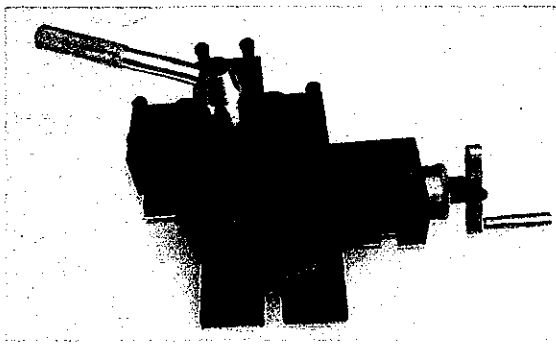
The PATRIOT uses special 2 piece adjustable nuts to reduce the inherent backlash in the acme system. On both the X and Y tables, each acme screw has 2 piece nuts with one half threaded for adjusting screws.. The nuts are held in a bracket with 2 clamp locks. When the clamp lock holding the flanged nut is loosened , you can adjust the tensioning set screws such that the nuts are forced apart putting contact on both leading and trailing threads of the lead screw. Because they are now contacting both the leading and trailing edges of the screw, the backlash is eliminated. As the machine is used and more wear begins to show, it is a simple operation to loosen the bracket and re-adjust them. *NOTE: Use care in this adjustment, as too much tension will make turning of the handles very difficult.*

ACME SCREWS WERE USED ON PATRIOT MACHINES FROM 2009 TO 2010 ALL PATRIOTS AFTER 2010 USED C-7 BALL SCREWS ON X, Y AND Z AXES AND ACME SCREW ON A AXIS.

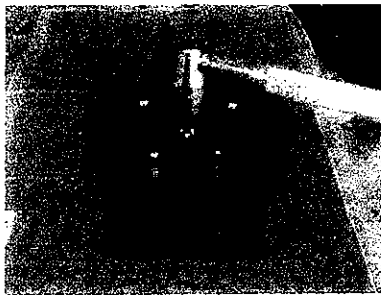


The PATRIOT comes equipped with a follow rest which attaches to the main carriage and travels along, following the cutting tool. It gives support to stock to prevent the force of the cutting tool from flexing the piece.

PATRIOT MACHINES FROM 2012 UNTIL 2014 USED A FOLLOW REST THAT WAS MOUNTED TO THE SIDE OF THE X AXIS CARRIAGE



The PATRIOT is equipped with a 4 way turret style toolpost with adjustable height tools. The turret is mounted on a compound slide base. The turret holds 4 separate tool holders. 2 holders are for lathe tools up to 1/2" size. The 3rd holder is for lathe tools and a boring bar (has a groove milled in it). The 4th holder is for a parting tool holder. It has a shallow groove to accept a 1/2" size blade and 4 bolts which clamp the blade in place. Each of the holders is secured by a large allen bolt in a slotted hole. On top of each holder is a 5mm allen bolt and jam nut to adjust the height of the holder. Once the height is adjusted, the holders can be taken on and off with no further adjustment necessary. The turret can hold all 4 holders and tools at one time, but it is more practical to use only 2 holders at 180 degrees to each other. The compound base can swivel a full 360 degrees and has a scale from 0-45 in each direction for quick reference in cutting bevels. The slide has 3 gib screws to set the tension. The compound should have some drag when moving it so that it does not deflect back under load. The dial is calibrated into 0.001" increments and 1 turn = 0.050".



MACHINE UPGRADES

Because the CNC cuts tapers, the compound toolpost is no longer a necessary feature. Beginning with serial # 14200, the compound has been replaced by the turret style as shown in the picture to the left. For those desiring a traditional compound, we offer an optional upgrade on our website, part # ST 27R.

SERVICING THE SPINDLES

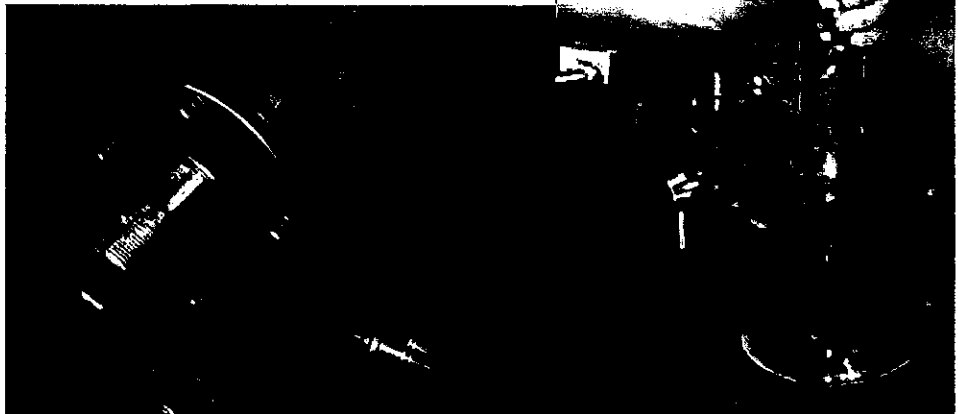
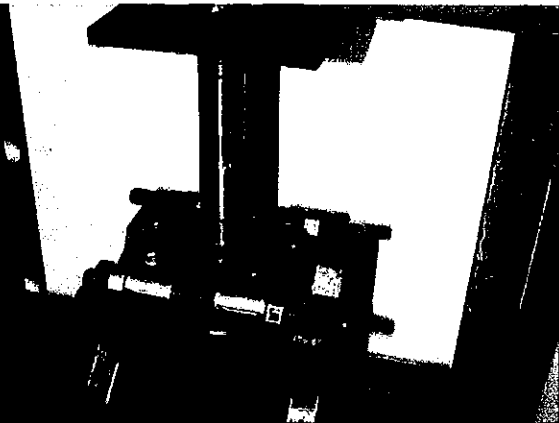
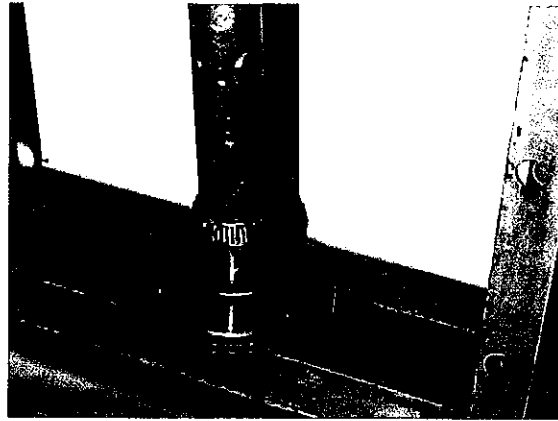
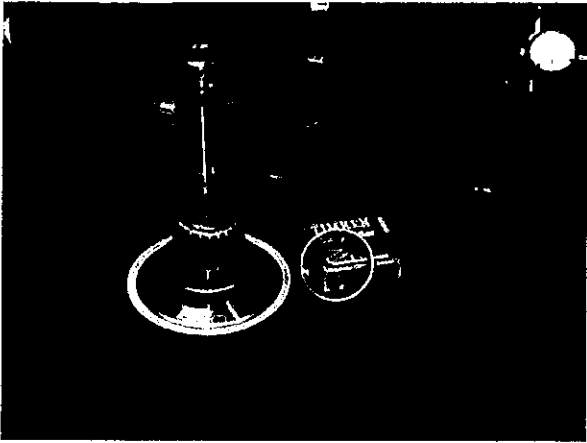
LATHE

- 1. Remove the 3 jaw chuck and remove the 3 allen bolts holding the front seal plate through the access hole in the spindle flange.**
- 2. Remove the spanner nuts which retain the drive pulley and remove the pulley.**
- 3. Pull the key from the spindle shaft and remove the 4 screws retaining the rear seal plate.**
- 4. Remove the seal plate and the seal collar from the spindle.**
- 5. Spin one spanner nut back on the spindle such that it is flush with the end to protect the threads.**
- 6. Use a wood block against the end of the spindle to protect the shaft and drive it out with a hammer.**
- 7. Clean the bearings and inspect them for any wear. If they are good, re-pack them and re-install. If they need replacing, use a press to remove and replace the chuck end bearing as shown in the photos and re-install the spindle.**

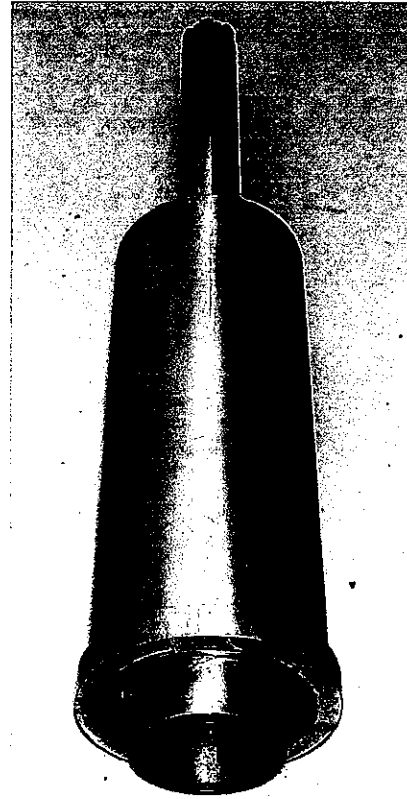
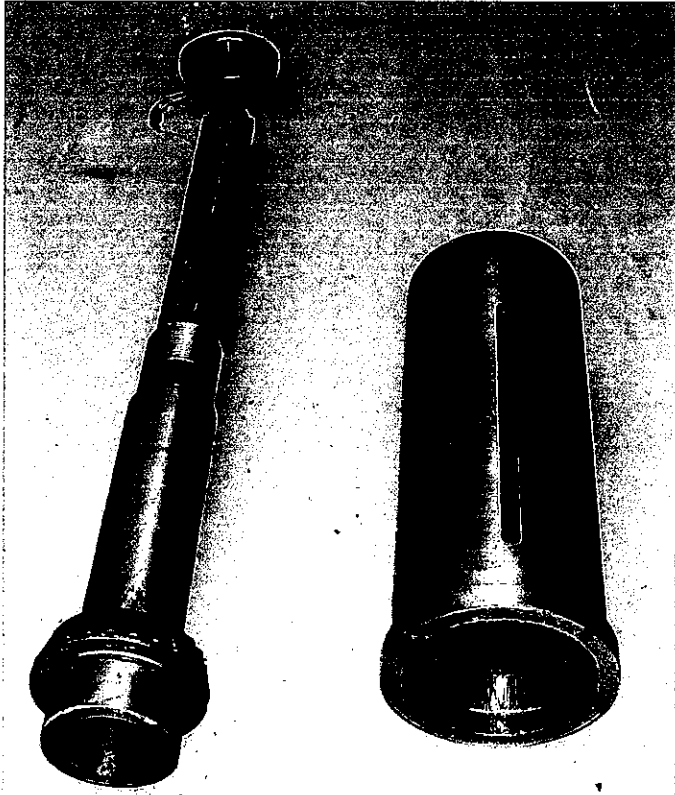
MILL

- 1. Remove the quill drive plate from the quill by loosening the 6 allen bolts, the lead screw nut and the DRO bracket if you have this option.**
- 2. Remove the allen set screw from the front of the mill head which rides in the groove.**
- 3. The quill assembly will drop out of the casting.**
- 4. Remove the 2 spanner nuts holding the spindle in the quill.**
- 5. Use a press if available or a hammer and wood block to drive the spindle out of the quill.**
- 6. Inspect the bearings for wear- if good, clean, re- pack and re-install. If they need replacing, use a press to remove the larger bearing from the spindle as shown in the lathe spindle photos.**
- 7. Use a press and/or heat to re-install the new bearings. Pack the bearings with moly grease and re-install the quill assembly.**

LATHE AND MILL SPINDLES AND BEARINGS



Your Shopmaster lathe spindle is supported by 2 machinery grade tapered roller bearings. They are lubricated by the oil in the mill head casting. There is a seal on each end of the spindle to retain the oil. The bearing nearest the chuck flange is pressed in place and must be removed in a press. Re-installing the bearing can also be done in the press, or by heating the bearing to 450 degrees. When heated, the bearing will fit over the spindle with only a light tapping using a hammer and a pipe to contact the inner race. The rear bearing is a light interference fit and can be tapped in place the same way without heating. When installing new bearings its best to pack them with grease to assure they have lubrication at startup.



The mill spindle assembly (QUILL) is similar to the lathe with 2 tapered roller bearings. However, the mill spindle is not oil lubricated. The bearings are packed with grease and designed to be serviced every 1000 hours of use. The quill assembly can be dropped out of the mill head as a unit. The upper bearing, like the lathe is a light interference fit and can be removed with light tapping. The lower bearing is press fit in place and requires a press and/or heat to remove and install it. Always use a high quality moly grease on the mill spindle bearings.

Both lathe and mill spindles use a pre-load of 35 ft/lbs torque and are secured by spanner nuts.

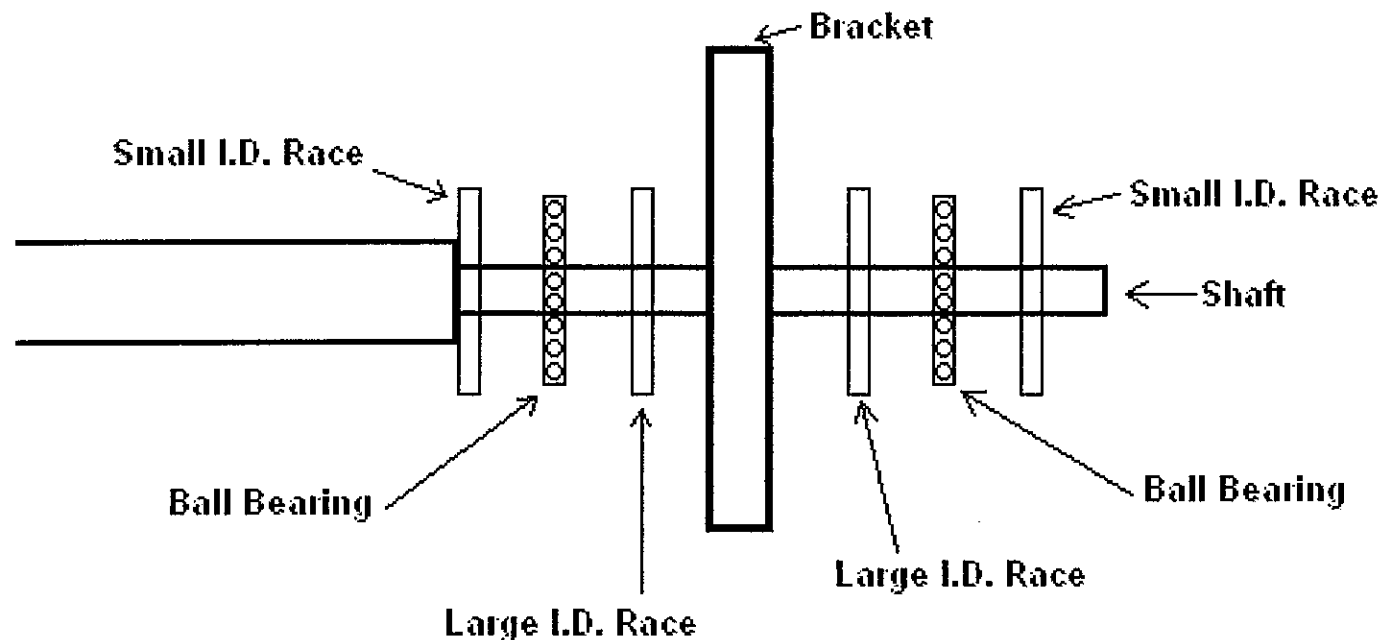
NOTES ON TAPERS AND DRAWBARS

Your lathe spindle has a hole through the spindle of 1.025' diameter to allow long shafts to be passed through. At the chuck end of the spindle there is a Morse # 4 taper . Morse tapers are industry standard for lathes and come in sizes ranging from Morse # 1 up. The geometry of all Morse tapers is the same, only the size changes. In your accessory box you will find a Morse # 4 dead center as well as a Morse #4 to #3 reducer sleeve. You can use these to adapt different tools to be used in the lathe.

The tailstock has a Morse # 3 taper and will accept the Morse #3 center, the extension socket and the Morse # 3 drill chuck arbor. Morse taper centers are used to support the ends of parts held in the 3 jaw chuck as well as when turning between centers. You can use the included drill chuck in the tailstock as well to drill into parts rotating in the lathe chuck.

The mill spindle has an R-8 taper, which is industry standard for most medium to large sized mills. The R-8 uses a drawbar to hold it in place. Your machine is shipped with the drawbar in the mill spindle retaining the R-8 drill chuck arbor. To remove tools from the spindle, loosen the jam nut a few turns and then tap the end of the drawbar with a hammer. This will loosen the taper and you can then unscrew the drawbar by hand and the tool will drop out. You tools also include an R-8 split collet. Split collets close up as the drawbar is tightened to grip around the cutting tools.

NOTES ON THRUST BEARING



The Shopmaster uses ball thrust bearings in a number of locations. If you remove them for servicing, be sure to re-install them properly. The bearing set consists of two races and a caged ball bearing. The two races have different inside diameters. This is not a manufacturing error. The race with the small diameter fits on the shaft, while the race with the large diameter always fits against the fixed bracket.

NOTES ON 3 JAW CHUCK

Your PATRIOT comes with a conventional 3-jaw chuck. A 4-jaw chuck is an option. See the notes on the 4-jaw chuck in the next section. The normal 3-jaw chuck has three inside jaws and three outside jaws. Be sure to take careful note that all bolts that hold the chuck to its face plate are tight and that the chuck fits properly in the face-plate recess made for it. The various parts of the chuck are an integral part of that particular chuck and should always be maintained as a unit. Each chuck is manufactured as a unit and is dialed in with the jaws that are provided with the chuck. The serial number of each individual chuck is stamped on the body and on each of the jaws (see following illustration). The order in which the jaws go into the chuck is also critical to maintain accuracy. Note that the jaws are numbered 1, 2 and 3 as well as stamped with the serial number.

THE NUMBER ON THE CHUCK JAW, BOTH INSIDE AND OUTSIDE, INDICATE THE POSITION THAT THEY SHOULD BE PLACED IN THE CHUCK BODY. Jaw NO. 1 must go in the slot stamped NO. 1 on the chuck body. The same NO. 1 slot will also typically have the chuck serial number stamped immediately after the slot number. Make certain you follow the instructions for installation exactly.

INSTALLATION OF THE CHUCK JAWS

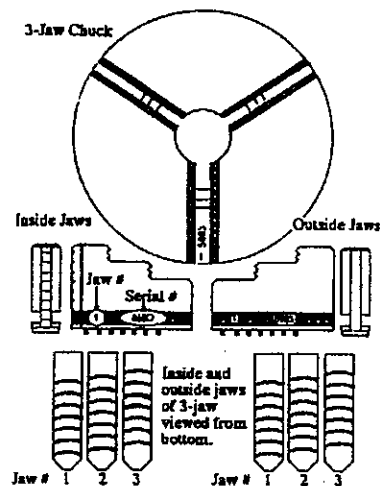
- 1. Using the chuck key provided, scroll to where the beginning of the scroll thread is visible in the NUMBER ONE slot, then back the thread off until the beginning of the thread is no longer visible in the slot (one-half turn counter clockwise will usually do it).**
- 2. Next, insert the jaw numbered NO. 1 in the slot and firmly push it toward the center of the chuck.**
- 3. Scroll the chuck until the thread becomes visible in the second slot; at this point pull out on the previously installed jaw to ensure that the scroll has engaged the teeth on the back of the jaw. If the jaw comes out, repeat steps 1 & 2. If the jaw holds proceed to step 4.**
- 4. With the beginning of the thread visible in the second slot, again back it off one-half turn and insert the jaw. Push it firmly toward the center of the chuck.**
- 5. Scroll the chuck until the thread becomes visible in the third slot; pull out on 2nd jaw to ensure the scroll has engaged the teeth.**

**WHEN ALL THE JAWS ARE INSTALLED AS INSTRUCTED ABOVE,
THEY WILL MEET AT THE CENTER OF THE CHUCK
SIMULTANEOUSLY.**

TO RECAP THE PROCEDURE...

- 1. Jaws are inserted in numerical order 1-3.**
- 2. Always begin with slot No. 1.**
- 3. Scroll until the beginning of the thread is visible.**
- 4. Install jaw, pushing it firmly toward center of chuck.**
- 5. Scroll until the beginning of the thread is visible in the next slot.**
- 6. Test the jaw just installed by pulling out.**
- 7. Repeat from STEP 4 until all the jaws are firmly installed.**
- 8. Scroll the chuck until all jaws meet in the center of the chuck.**

**IMPORTANT! IF ALL THE JAWS DO NOT MEET AT THE CENTER,
REPEAT THE STEPS ABOVE AFTER REMOVING THE INCORRECTLY
INSTALLED JAWS.**



NOTE!

**IF YOU LOSE THE JAWS YOU WILL HAVE TO BUY A COMPLETE NEW CHUCK-
PARTS ARE NOT INTERCHANGABLE.**

NOTES ON THE FOUR-JAW CHUCK

The 4 jaw chuck can be purchased as an option. Whether or not you need the extreme accuracy offered by a 4-jaw chuck is a decision that you need to make. Also, some units come with a machined installation plate while others come with plate which must be machined by you (this depends upon our suppliers). The diagram and instructions included at the back of this owner's manual will tell you how the plate must be machined to fit properly. It is not a very difficult procedure and might well qualify for your first serious project after you get set up and take a few practice cuts to familiarize you with your machine.

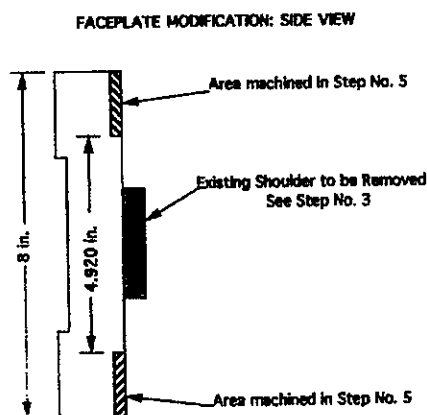
FACEPLATE MODIFICATION FOR THE FOUR JAW CHUCK.

Due to factory specification changes, please modify your faceplate according to the following instructions. Please refer to the following diagram for assistance.

1. Remove the three jaw chuck from the spindle.
2. Bolt the 8" face plate that came with your standard accessories to the spindle.
3. Make a cut across the surface of the face plate to true it to the spindle. Be sure to work slow to attain a ultra-smooth surface.
4. Measure the diameter and recess depth on the back of the chuck.
5. Cut the shoulder on the face plate to the same diameter and face it so the raised area fits snugly into the chuck recess.
6. Test the fit of the 4-Jaw chuck to the face plate.
7. When the fit is snug, remove the face plate from the spindle.
8. Clamp the chuck to the face plate and mark the position of the four mounting holes.
9. Drill and tap holes to accept the bolts supplied or any of your choice.

As always, do not be afraid to call the technical line for assistance.

FACEPLATE MODIFICATION: SIDE VIEW



When performing any lathe work, please be sure to remove the chuck key from chuck **BEFORE TURNING ON THE MACHINE!** Serious injury can result if you carelessly leave the chuck key in the machine. It becomes a flying object of great speed due to the centrifugal force generated by the fast turning chuck.

LUBRICATION OF THE UNIT

For accurate work, machinery must be properly lubricated. Take time to examine the CLEAR PLASTIC PORT located on the front of the lathe column. It is called the GEAR BOX SIGHT GLASS. It is important to add only enough oil to become visible in the sight glass when the lathe is running. If needed, add oil by unscrewing the plug that is located on the mill support plate which is mounted to the lathe casting. A drain plug is located on the opposite side of the column from the sight glass. DO NOT OVERFILL. Another important item is to make sure the lathe bed ways are lubricated each time you use the unit. Oil all "button" oilers daily. The lead screws for the lathe and the cross slide must not be ignored. Using an oil can, lubricate both lead screws while they are in motion. To easily oil the cross slide, move the table toward you as far as it reaches and squirt a generous amount onto the screw as you turn the hand wheel to move the table back away from you. Annually the machine should be disassembled to the point where the mill taper bearings can be re-packed in grease. We recommend a durable wheel bearing grease that is obtained at any auto parts store. Remember to adjust the pre-load carefully upon re-assembly.

An excellent all-round lubrication available in many places is MARVEL MYSTERY OIL.

ELECTRICAL, CNC, VFD

IN THIS SECTION:

MACHINE WIRING DIAGRAMS

CNC WIRING DIAGRAMS

VFD INVERTER WIRING DIAGRAMS

CNC SETUP PROCEDURES

VFD CODES AND TROUBLE SHOOTING

MACHINE ELECTRICAL TROUBLE SHOOTING

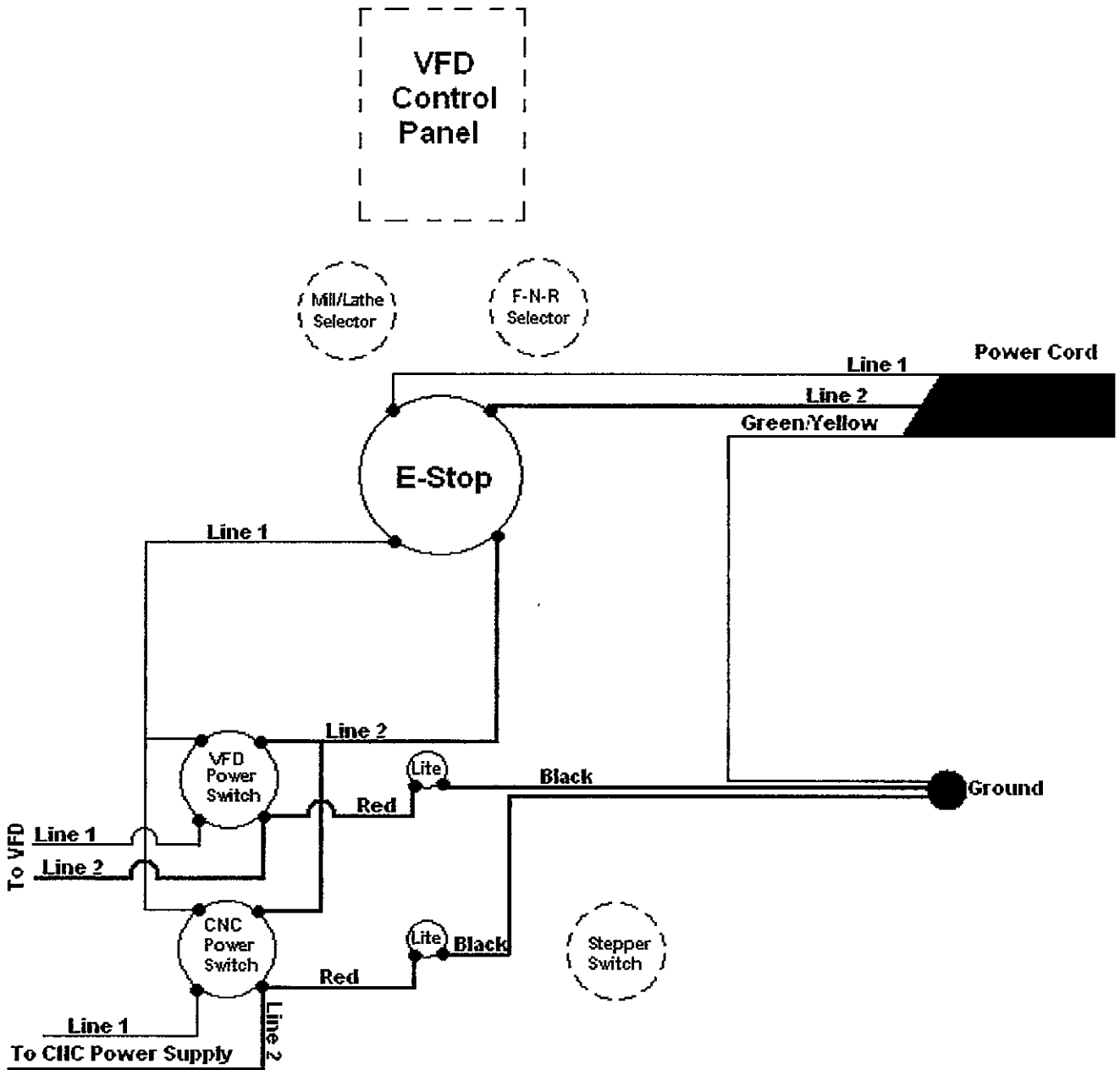
PLEASE NOTE:

The full CNC manual is included on your CNC software disc as a .PDF file.

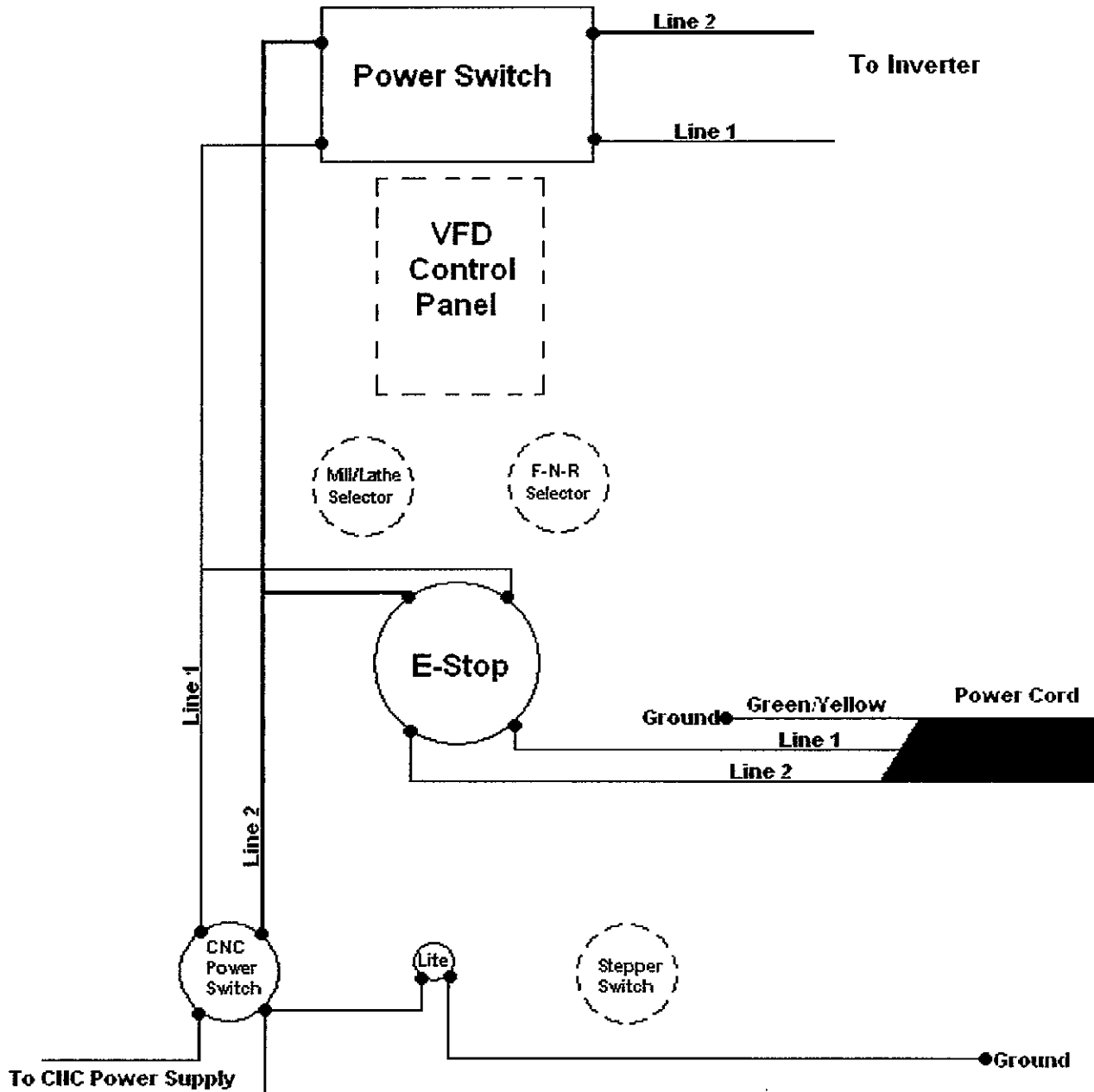
The full VFD manual will be sent to you as a .PDF file.

Because each of these full manuals consist of hundreds of pages, it is not practical to print them all. Also, in electronic formats we can update your manuals each time a change is made.

Overall Front Panel Wiring
This diagram for serial #'s 10023-

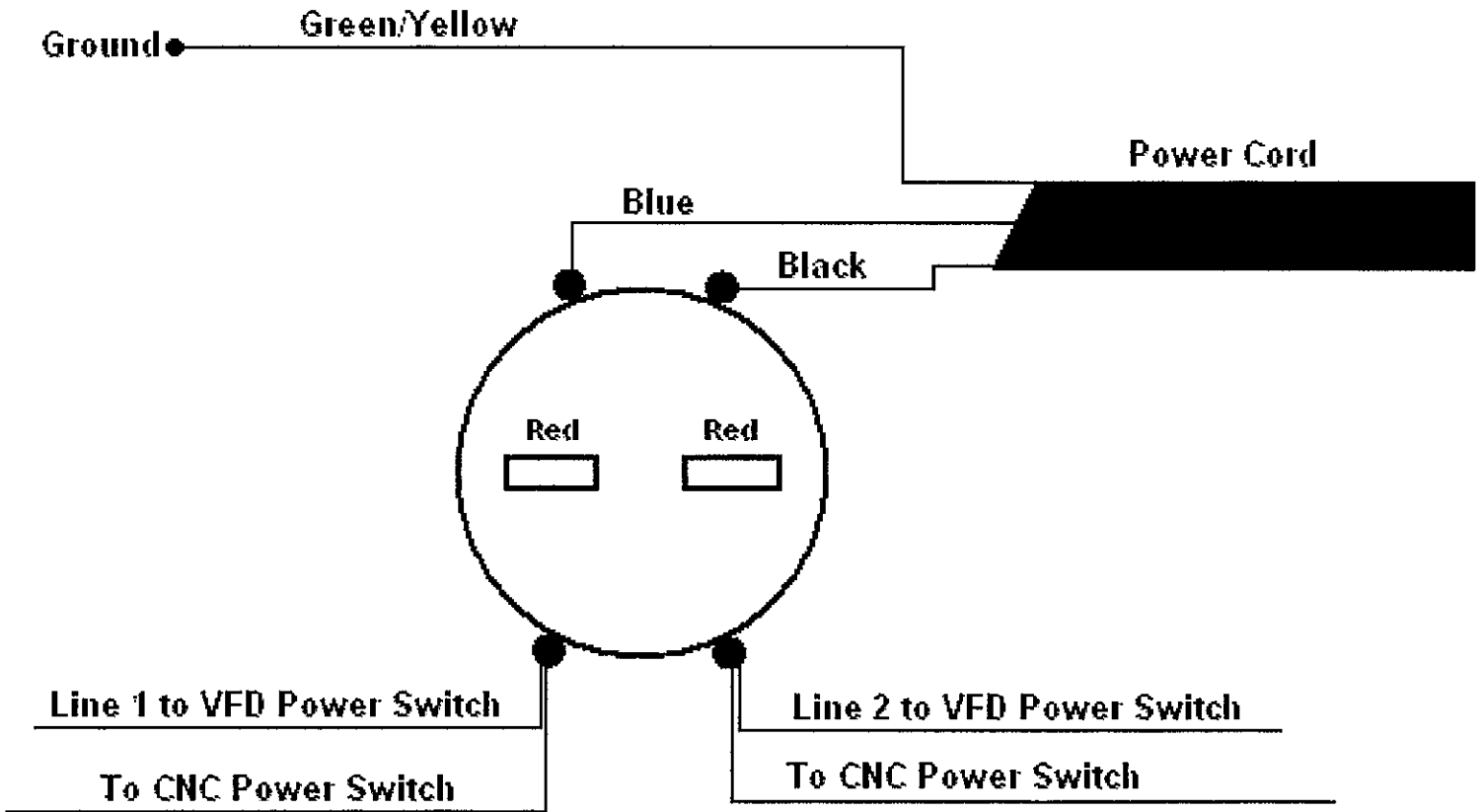


Overall Front Panel Wiring

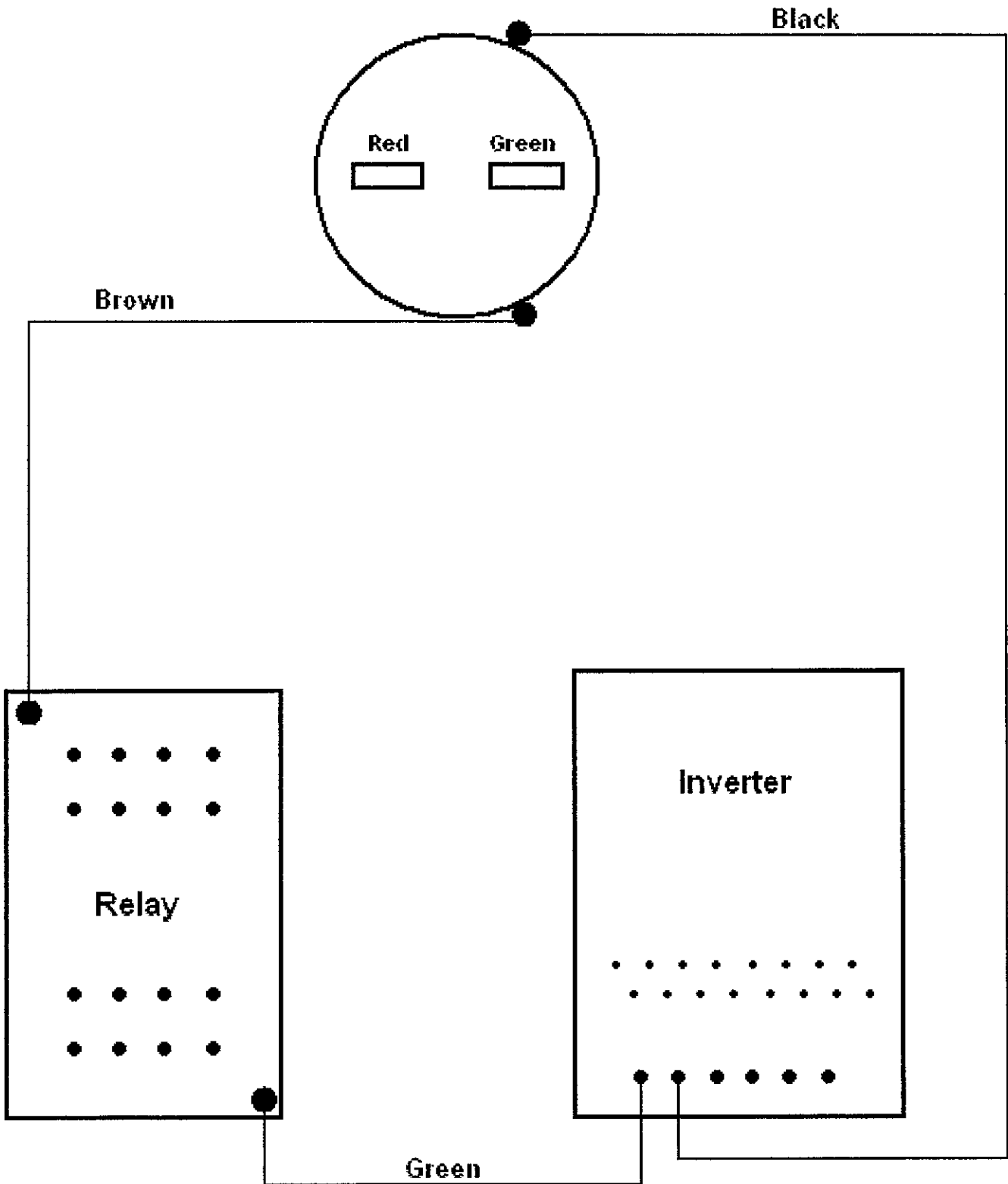


This diagram for serial #'s 09116-09917, 10001-10022.

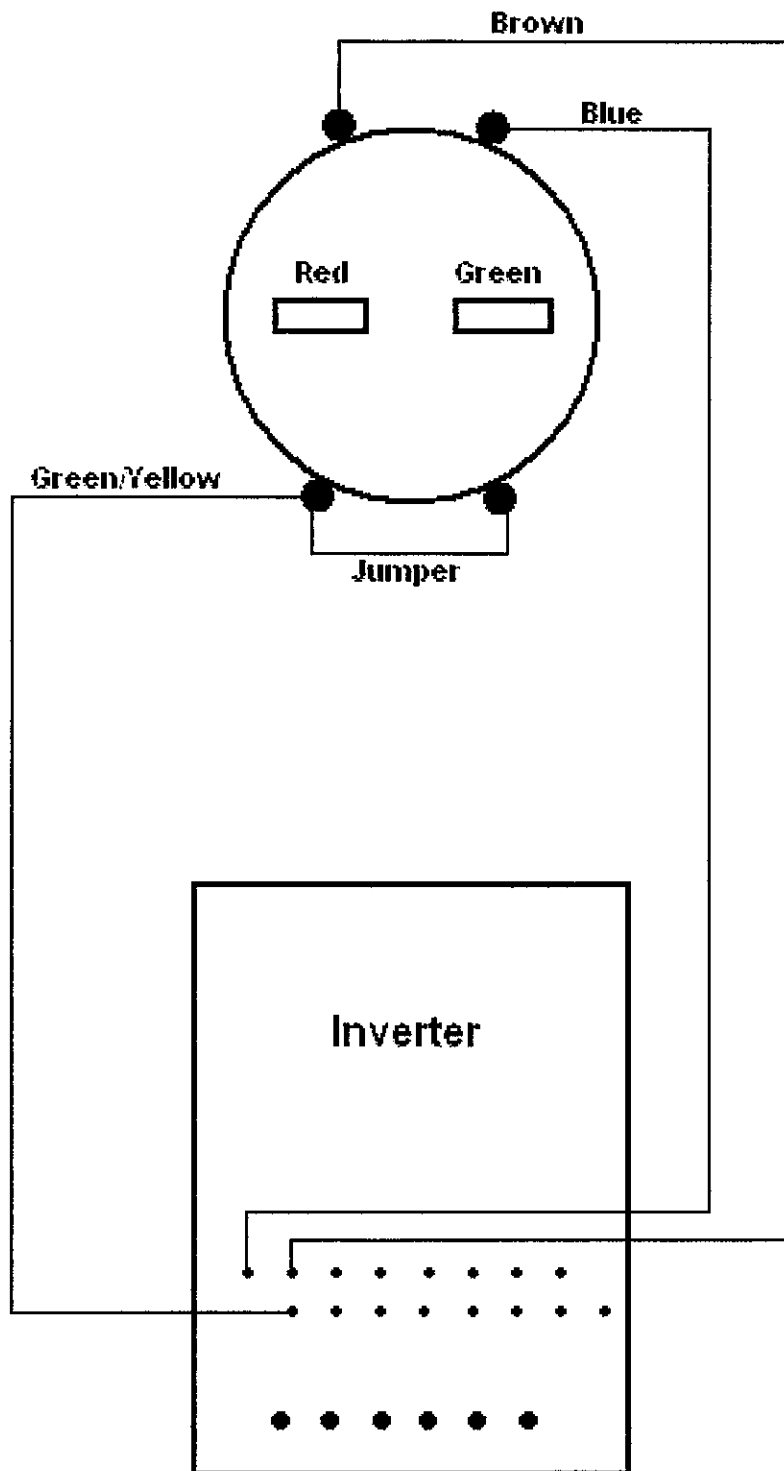
E-Stop Wiring Diagram



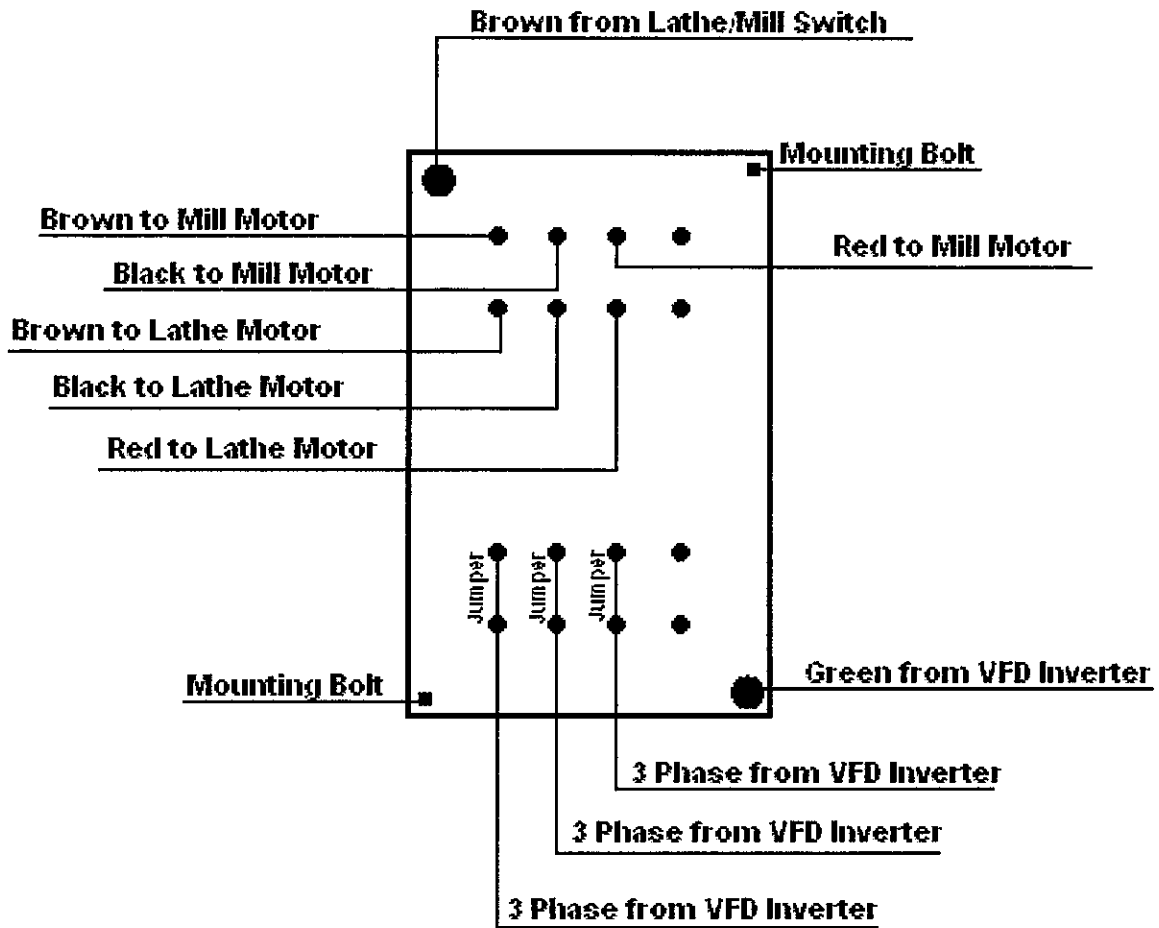
Lathe-Mill Selector Switch



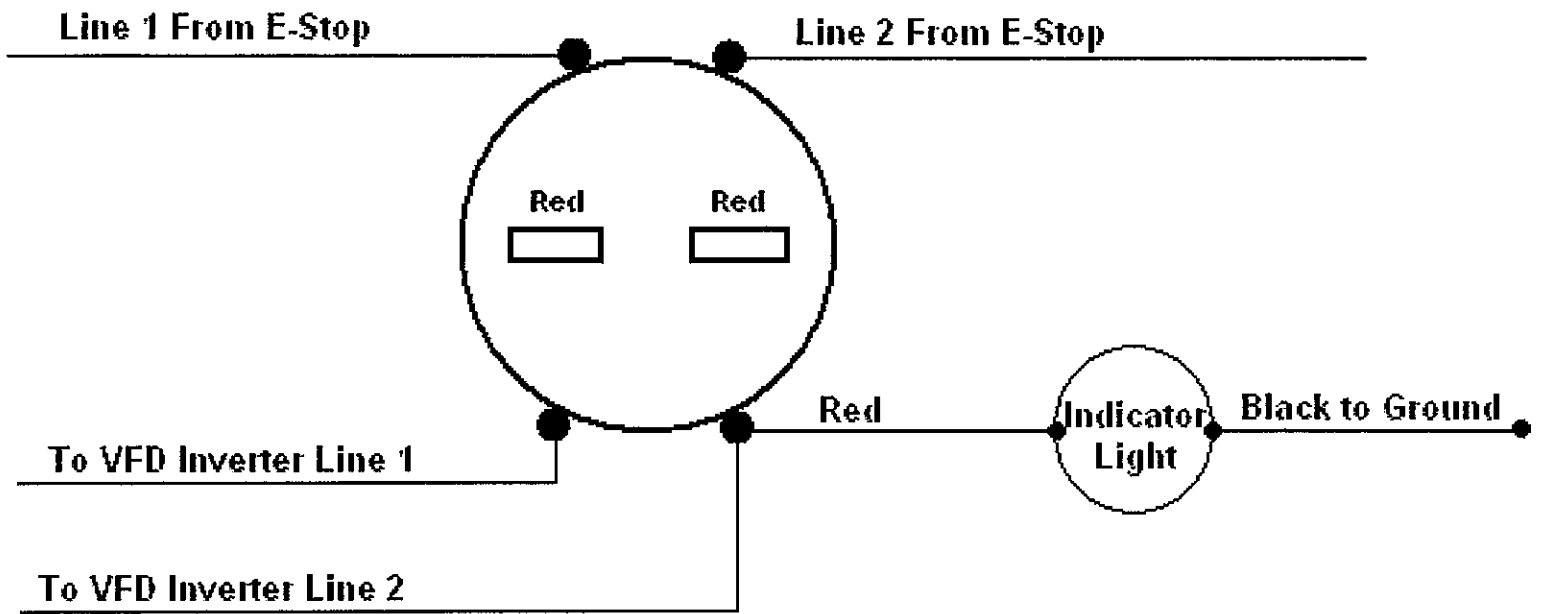
Forward-Neutral-Reverse Switch



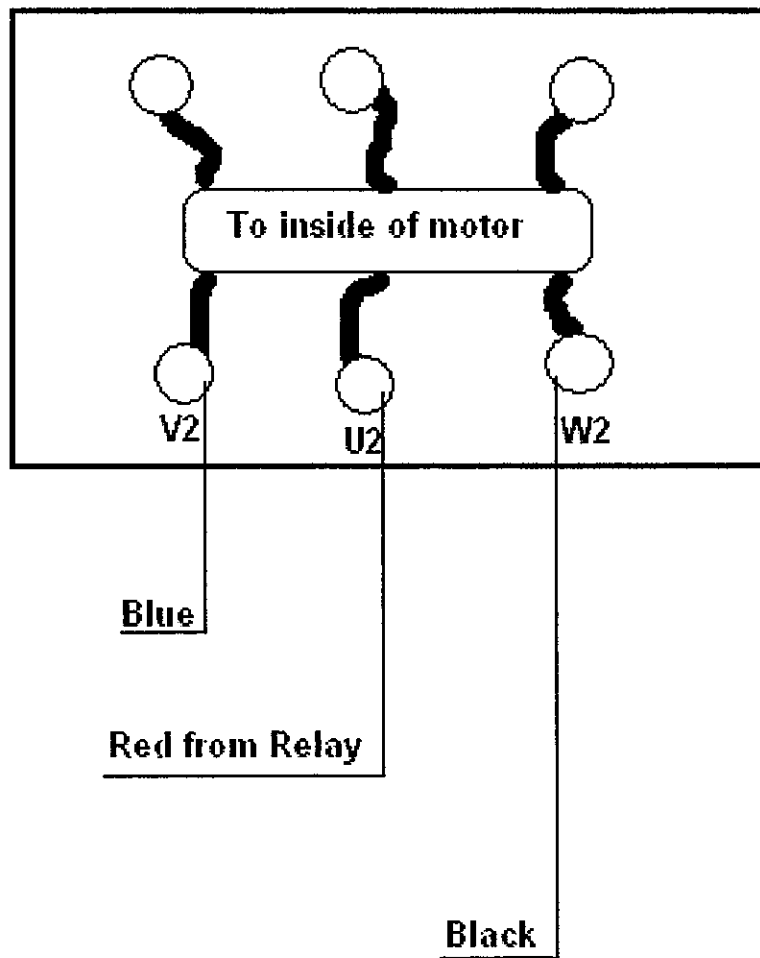
Relay



VFD Power Switch

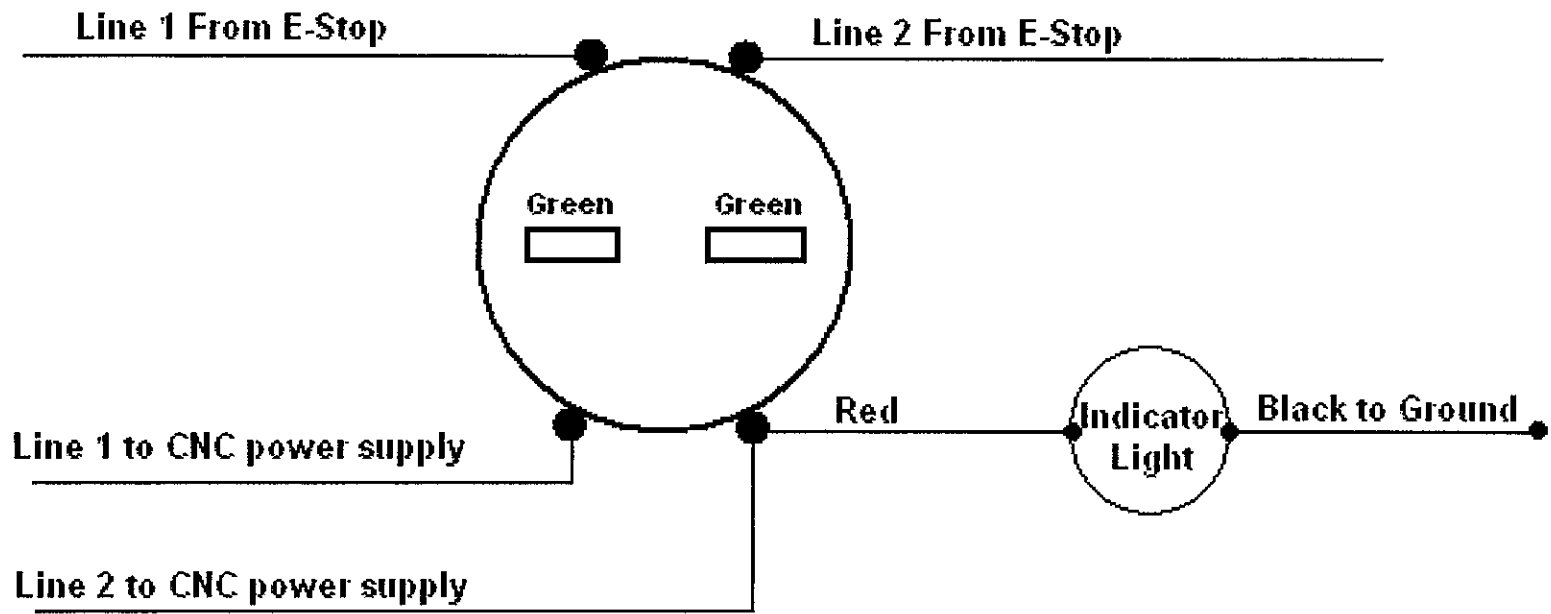


Motor Wiring

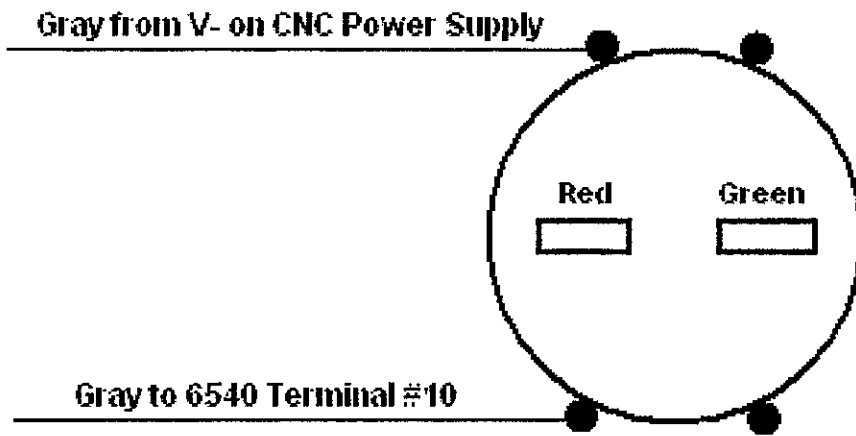


To reverse Motor Direction Swap Blue and Black

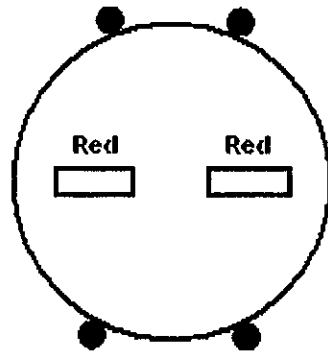
CNC Power Switch



Stepper Motor Switch

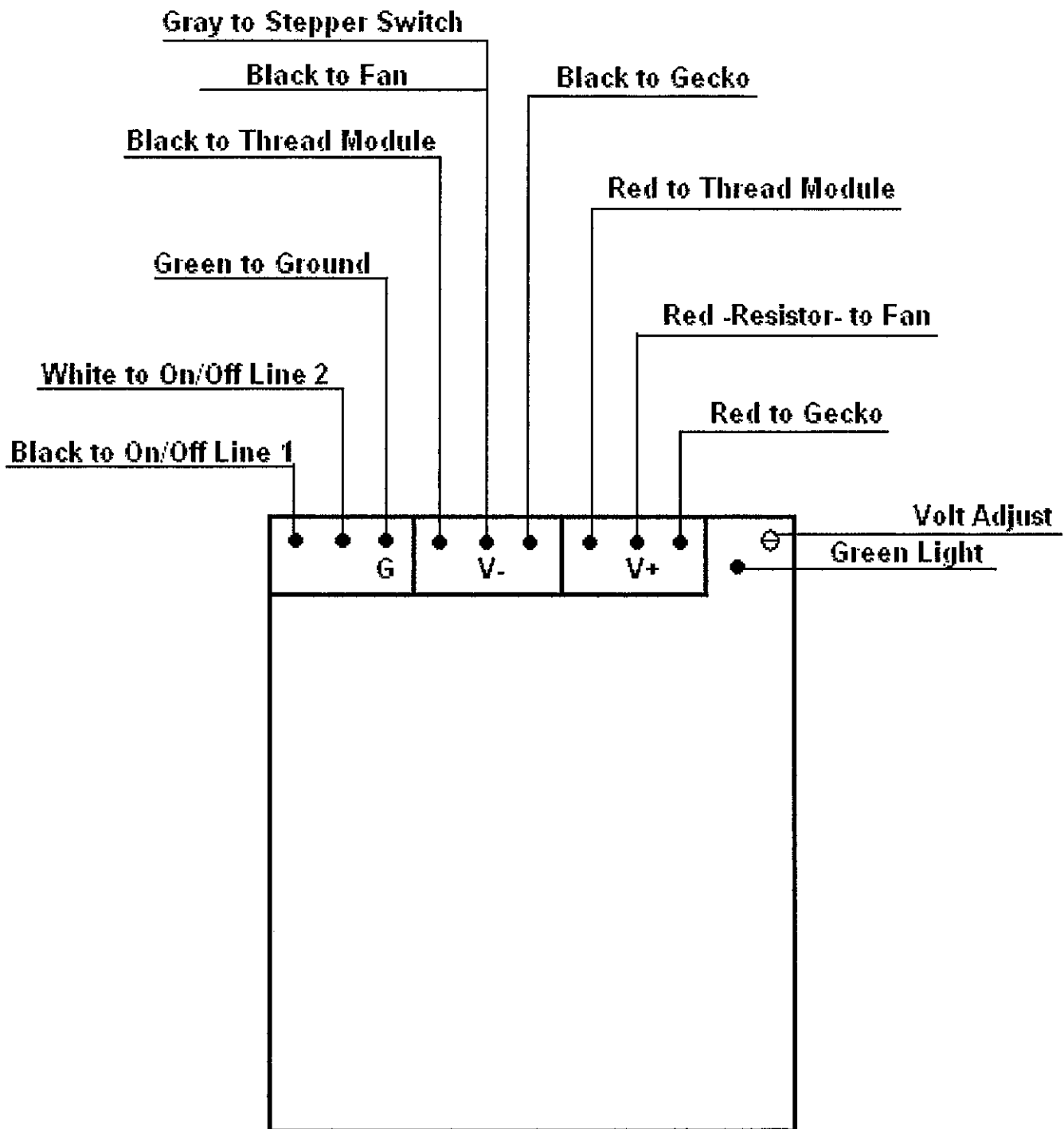


Switch Explanation

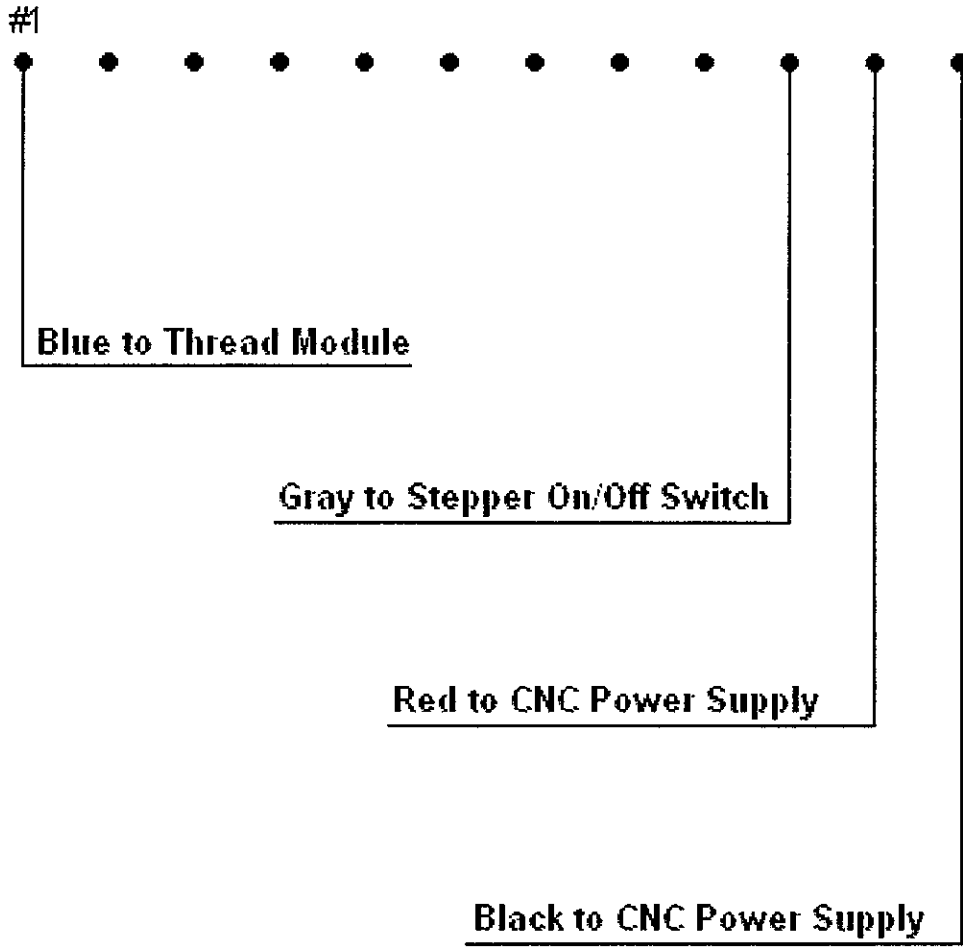


To remove the switch body from the button portion, push down the white tab. The switch portion will pull away from the the button. Looking inside the switch you will see two spring loaded contacts. These will be red, green, or red and green. Two red contacts means a normally open switch. Two green contacts are a normally closed switch. One red and one green means one side is normally open while the other is normally closed. The button portion can have a single notch for ON/OFF or a double notch for ON-NEUTRAL-OFF. The button portion is held in with a plastic nut, to get a firmer grip you can use a 12 point 25mm socket, but only tighten the socket by fingers not with a ratchet.

CNC Power Supply



G540 Gecko Drive

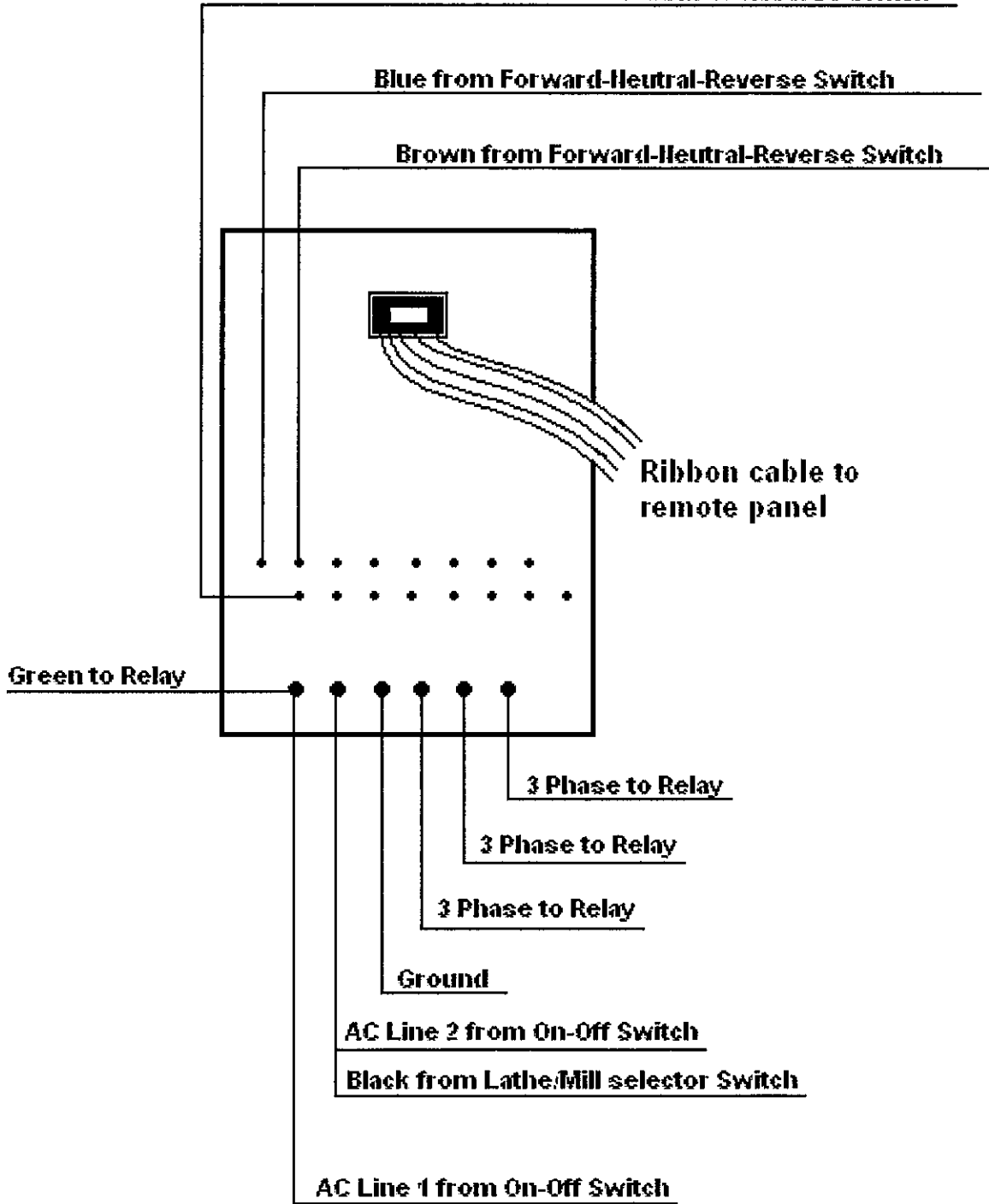


NowForever VFD Inverter

Green/Yellow from Forward-Neutral-Reverse Switch

Blue from Forward-Neutral-Reverse Switch

Brown from Forward-Neutral-Reverse Switch



MACH III Control of VFD

Your VFD inverter can be controlled through the Mach III software to perform a variety of functions, including spindle speed, spindle direction, CSS (constant surface speed) etc.

However, the machine comes from the factory setup for manual control of these functions.

We strongly recommend that you become familiar with the operation of the machine and cnc before changing to Mach III control.

The necessary wires are already attached to the CNC controller, but are not attached to the VFD inverter. The wire harness has the loose ends shrink wrapped and they are tucked away between the CNC drive and power supply. To attach the wires, disconnect the unit from the power source and open the end panel. Follow the diagram in your manual titled *SHOPTASK CNC WIRING DIAGRAM*

Forward and reverse operations will now be controlled via Mach III or the VFD control panel on the front of your machine, so keep the F-R manual switch in the neutral position.

Prior to modifying the VFD control settings, you must unlock the parameters.

The locking code is P1-000

To unlock the code –

Press Enter

P0-000 is displayed

Press the UP arrow until P1-000 is displayed

Press Enter

000001 will be displayed

Press the DOWN arrow until it reads 000000

Press Enter

Your codes are now unlocked, and you can follow the procedures outlined in the pages titled-

CHANGING CODES FOR SPINDLE CONTROL THROUGH MACH III

MODELS WITH DUAL SENSORS 2013- ON

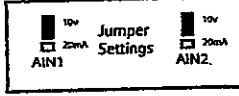
Shopmaster CNC Wiring Diagram

To enable Mach3 control of Mill Spindle Direction and Speed

NOWFOREVER E100S1R5B VFD Panel

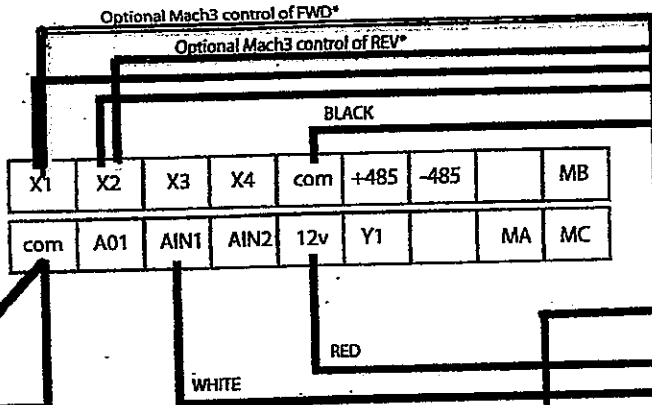
VFD Panel Connections

- X1 - FWD Run
- X2 - REV Run
- X3 - FWD Jog
- X4 - REV Jog
- Common
- +485 - Modbus RS485+
- 485 - Modbus RS485-
- MB - Relay Out - B node - Fault HD

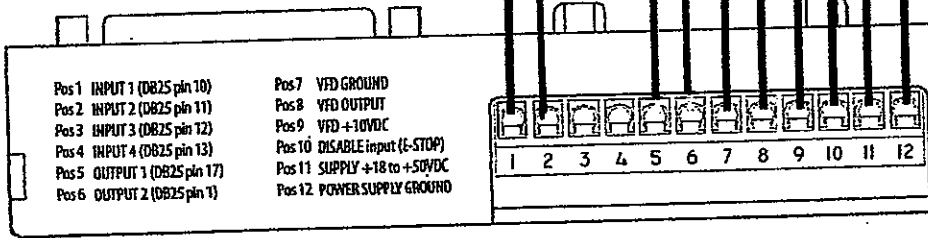


Common

- A01 - Analog Out 1 - Frequency Out
- AIN1 - Analog Frequency 1 - DC 0-10v (1/1000)
- AIN2 - Analog Frequency 2 - DC 0-10v or 0-20mA (1/1000)
- 12v - 12v power
- Y1 - Digital Out 1 - Inverter Running
- MA - Relay Out - A node - Fault NC
- MC - Relay Out - C node

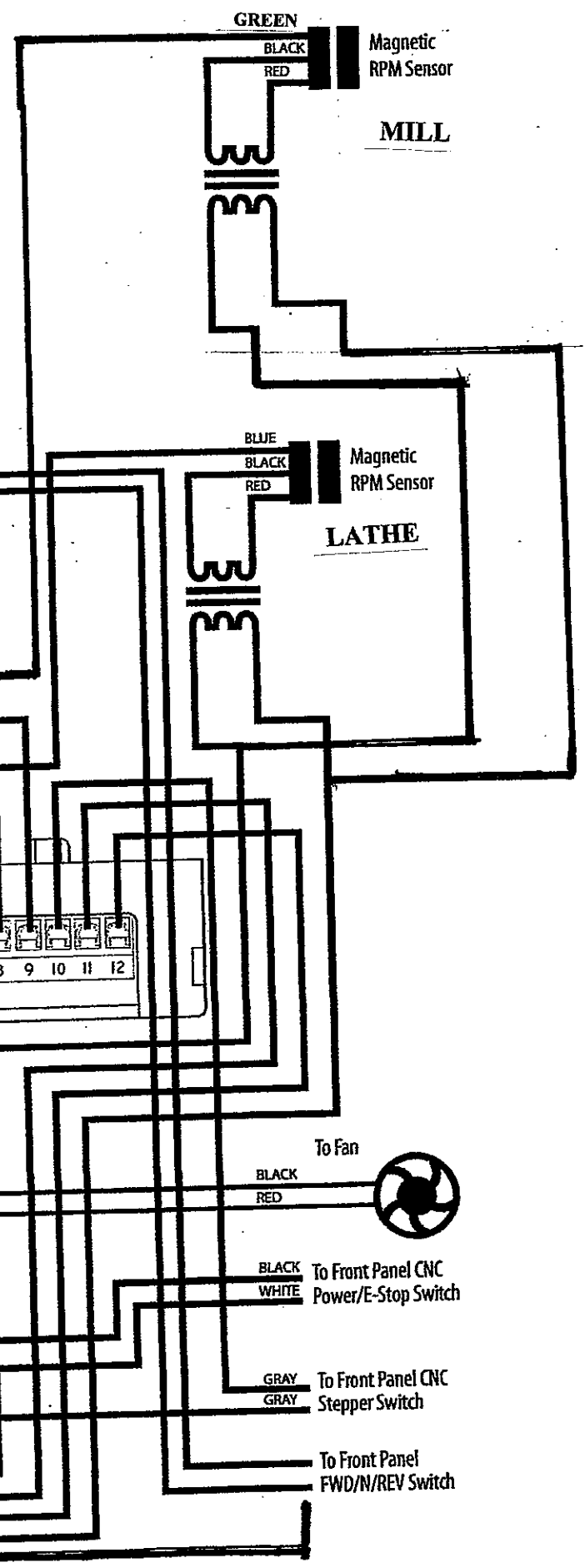
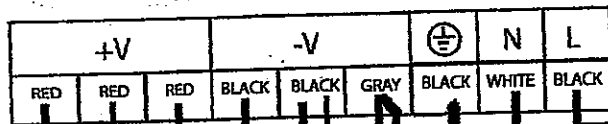


Gecko G540 Panel



GROUND

CNC 48v Power Supply S-350-48 Panel



*Mach3 control of FWD/REV will make front panel switch Inoperative.

MODELS WITH SINGLE SENSOR 2009-2012

Shopmaster CNC Wiring Diagram

To enable Mach3 control of Mill Spindle Direction and Speed

NOWFOREVER E100S1R5B VFD Panel

VFD Panel Connections

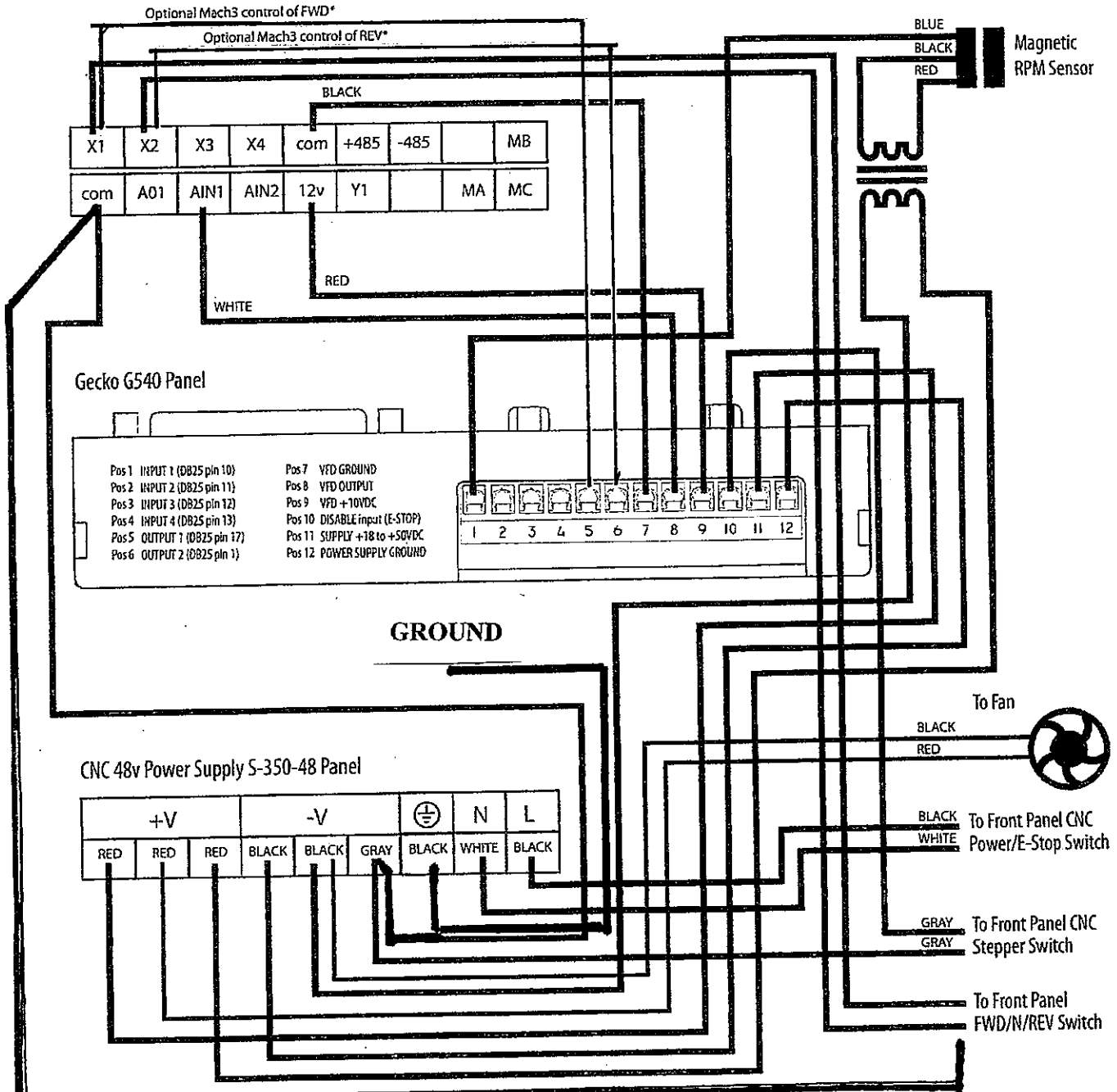
- X1 - FWD Run
- X2 - REV Run
- X3 - FWD Jog
- X4 - REV Jog
- Common



- +485 - Modbus RS485+
- 485 - Modbus RS485-
- MB - Relay Out - B node - fault NO

Common

- A01 - Analog Out 1 - Frequency Out
- AIN1 - Analog Frequency 1 - DC: 0-10v (1/1000)
- AIN2 - Analog Frequency 2 - DC: 0-10v or 0-20mA (1/1000)
- 12v - 12v power
- Y1 - Digital Out 1 - Inverter Running
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- MC - Relay Out - Com node



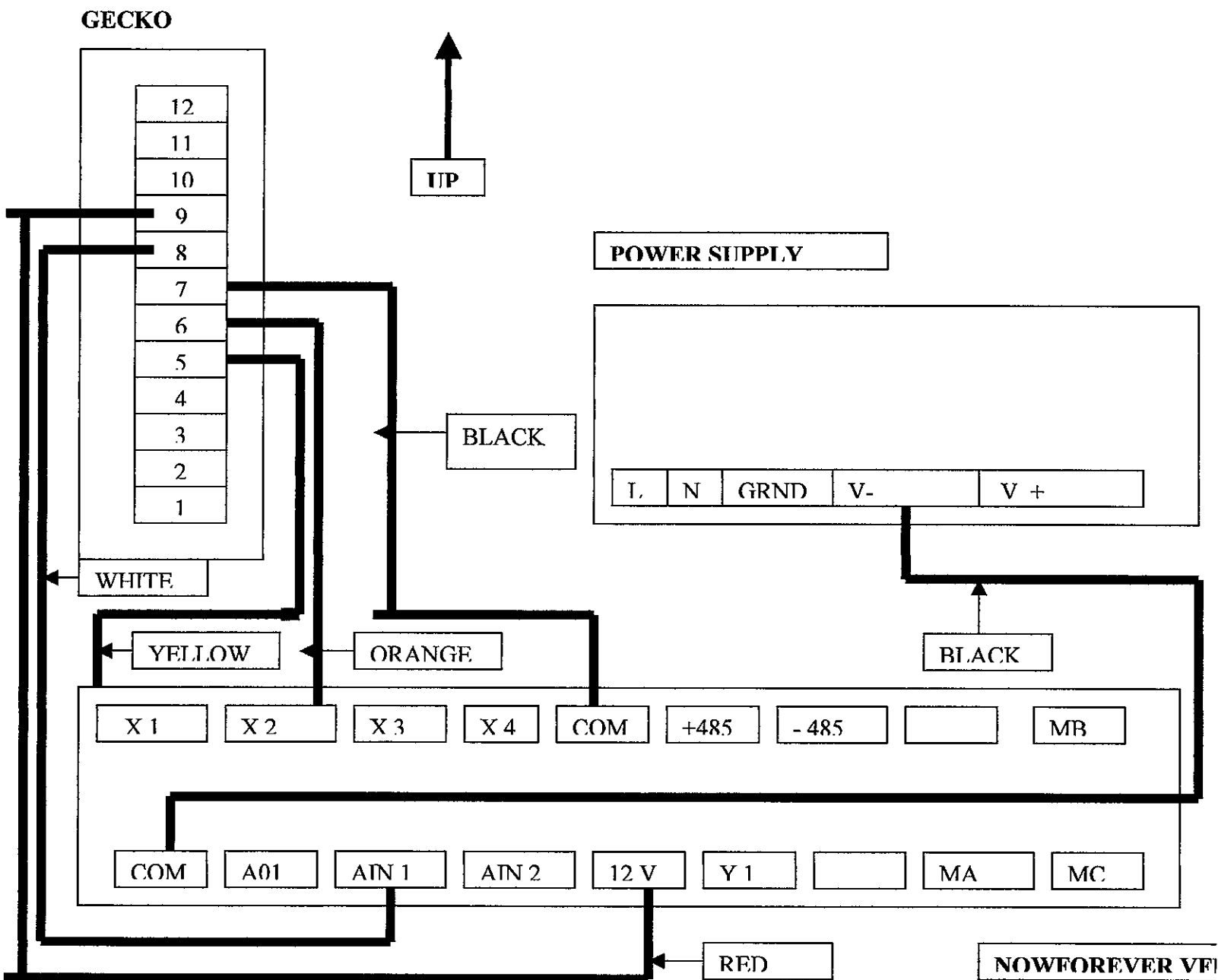
*Mach3 control of FWD/REV will make front panel switch inoperative.

WIRING DIAGRAM FOR ADVANCED OPTIONS

Your Patriot machine comes ready to run using the VFD key pad for controlling spindle speeds and a switch on the front panel for selecting Forward or Reverse. With the addition of a few wires and some changes in the VFD and MACH 3 settings you can control your spindle speeds and direction from Mach3 on your computer. This also opens up other functions such as CSS (Constant Surface Speed) and tapping in your mill. When you are ready to make these changes, please e-mail us and we will send you the necessary files for changing the VFD and Mach 3 settings. The wires in this diagram are already attached to the Gecko drive on your machine- you only need to attach them to the proper place on your VFD. The wires also show in the main wiring diagram in this manual, but they are a bit difficult to trace around all the other wires, so we have created this simplified diagram for your convenience.

PLEASE NOTE:

We **STRONGLY** recommend that you use the machine for a few days or weeks in its delivered form before proceeding to these advanced setups. Take some time to familiarize yourself with Mach 3, the VFD drive and run a few test programs of your own.



CHANGING CODES FOR SPINDLE CONTROL THROUGH MACH III

The Shopmaster VFD system comes ready to run in the Manual (Keypad) mode. This procedure is not applicable if you don't use the VFD with Mach3.

If the VFD was last used in the Mach3 Mode then you should be still in the Mach3 mode when you run your machine after it was last shut down. Similarly, if you last ran the machine in the manual mode then the keypad will still be active and the motors will run according to the settings of the speed (frequency) control knob after the Run button is pressed on the keypad.

To shift from the manual mode to CNC mach3 mode use the following sequential steps.

1 Main Power On to VFD.

2. CNC Power On

3. Step Motor engage ON

4. Mach3 loaded and Mach3 reset not flashing and is solid.

5. Green light on G540

6. Disable factory lock setting:

On VFD press Enter

P0 is displayed

Press UP arrow once

P1 is displayed

Press Enter

P1-000 is displayed

Press Enter

000001 (*Lock Effective*) is displayed

Press down arrow once

000000 (*Lock Invalid*) is displayed

Press Enter

P1-000 is displayed

Press VFD keypad Monitor/ESC 2 times

7. Change from manual mode to Mach3 control

Press Enter

P0-000 is displayed

Press Enter

000000 (*Keyboard Control*) is displayed

Press UP arrow once

000001 (*Analog Terminal Control*) is displayed

Press Enter

P0-000 is displayed

Press UP arrow until P0-002 is displayed

Press Enter

000000 (*Keyboard Potentiometer Control*) is displayed

Press up arrow until display reads 000002 (*AIN1 Control*)

Press Enter

P0002 (*AIN1 Control*) is displayed

Press VFD keypad Monitor/ESC 2 times

Using your PC keyboard select mach3's MDI screen, Enter the Command M3 S500. Press the PC keyboards Enter Key. Motor should now be running. The frequency is now displayed Not the RPM ordered.

M5 stops the motor. Your G code program should allow you to turn on and off motors at the various speeds.

After using the mach3 commands to the VFD and you want to switch back to manual VFD control use the following sequential steps:

Shut off CNC power switch

VFD on

Press Enter on the VFD keypad

P0 is displayed

Press Enter on the VFD keypad

P0 -000 is displayed

Press Enter

000001 (*Analog Terminal Control*) is displayed

Press down arrow once

000000 (*Keyboard Control*) is displayed

Press Enter

P0-000 is displayed

Press UP arrow until P0-002 is displayed

Press Enter

000002 (*AIN1 Control*) is displayed

Use the down arrow key twice

000000 (*Keyboard Potentiometer Control*) is displayed

Press Enter

P0-002 is displayed

Press Monitor/Esc button

Frequency as set by the Speed control knob is now displayed. Set Frequency to desired value. Press Run

The selected motor will now run at the frequency selected.

Now Forever E100 VFD Setup Codes

Refer to pg 20 of E100 manual for Operation of VFD controls. Change Default settings to *Mach3 Control* settings.

Code	Factory	Default	<i>Mach3 Control</i>	Description
P0-002	0	0	2	Frequency X source - 2=AIN1
P0-007	50hz	75hz	50, 75, 100, 125*	Upper Limit Freq
P0-024	50hz	50hz	50, 75, 100, 125*	AIN Input Corresponding Freq

* 50, 75, 100, & 125 are only examples, but both frequency settings should match

Mach3 Settings

Configure Motor Output - *Config/Ports and Pins/Motor Outputs*

Port Setup and Axis Selection | **Motor Outputs** | Input Signals | Output Signals | Encoder/MPG's | Spindle Setup | Mill Options |

Signal	Enabled	Step Pin#	Dir Pin#	Dir LowActi...	Step Low A...	Step Port	Dir Port
X Axis	<input checked="" type="checkbox"/>	2	3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	1
Y Axis	<input checked="" type="checkbox"/>	4	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	1
Z Axis	<input checked="" type="checkbox"/>	6	7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	1
A Axis	<input checked="" type="checkbox"/>	8	9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	1
B Axis	<input checked="" type="checkbox"/>	2	3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2	2
C Axis	<input checked="" type="checkbox"/>	4	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2	2
Spindle	<input checked="" type="checkbox"/>	14	14	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	1

OK

Cancel

Apply

Configure Output Signals - *Config/Ports and Pins/Output Signals*

Port Setup and Axis Selection | Motor Outputs | Input Signals | **Output Signals** | Encoder/MPG's | Spindle Setup | Mill Options |

Signal	Enabled	Port #	Pin Number	Active Low
Enable2	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>
Enable3	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>
Enable4	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>
Enable5	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>
Enable6	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>
Output #1	<input checked="" type="checkbox"/>	1	17	<input checked="" type="checkbox"/>
Output #2	<input checked="" type="checkbox"/>	1	1	<input checked="" type="checkbox"/>
Output #3	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>
Output #4	<input checked="" type="checkbox"/>	0	0	<input checked="" type="checkbox"/>

Pins 2 - 9 , 1, 14, 16, and 17 are output pins. No other pin numbers should be used.

OK

Cancel

Apply

Mach3 Settings

Configure Spindle

Port Setup and Axis Selection | Motor Outputs | Input Signals | Output Signals | Encoder/MPG's | Spindle Setup | Mill Options

Relay Control <input type="checkbox"/> Disable Spindle Relays Clockwise (M3) Output # <input type="text" value="1"/> CCW (M4) Output # <input type="text" value="2"/> Output Signal #'s 1-6	Motor Control <input checked="" type="checkbox"/> Use Spindle Motor Output <input checked="" type="checkbox"/> PWM Control <input type="checkbox"/> Step/Dir Motor PWMBase Freq. <input type="text" value="10"/> Minimum PWM <input type="text" value="0"/> %	Special Functions <input checked="" type="checkbox"/> Use Spindle Feedback in Sync Modes <input checked="" type="checkbox"/> Closed Loop Spindle Control P <input type="text" value="0.25"/> I <input type="text" value="1"/> D <input type="text" value="0.3"/> <input type="checkbox"/> Spindle Speed Averaging
Flood Mist Control <input type="checkbox"/> Disable Flood/Mist relays Delay Mist M7 Output # <input type="text" value="3"/> <input type="text" value="0"/> Flood M8 Output # <input type="text" value="4"/> <input type="text" value="0"/> Output Signal #'s 1-6	General Parameters CW Delay Spin UP <input type="text" value="3"/> Seconds CCW Delay Spin UP <input type="text" value="3"/> Seconds CW Delay Spind DOWN <input type="text" value="3"/> Seconds CCW Delay Spin DOWN <input type="text" value="3"/> Seconds <input type="checkbox"/> Immediate Relay off before delay	Special Options, Usually Off <input type="checkbox"/> HotWire Heat for Jog <input type="checkbox"/> Laser Mode. freq I <input type="checkbox"/> Torch Volts Control <input type="checkbox"/> Torch Auto Off
ModBus Spindle - Use Step/Dir as well <input type="checkbox"/> Enabled Reg <input type="text" value="64"/> 64 - 127 Max ADC Count <input type="text" value="16380"/>		

Configure Pulley Ratio

Current Pulley	Min Speed	Max Speed	Ratio
Pulley Number 1 <input type="button" value="v"/>	<input type="text" value="0"/>	<input type="text" value="2650"/>	<input type="text" value="0.67"/>
<input type="checkbox"/> Reversed			
<input type="button" value="OK"/>			

In the Pulley settings you can adjust the Max pulley speed to "dial in" the VFD's RPM. Based on the Shoptask's Motor RPM of 1390 at 50hz, 1 RPM = 27.8. So at 75, 100, and 125hz the Max RPMs would be 2085, 2780, and 3475 respectively. With a pulley ratio of .67, the Max pulley speeds should be 1388, 1851 and 2314. That's a good place to start, but the real world numbers will vary.

By using the .6 pulley ratio again, we get 925rpm at 50hz, 1388rpm at 75hz and 1854rpm at 100hz.

Adjust the Max Speed numbers and then type in a speed of 925rpm in Mach's Spindle Speed control, you should read 50hz on the E100 VFD's display panel. If it is higher or lower, adjust your pulley settings.

Typing 1388rpm should show 75hz and 1851rpm should be 100hz.

IN ORDER MAKE THESE SETTINGS YOU MUST FIRST UNLOCK THE PARAMETERS IN THE P1-000 CODE AS DISCUSSED BELOW.

Patriot CNC VFD Settings

Manual For/Rev Switch Control - Set PO-000 to 1 and P0-002 to 0

VFD Keypad Control - Set P0-000 to 0 and P0-002 to 0

Mach3 Control – Set P0-000 to 1 and P0-002 to 2 (Must be wired for this Option)

P1-000 – Set to 0 to allow editing of the PO-XXX parameters below – Set to 1 to protect

PO-XXX	PO-XXX	PO-XXX	PO-XXX
000 See Above	027 0	054 15	081 0
001 0	028 1	055 1	082 0
002 See Above	029 0	056 2	083 0
003 0	030 0	057 0	084 0
004 50	031 0	058 0	085 0
005 5	032 0	059 0	086 0
006 0	033 0	060 1	087 0
007 75	034 0	061 2	088 0
008 0	035 100	062 3	089 0
009 .5 Acceleration	036 180	063 4	090 0
010 .5 Deceleration	037 130	064 5	091 0
011 6	038 125	065 6	092 0
012 50	039 3	066 7	093 0
013 13 Torque Boost	040 0	067 8	094 15
014 230 Auto Torque	041 0	068 9	095 15
015 230 Auto Slip	042 0	069 10	096 15
016 1	043 0	070 11	097 15
017 2	044 0	071 12	098 15
018 4	045 0	072 13	099 15
019 9	046 3	073 14	100 15
020 0	047 0	074 15	101 15
021 0	048 1	075 0	102 0
022 0	049 2	076 0	
023 10	050 0	077 0	
024 75	051 0	078 0	
025 1	052 0	079 0	
026 3	053 15	080 0	

We find that the above VFD settings worked good for us to achieve the following functions:

- To allow Mach3 to control the “Spindle Functions” such as Speed, Forward/Reverse, and Stop.
- To do “Standard Tapping” using the Mill or Lathe spindle (A floating tap holder is required).

- To maintain CSS when using “Mach3 lathe”. The spindle “automatically speeds up” to maintain a “Constant Surface Speed” when the cutter moves closer to center of the part.

Please note that the VFD needs to be wired and Mach 3 setting made as per SHOPMASTER for all the above options to work.

Please note:

We do not find a need to disconnect the Forward/Reverse switch or add an extra switch It’s automatically disabled when the VFD settings are correct and works fine when the settings are reset to enable it.

Here are some simple Sample G-Code programs We made for you to demonstrate the above optional functions (you may need to tweak for your own situation):

(EXAMPLE FOR TAPPING ON MILL AND LATHE)

(FOR TAPPING ON "MILL" SET PLANE TO X-Y)
(IE: FOR 5/16-UNC TAP)

```
G00G90
X0.0 Y0.0 Z1.0
S200M3
G84 Z-.5 R.2 F11.11111
X1.0 Y-1.0
Y1.0
G00X0.0 Y0.0 Z1.0
M30
```

(FOR TAPPING ON LATHE MODE USING MACH3 "MILL" SET PLANE TO Y-Z)
(IE: FOR 5/16-UNC TAP)

```
G00G90X1.0
S200M3
G84 X-.5 R.2 F11.11111
G00X1.0
M30
```

(IF YOU USE MACH3 "LATHE", THEN THE PLANE SHOULD BE X-Z, AND "Z" WOULD REPLACE "X" IN THE EXAMPLE)

(HERE IS A STANDARD G CODE FORMAT FOR "STANDARD TAPPING"
WITHOUT USING G84)

```
G00G90Z1.0  
S200M3  
Z.2  
G01Z-.5 F11.1111  
M5  
M4Z.2  
G00Z1.0  
M30
```

(EXAMPLE FOR TAPPING ON MILL AND LATHE)

First... you need to set the spindle to not delay in Mach3 Mill.

Go to:

"Config->Ports and Pins->Spindle Setup->General Parameters->Set all 4 to "0" and check the box "Immediate relay off before delay" (Not sure if you really need that box checked because the delay times are now off)

Then you need to "Set the plane" depending on whether your tapping using the "Mill" or the "Lathe"

"Plane Settings" can be found in "Config->General Config->Active Plane of Movement"

For Tapping on "Mill" set the Plane to X-Y

For Tapping on "Lathe" set the Plane to Y-Z (When using Mach3 Mill)

You will need a small floating holder because this is "Standard Tapping" NOT "Rigid Tapping"

You don't need to install a tach on the mill spindle for this type of tapping.

ELECTRICAL TROUBLESHOOTING

**!!! When Checking Electrical System,
Always Disconnect Unit From The Power Source !!!**

1. Neither motor will run-

- A. Be sure unit is plugged in.
- B. Check the E-Stop button to see if it is in the RUN position.
- C. Check your outlet with an electrical tester to be sure it is "hot".
- D. Ensure electrical breaker hasn't been tripped.
- E. Check the cord connections to the E-Stop button.
- F. Check the connections from the E-Stop button to the power ON-OFF switch.
- G. Check the connections from the ON-OFF switch to the inverter.
- H. Check the wires from the inverter to the relay.
- I. Check for power on all 3 wires from inverter to relay.

For other diagnosis refer to the VFD manual section

2. Only one motor runs-

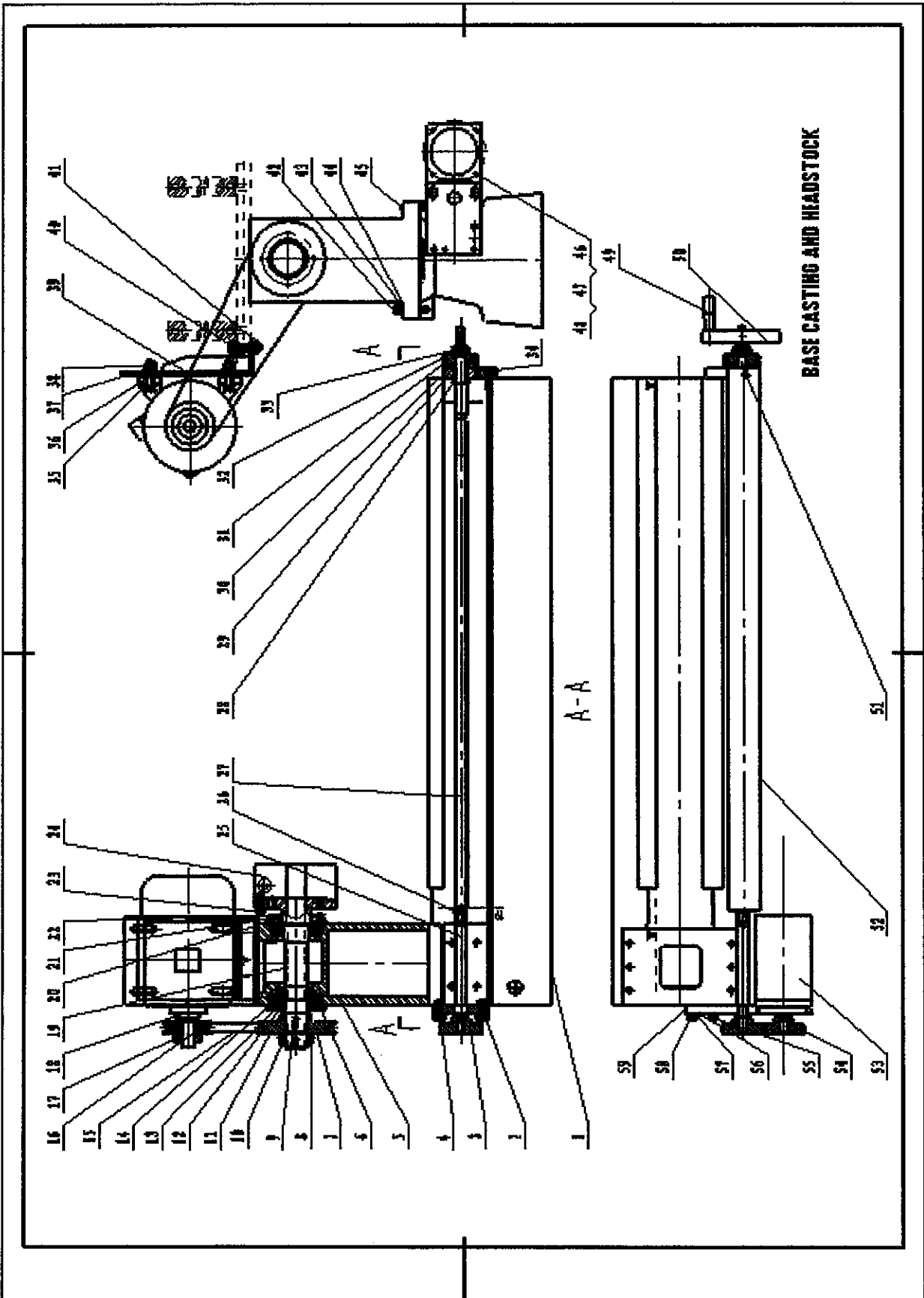
- A. Check relay for engage/disengage
- B. Check all connections on inoperable motor junction block.
- C. Check connections of wires on relay.
- D. Check connections of wires from relay to VFD inverter.

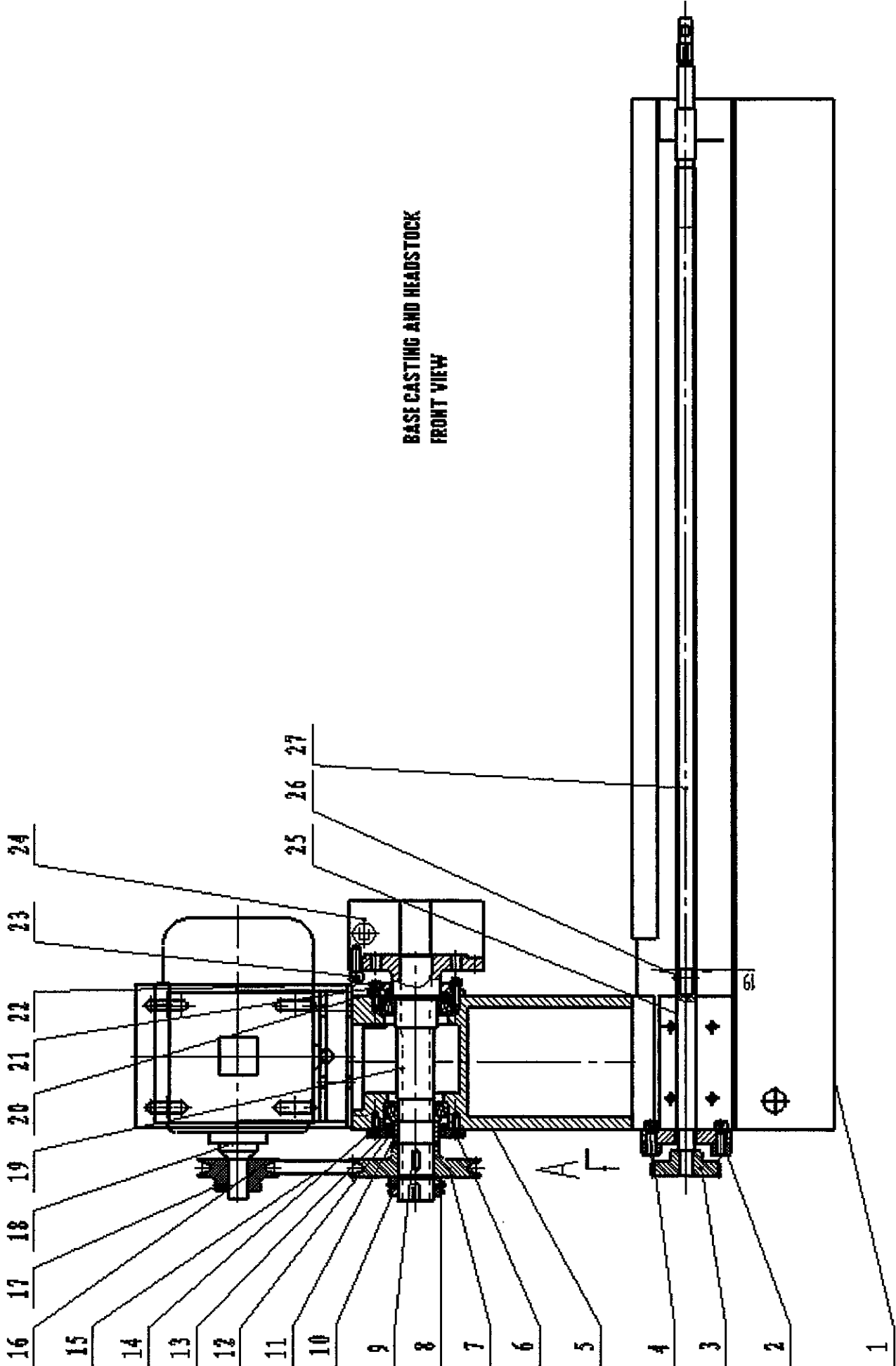
3. Motor runs only one direction-

- A. Check all connections on junction box.
- B. Check connections from Forward/Reverse switch to inverter.

SPARE PARTS

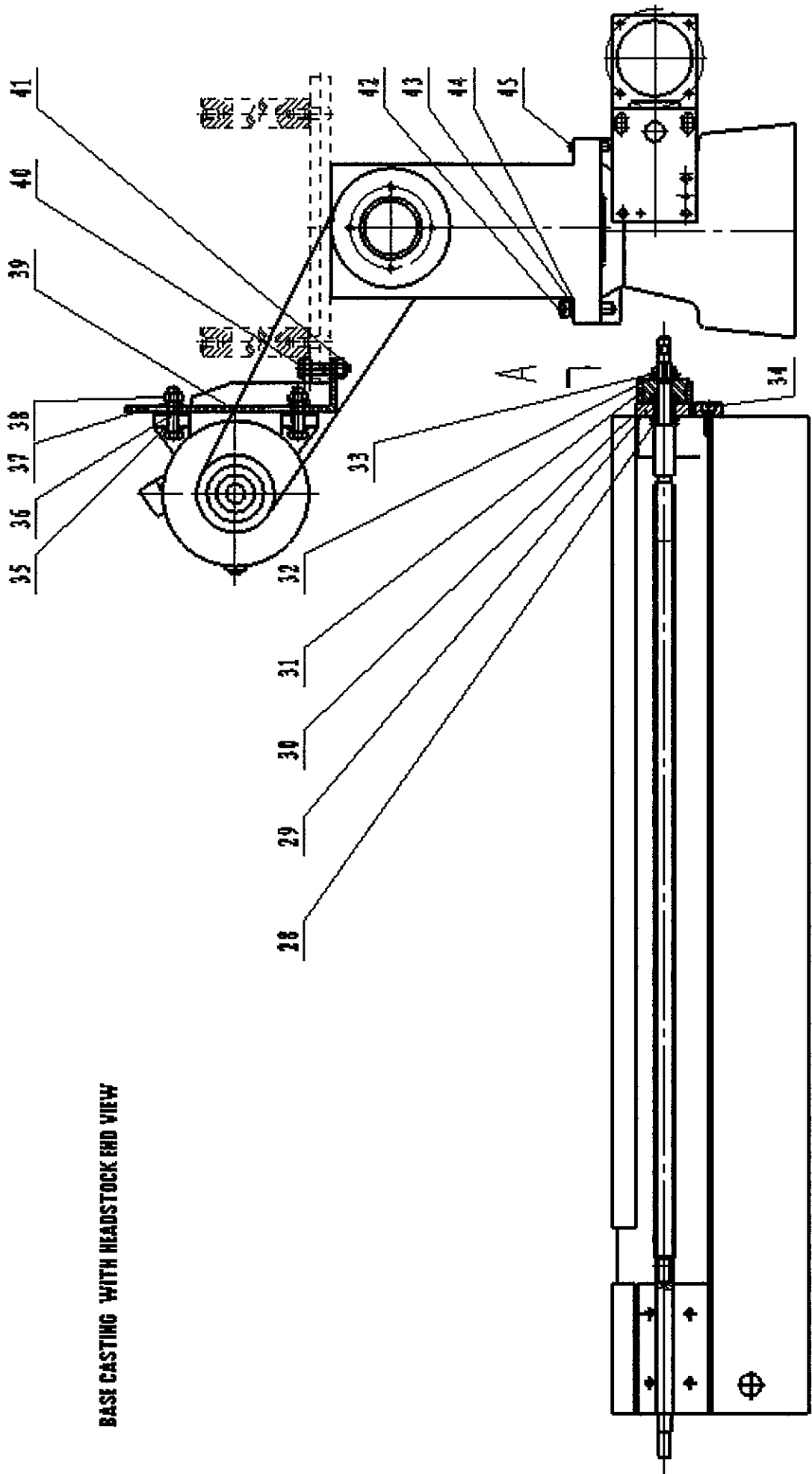
**When ordering spare parts please refer to the SECTION, SERIAL #, PART CODE
and NAME OF PART**





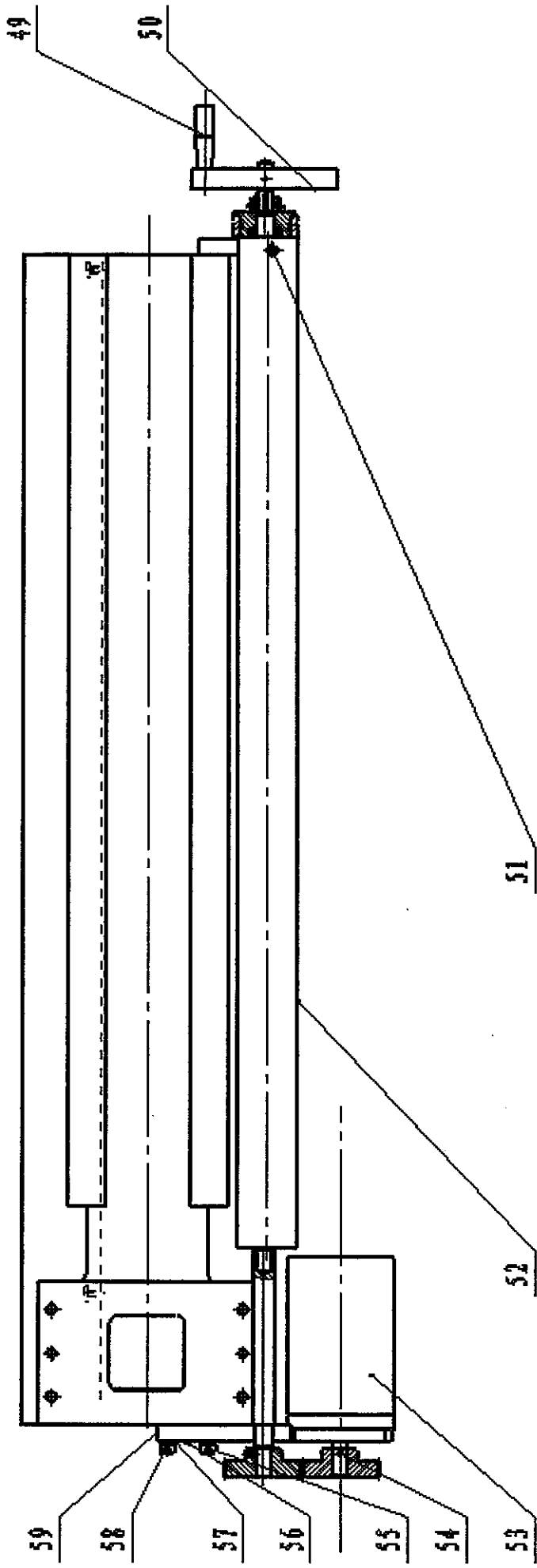
**BASE CASTING AND HEADSTOCK
 FRONT VIEW**

BASE CASTING WITH HEADSTOCK END VIEW



BASE CASTING TOP VIEW

A-A

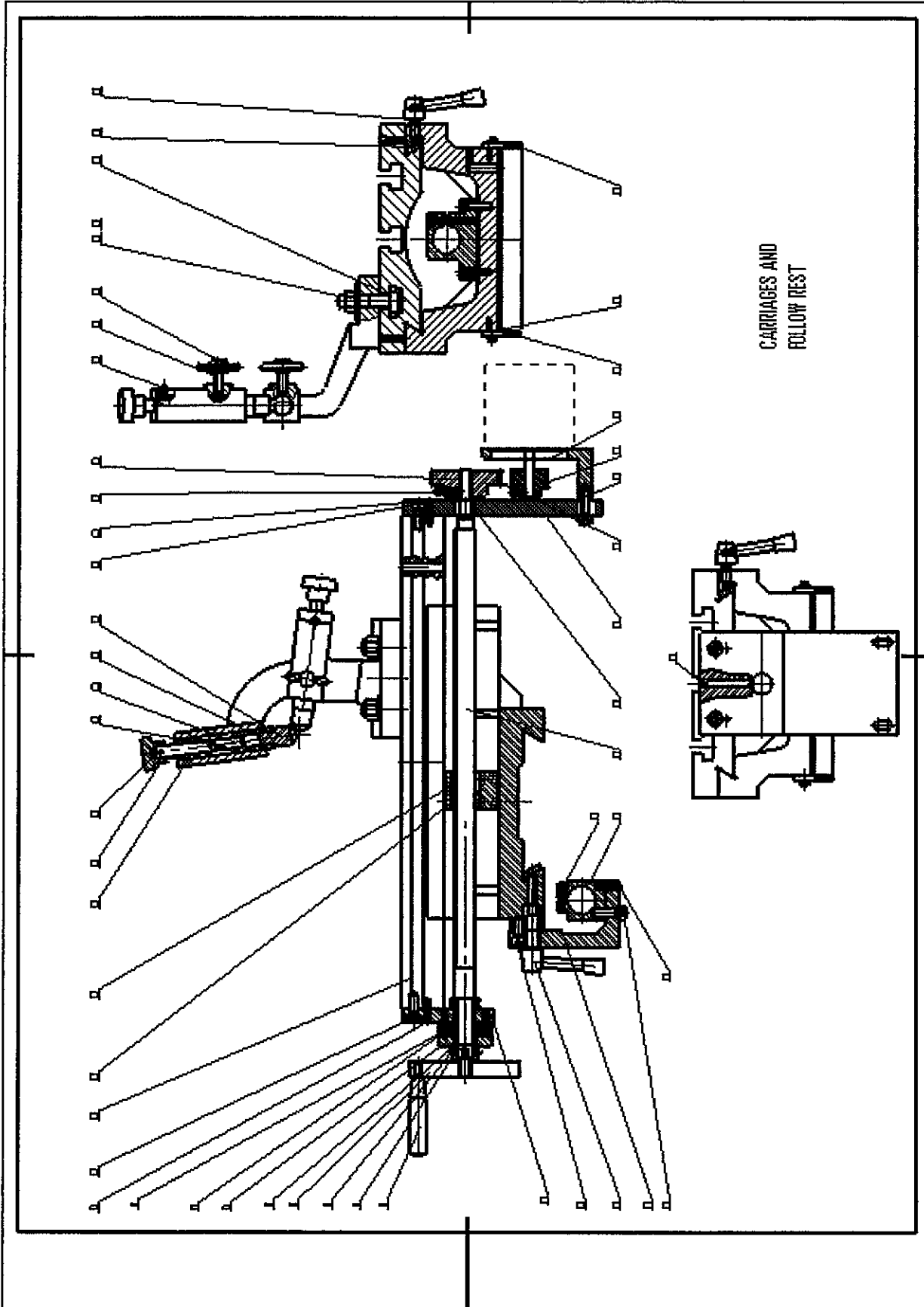


01-主轴箱及纵向进给部分

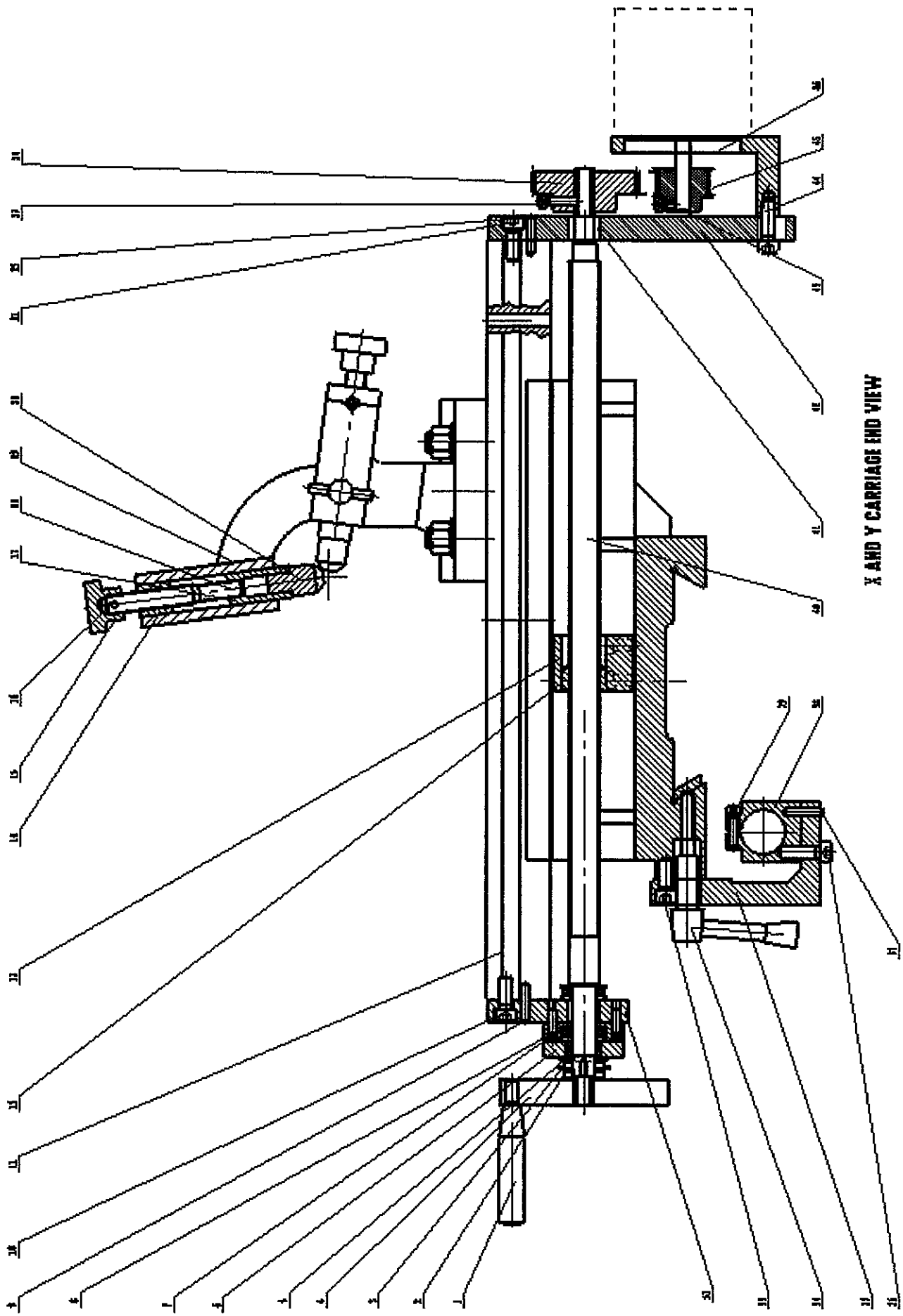
01-Headstock and Vertical feed Section

序号 serial number	代号 Part code	名称	Name of part	Specification	数量 Quantity
1	01-14	床身	Chassis		1
2	01-22-02	丝杆左支架	Left support for Screw bar		1
3	03-14	被动带轮	Teeth wheel		1
4	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X25	2
5	01-40	主轴箱	Gear box		1
6	GB/T68-2000	开槽沉头螺钉	Cross head screw	M6X20	4
7	01-06	主轴皮带轮	Pulley for main shaft		1
8	GB810-1988	小圆螺母	Round nut	M35	2
9	GB/T1096-1979	平键	Flat key	6X20	1
10	GB858-1988	圆螺母用止动垫圈	Lock washer	35	1
11	01-42	皮带轮隔套	Pulley spacer		1
12	01-07	I 轴左端盖	I shaft left end cover		1
13	01-41	主轴毛毡圈	Spindle Felt ring		1
14	32007	圆锥滚子轴承	Bearing	30000 型 35	1
15		皮带	Leather belt		1
16	01-36-01	电机皮带轮	Motor pulley		1
17	GB72-1988	开槽锥端定位螺钉	Lock screw	M4X14	1
18		主电机	Motor		1
19	01-10	主轴	Main shaft		1
20	01-09	I 轴右端盖	I shaft right cover		1
21	GB93-1987	标准型弹簧垫圈	Spring washer	6	4
22	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M6X20	4
23	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X25	4
24		三爪卡盘	Three jaw chuck		1
25	01-102	加长轴	Plus the long axis		1
26	GB/T117-2000	圆锥销	Round pin	A4X20	1
27	01-28	丝杆	Screw bar		1
28	51102	推力球轴承	Bearing	51000 型 15	2

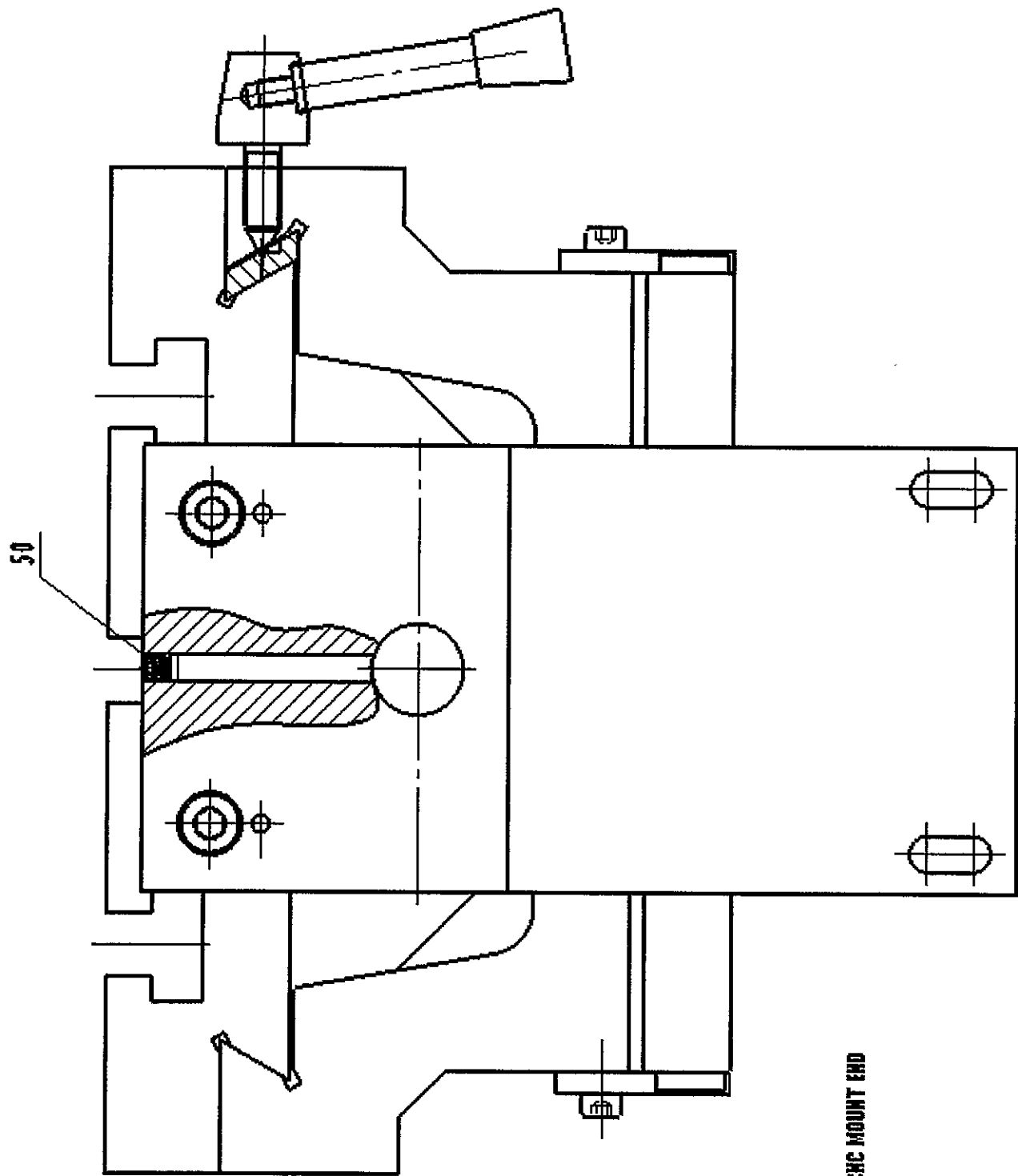
29	01-22-03	丝杆右支架	Right support for Screw bar		1
30	01-80	摩擦套	Friction sleeve		1
31	01-81-01	刻度盘	Dial		1
32	GB810-1988	小圆螺母	Round nut	M14X1.5	2
33	GB858-1988	圆螺母用止动垫圈	Lock washer	14	3
34	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X25	4
35	GB95-2002	平垫圈	Flat washer	10	4
36	GB/T5780-2000	六角头螺栓	Hexagon bolts	M10X45	4
37	GB93-1987	标准型弹簧垫圈	Spring washer	10	4
38	GB/T6175-2000	六角螺母	Hexagon nut	M10	4
39	01-03	电机座	Motor seat		1
40	GB/T5780-2000	六角头螺栓	Hexagon bolts	M10X45	2
41	GB/T6175-2000	六角螺母	Hexagon nut	M10	2
42	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M10X45	4
43	GB93-1987	标准型弹簧垫圈	Spring washer	10	4
44	GB95-2002	平垫圈	Flat washer	10	4
45	GB/T117-2000	圆锥销	Round pin	A8X40	2
46	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M6X10	4
47	GB93-1987	标准型弹簧垫圈	Spring washer	6	4
48	GB95-2002	平垫圈	Flat washer	6	4
49		手柄	Handle		1
50	01-80-2	手臂	Arm		1
51	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X8	2
52	01-72	丝杆盖板	Screw bar shield		1
53		进给电机	Motor		1
54	GB72-1988	开槽锥端定位螺钉	Lock screw	M5X5	2
55	GB93-1987	标准型弹簧垫圈	Spring washer	8	3
56	GB/T117-2000	圆锥销	Round pin	A5X45	2
57	GB95-2002	平垫圈	Flat washer	8	3
58	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X35	3



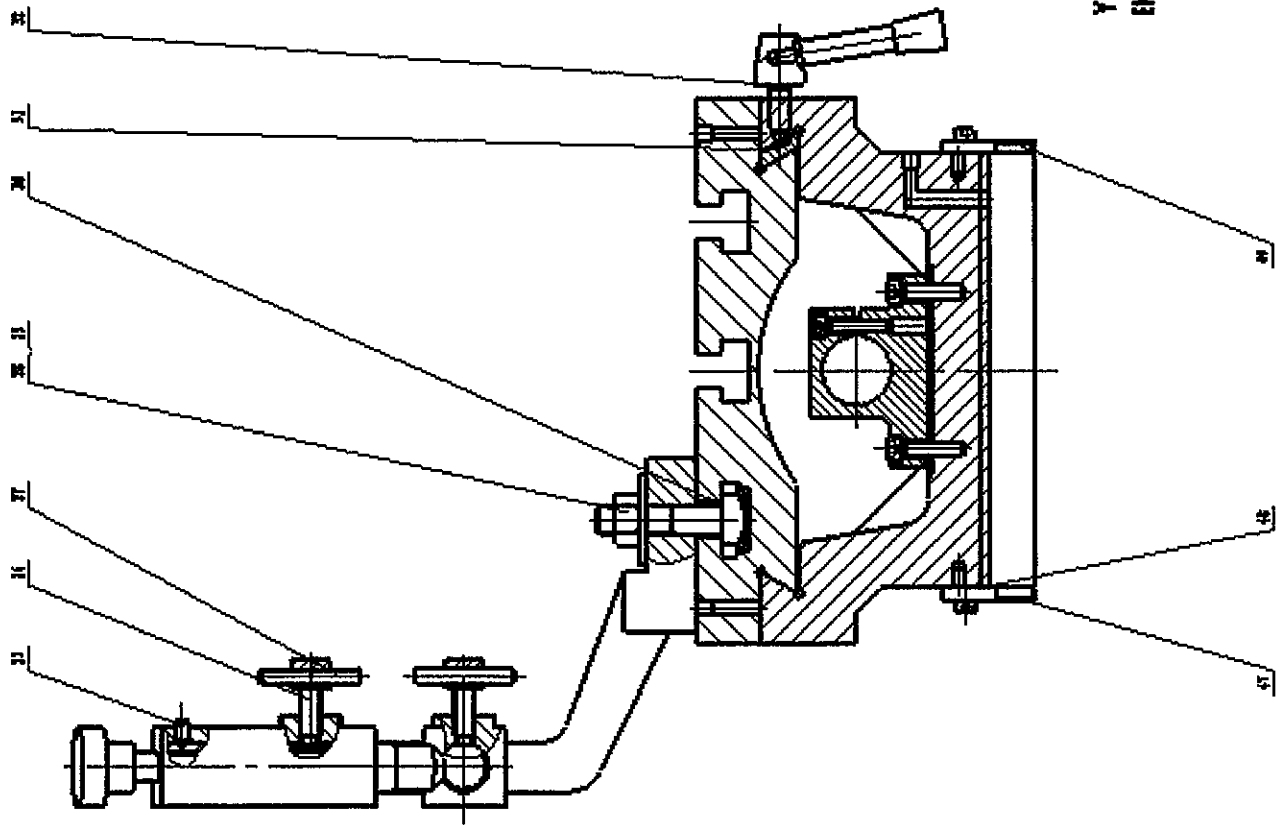
CARRIAGES AND
FOLLOW REST



X AND Y CARRIAGE END VIEW



Y CARRIAGE AND CMC MOUNT END
VIEW



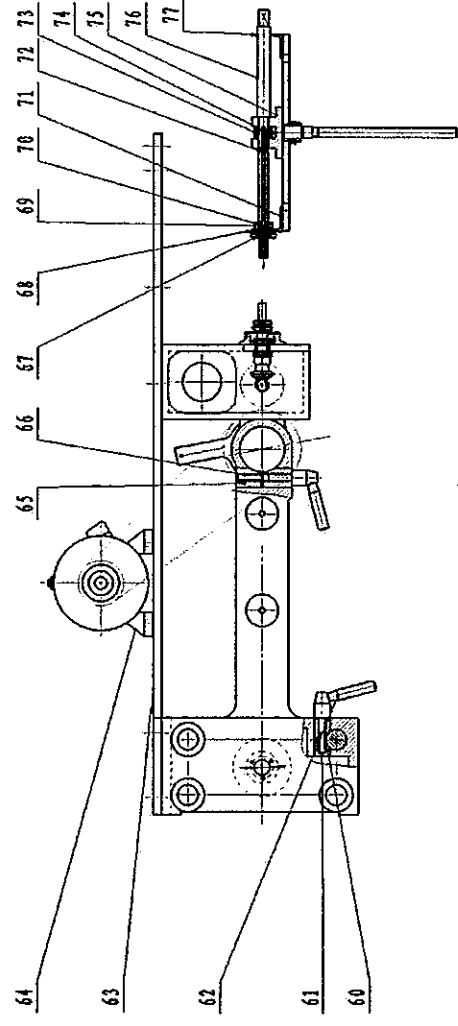
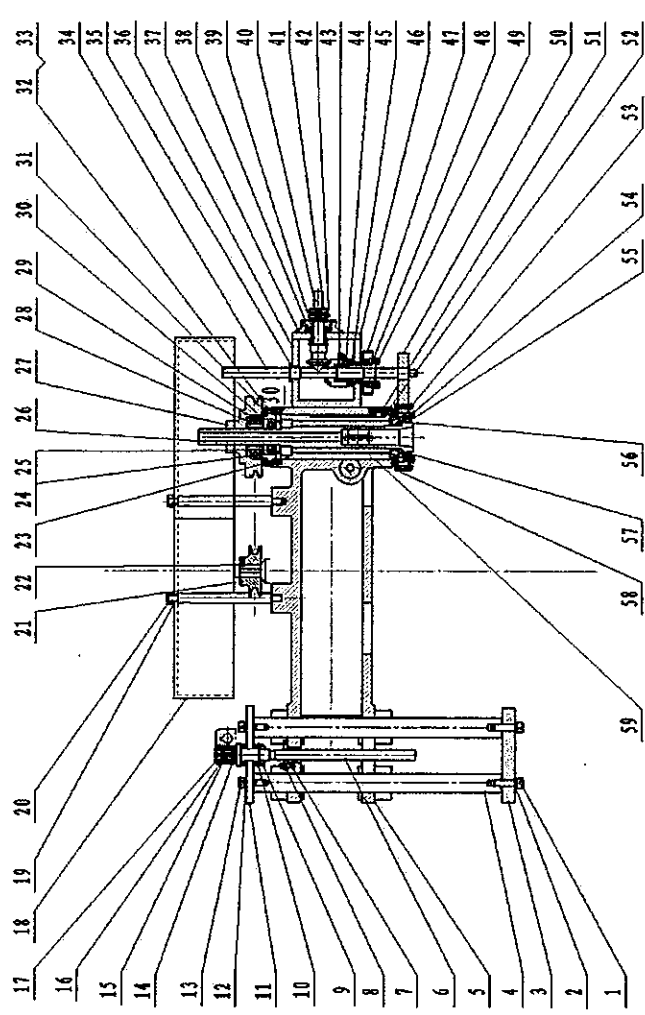
Y CARRIAGE AND FOLLOW REST
END VIEW

03-工作台部分

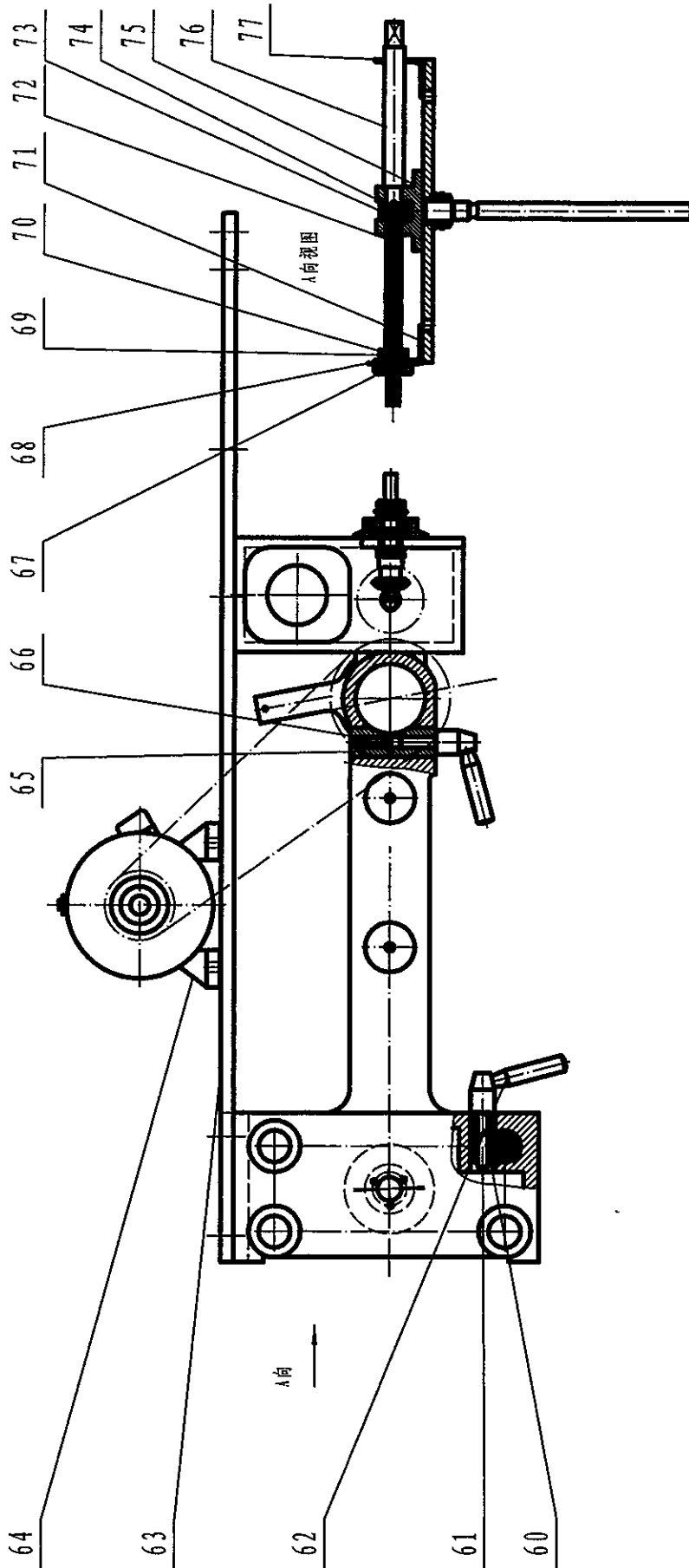
03-Table Section

序号 serial number	代号 Part code	名称	Name of part	Specification	数量 Quantity
1		手柄	Handle		1
2	GB810-1988	小圆螺母	Round screw	M14X1.5	2
3	GB858-1988	圆螺母用止动垫圈	Lock washer	14	1
4		手轮	Hand wheel		1
5	03-45	摩擦套	Position sleeve		1
6	02-21	刻度盘	Dial		1
7	03-43	基准环	Benchmark Ring		1
8	GB/T68-2000	开槽沉头螺钉	Sank screw	M5X20	2
9	GB117-86	圆锥销	Round pin	φ 5x22	2
10	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X20	2
11	03-05	工作台	Table		1
12	03-30	工作台螺母	Table Nut		1
13	03-23	工作台螺母座	Table Nut Block		1
14	03-07	定位套	Position sleeve		1
15	03-08	把手	Handle		1
16	GB117-86	圆锥销	Round pin	φ 5x22	1
17	03-09	螺母套	Nut sleeve		1
18	03-10	调整螺杆	Adjustment screw		1
19	03-11	跟刀架	Movable support		1
20	03-12	摩擦铜套	Copper sleeve friction		1
21	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X20	2
22	GB/T119.1-2000	圆柱销	Cylindrical pin	5X24	2
23	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X20	1
24	03-14	被动带轮	Teeth wheel		1
25	GB79-85	内六角锥端紧定螺钉	Inner hexagon lock screw	M5x8	1
26	03-16	导向螺钉	Guide screws		2
27	GB/T119.1-2000	圆柱销	Cylindrical pin	φ 6x40	2
28	GB/T41-2000	六角螺母	Hexagon nut	M12	2

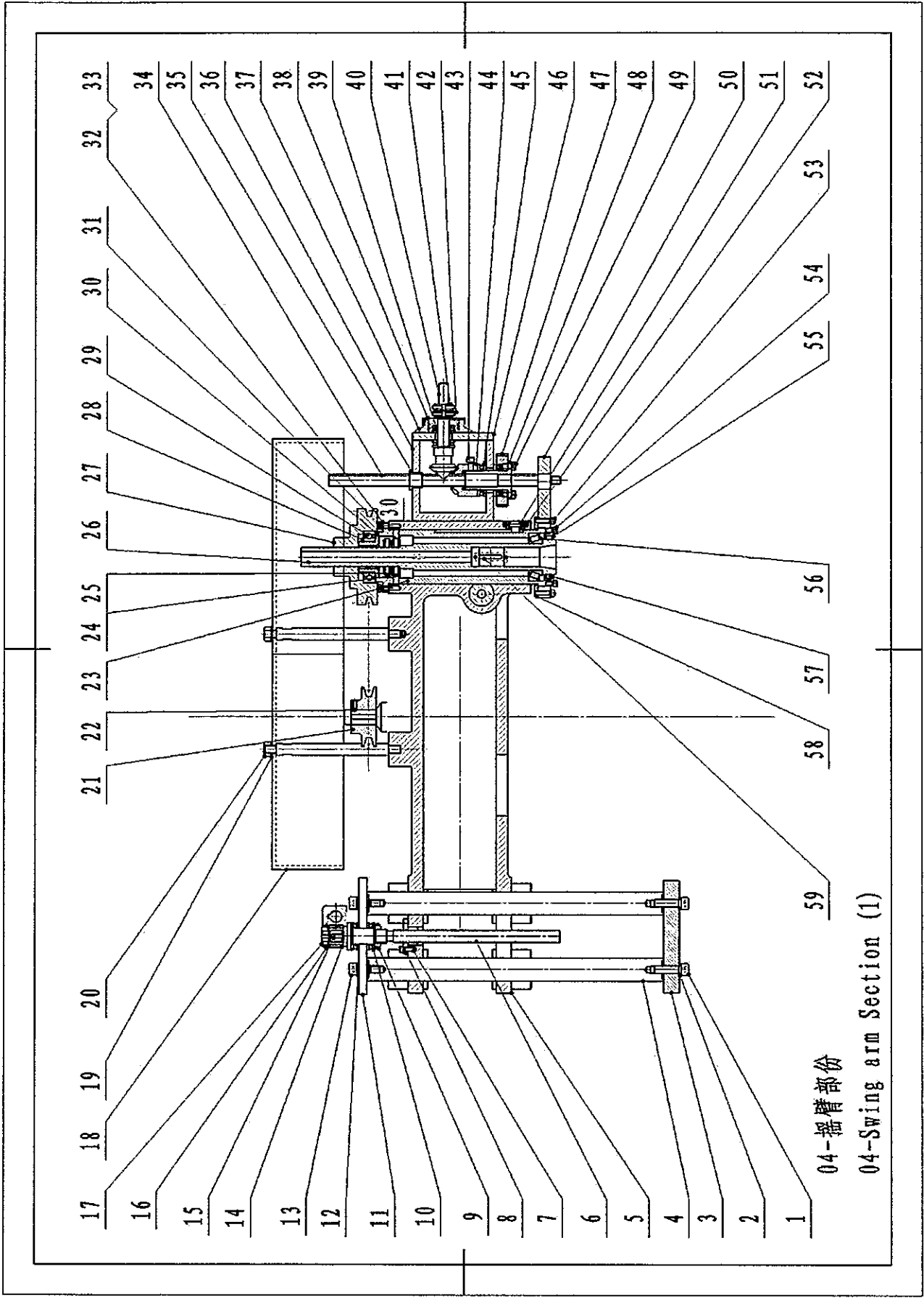
29	GB95-2002	平垫圈	Flat washer	12	2
30	GB37-1988	T形槽用螺栓	T-slot bolt	M12X50	2
31	03-39	工作台导轨调隙板	Gap adjustment plate of Table rail		1
32	03-41	工作台导轨调隙螺钉	Gap adjustment screw of Table rail		1
33	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X20	2
34	03-28	床身导轨调隙螺钉	Gap adjustment screw of Bed rail		1
35	03-27	支架	Support		1
36	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X25	2
37	GB/T119.1-2000	圆柱销	Cylindrical pin	5X24	2
38	03-32	拖板螺母座	Block nut extension units		2
39	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X20	1
40	03-06	工作台丝杆	Screw bar		1
41	03-24	丝杆轴套	Screw shaft		1
42	03-13	电机过渡连接板	Motor transition board		1
43	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X8	1
44	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M8X25	2
45	03-33	主动带轮	Active pulley		1
446	03-34	电机连接板	Electrical Interconnect		2
47	03-35	左防尘盖	Left Shield		1
48	03-36	防尘片	Dust film		1
49	03-40	右防尘盖	Right Shield		1
50	GB1155-89	压配式压注油杯	Pressure oil filler	6	1
51	03-42	工作台前挂架	Working the stage rack		1



04-摇臂部份
04-Swing arm Section



04-摇臂部分
 04-Swing arm Section (2)



04-摇臂部份

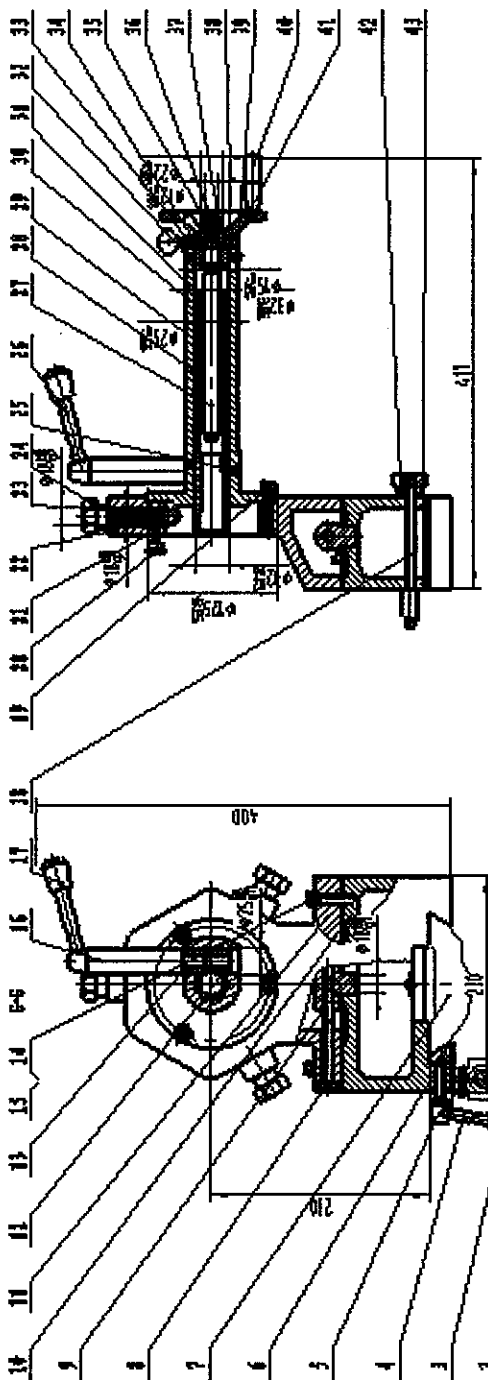
04-Swing arm Section (1)

04-摇臂部分

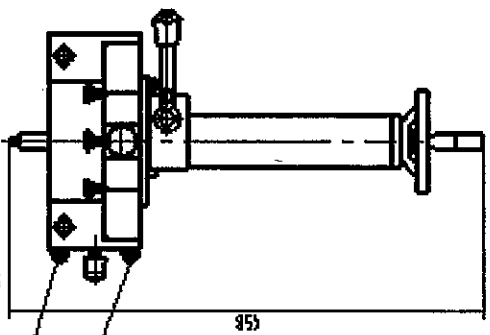
04- Swing arm Section

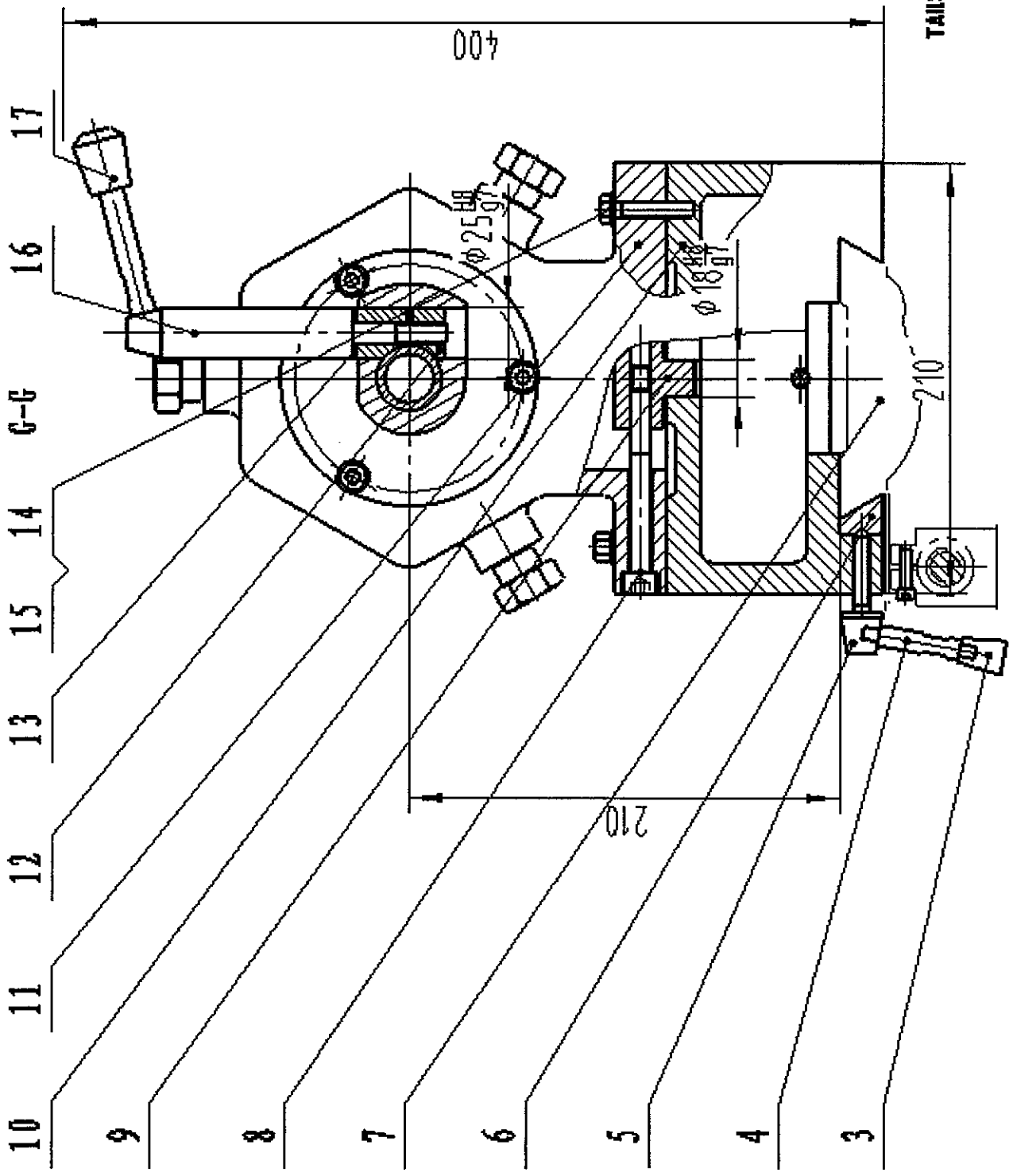
序号 serial number	代号 Part code	名称	Name of part	Specification	数量 Quantity
1.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M10X35	4
2.	GB93-1987	标准型弹簧垫圈	Spring washer	10	4
3.		板	plate	Q235-B	1
4.	04-30	导柱	Guide column	45	4
5.	04-27	摇臂	Swing arm	HT200	1
6.	04-09	升降螺杆	Lifting screw	45	1
7.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X16	3
8.	04-08	升降螺母	Lifting nut	H62	1
9.	GB812-1988	圆螺母	Round nut	M18X1.5	1
10.	51104	推力球轴承	Bearing	51000 型 20	2
11.	04-07	上连接板	Uppper connection board	Q235-B	1
12.	GB93-1987	标准型弹簧垫圈	Spring washer	10	4
13.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M10X25	4
14.	04-90-49	斜齿轮	Gear	45	1
15.	GB/T1096-1979	普通平键 A 型	Gear seat	5X16	1
16.	GB858-1988	圆螺母用止动垫圈	Lock washer	14	1
17.	GB812-1988	圆螺母	Round nut	M14X1.5	1
18.	04-02	顶罩	Top cover	Q235-B	1
19.	GB95-2002	平垫圈	Flat washer	10	2
20.	GB/T6175-2000	六角螺母	Hexagon nut	M10	2
21.	01-36-01	电机皮带轮	Motor pulley		1
22.	GB72-1988	开槽锥端定位螺钉	Lock screw	M4X14	1
23.	04-62	主轴套	Main shaft sleeve	45	1
24.	GB812-1988	圆螺母	Round nut	M30X1.5	2
25.	GB858-1988	圆螺母用止动垫圈	Lock washer	30	1
26.	04-61	主轴	Main shaft	40Cr	1
27.	04-04	主轴带轮	Pulley for main shaft	HT200	1
28.		轴用弹性挡圈	Spring lock ring for shaft	Φ40	1
29.	6008	深沟球轴承	Bearing	60000 型 40	1
30.	04-16	主轴轴承座	Bearing seat for main shaft	HT200	1
31.	GB/T5782-2000	六角头螺栓	Hexagon bolts	M5X25	4
32.	GB/T5782-2000	平垫圈	Flat washer	5	4
33.	GB93-1987	标准型弹簧垫圈	Spring washer	5	4
34.	04-90-27	V 轴	V shaft	45	1
35.		套	sleeve	45	1
36.	04-90-00-1	齿轮箱	Gear box	Q235-B	1

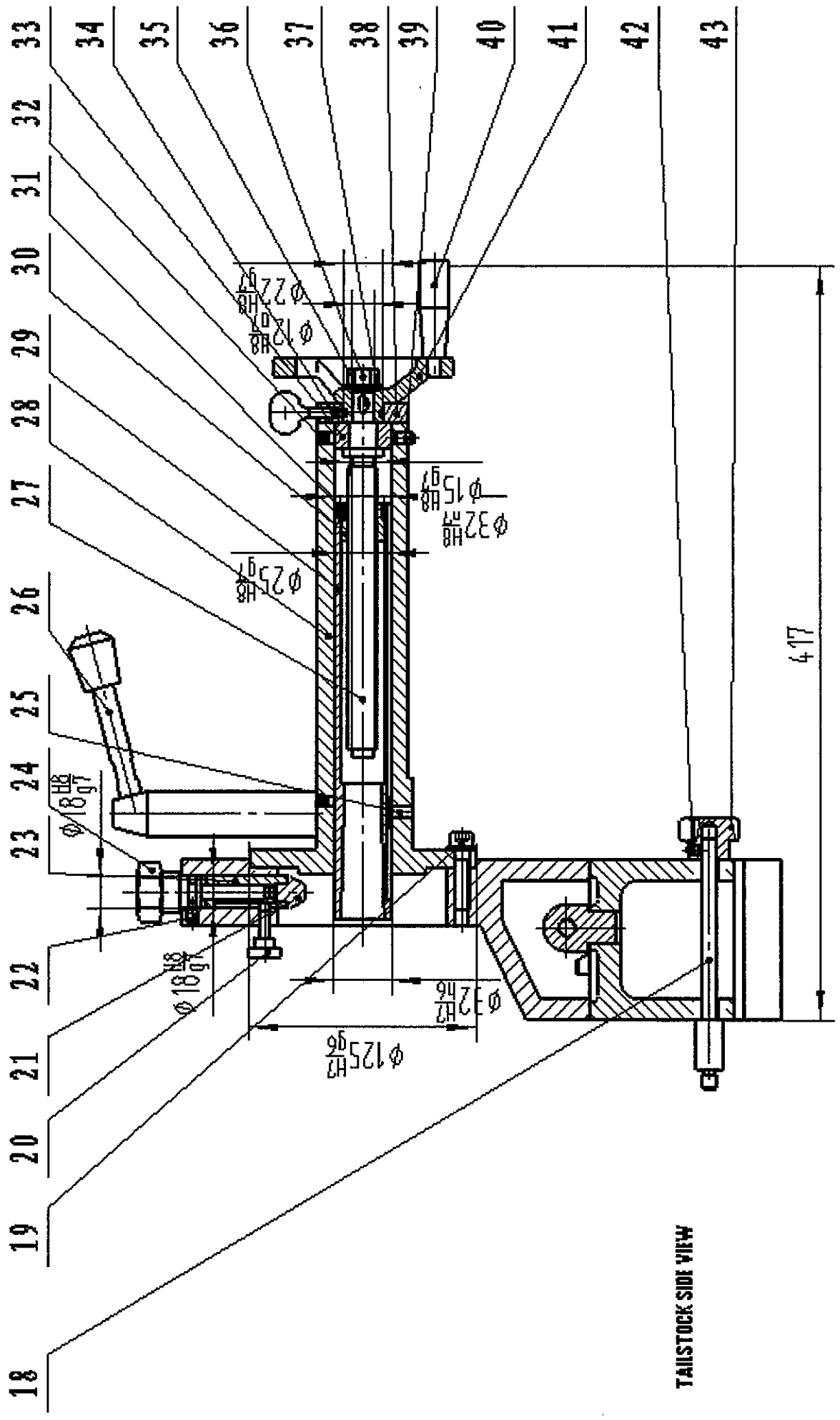
37.	04-51	刻度盘	Dial	45	1
38.	04-90-61	摩擦套	Position sleeve	45	1
39.	51102	推力球轴承	Bearing	51000 型 15	2
40.	04-90-28	手动齿轮轴	Gear shaft	45	1
41.	GB812-1988	圆螺母	Round nut	M14X1.5	2
42.	GB858-1988	圆螺母用止动垫圈	Lock washer	14	1
43.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M6X12	2
44.	04-90-20	IV轴齿轮组	Gear	45	1
45.	51105	推力球轴承	Bearing	51000 型 25	2
46.	04-90-01	齿轮箱盖板	Cover of gear box	Q235-B	1
47.	04-90-23	V轴带轮	Belt wheel of V-axis	45	1
48.	04-90-25	V轴调整螺母	Adjusting nut	45	1
49.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M6X12	2
50.	04-22	升降板	Lift plate	HT200	1
51.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M4X6	2
52.		导向键	Feather key	45	1
53.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X20	6
54.	GB/T70.1-2000	内六角圆柱头螺钉	Inner hexagon screw	M5X10	2
55.	04-20	轴承盖	Bearing cover	45	1
56.	32007	圆锥滚子轴承	Bearing	30000 型 35	1
57.	04-19	毛毡圈	Hair felt circle	毛毡	1
58.	04-23	上压板	Top platen	Q235-B	1
59.	04-61-1	导向键	Feather key	45	1
60.	04-63	锁紧套	Lock servw	Q235-B	1
61.	04-64	锁紧螺钉	Lock sleeve	45	1
62.	04-90-64-03	升降摇把手柄	Elevating cranking-bar handle	45	2
63.	04-05	电机安装板	Mounting plate of motor	Q235-B	1
64.		电机	Motor		1
65.	04-90-62	锁紧套	Lock servw	45	1
66.	04-90-63	锁紧手柄	Lock handle	45	1
67.	GB812-1988	圆螺母	Round nut	M22X1.5	1
68.	GB856-1988	外舌止动垫圈	Lock washer	22	1
69.	04-90-58	调整螺母	Adjusting nut	45	1
70.	04-90-60	主动轴轴套	Sleeve for main shaft	含油轴承	1
71.	04-10-01	角钢	Angle metal		1
72.		轴用弹性挡圈	Spring lock ring for shaft	Φ 15	1
73.	04-90-49	斜齿轮	Gear	45	1
74.	GB/T1096-1979	普通平键	Flat key	5X18	1
75.	04-90-48	齿轮座	Gear seat	HT200	1
76.	04-90-51	升降主动轴	Main lifting shaft	45	1
77.	04-10	角钢	Angle metal		1



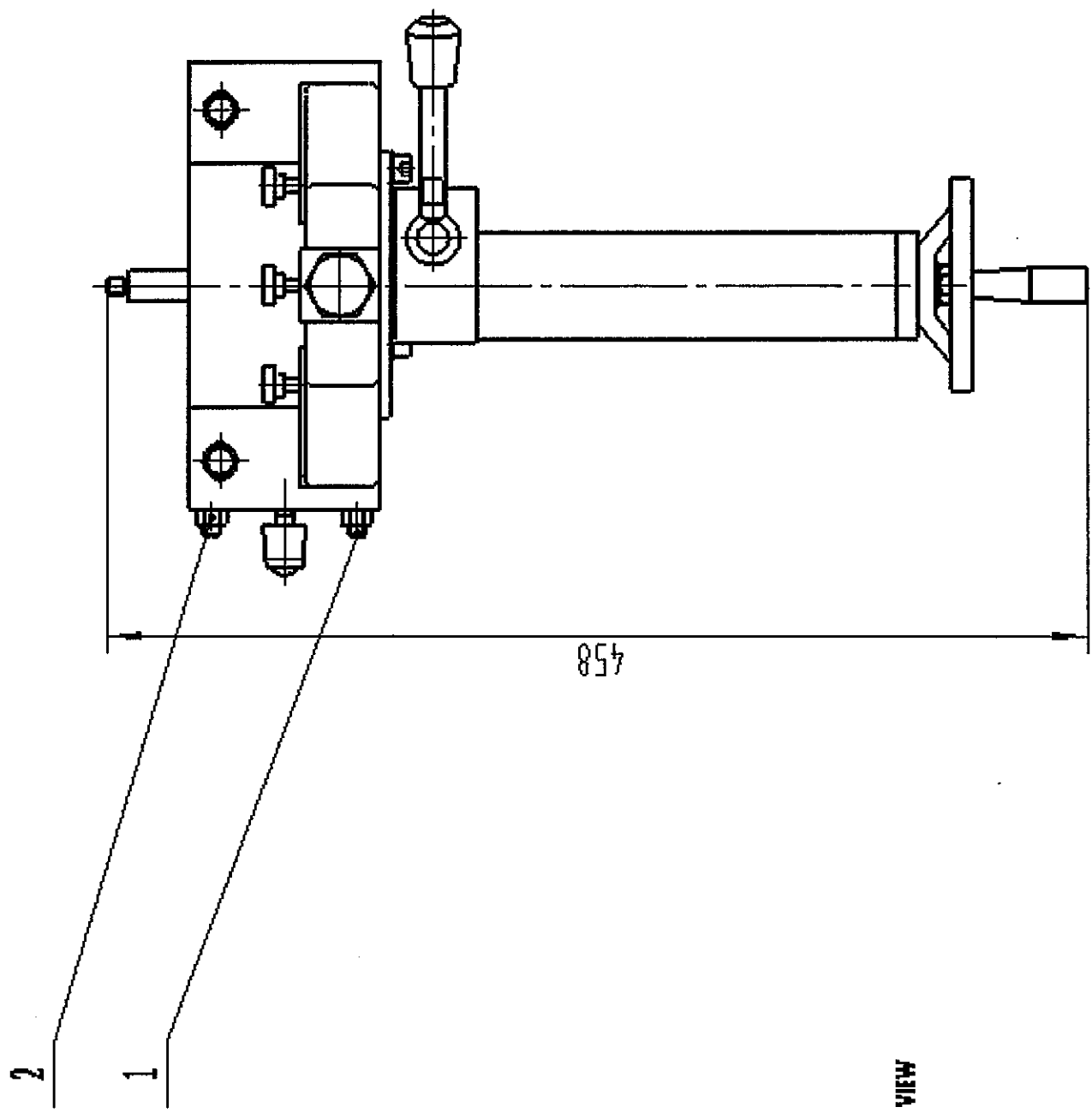
**TAILSTOCK AND STEADY
RIST ASSEMBLY**







TAILSTOCK SIDE VIEW



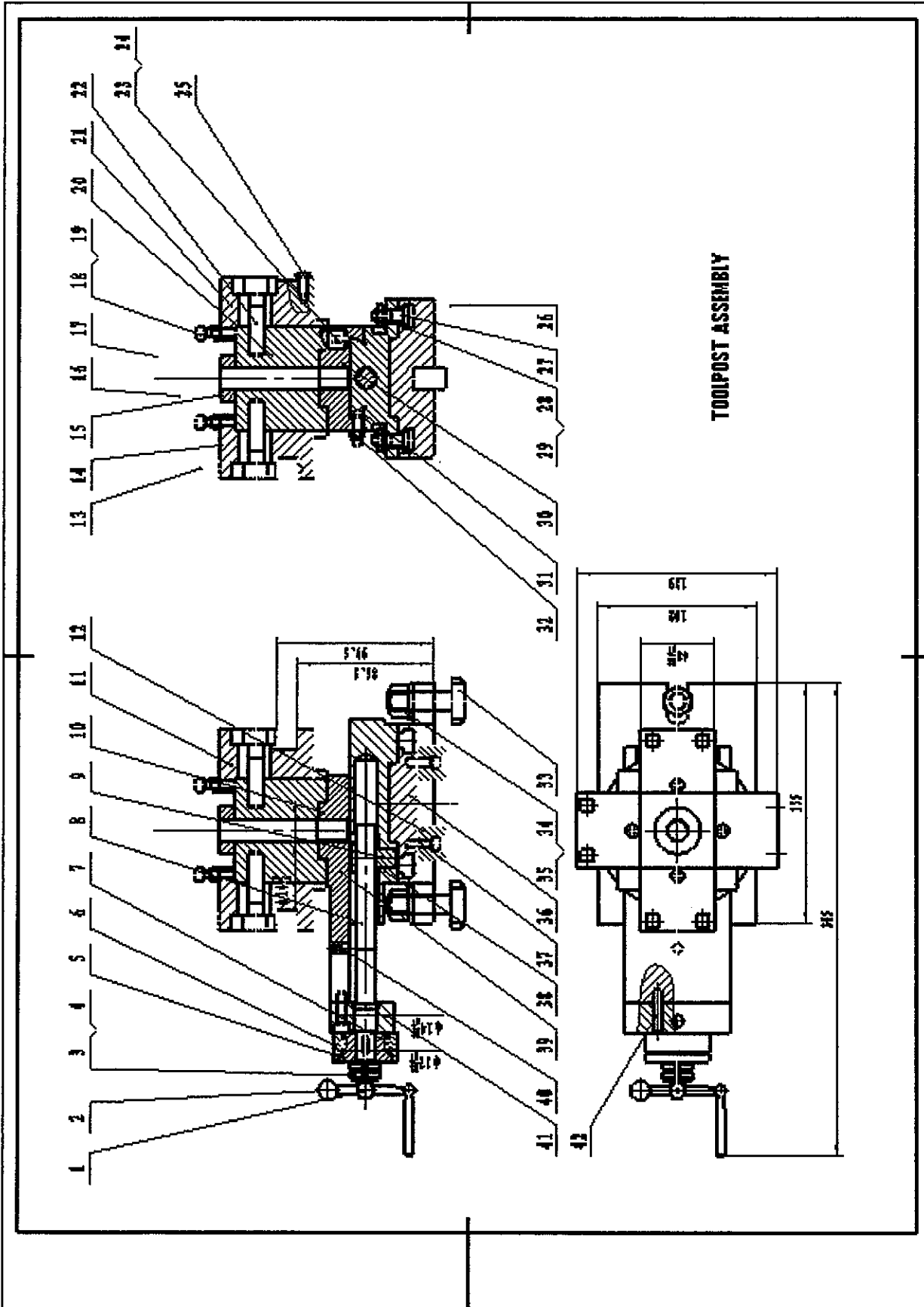
TAILSTOCK TOP VIEW

02-尾座部分

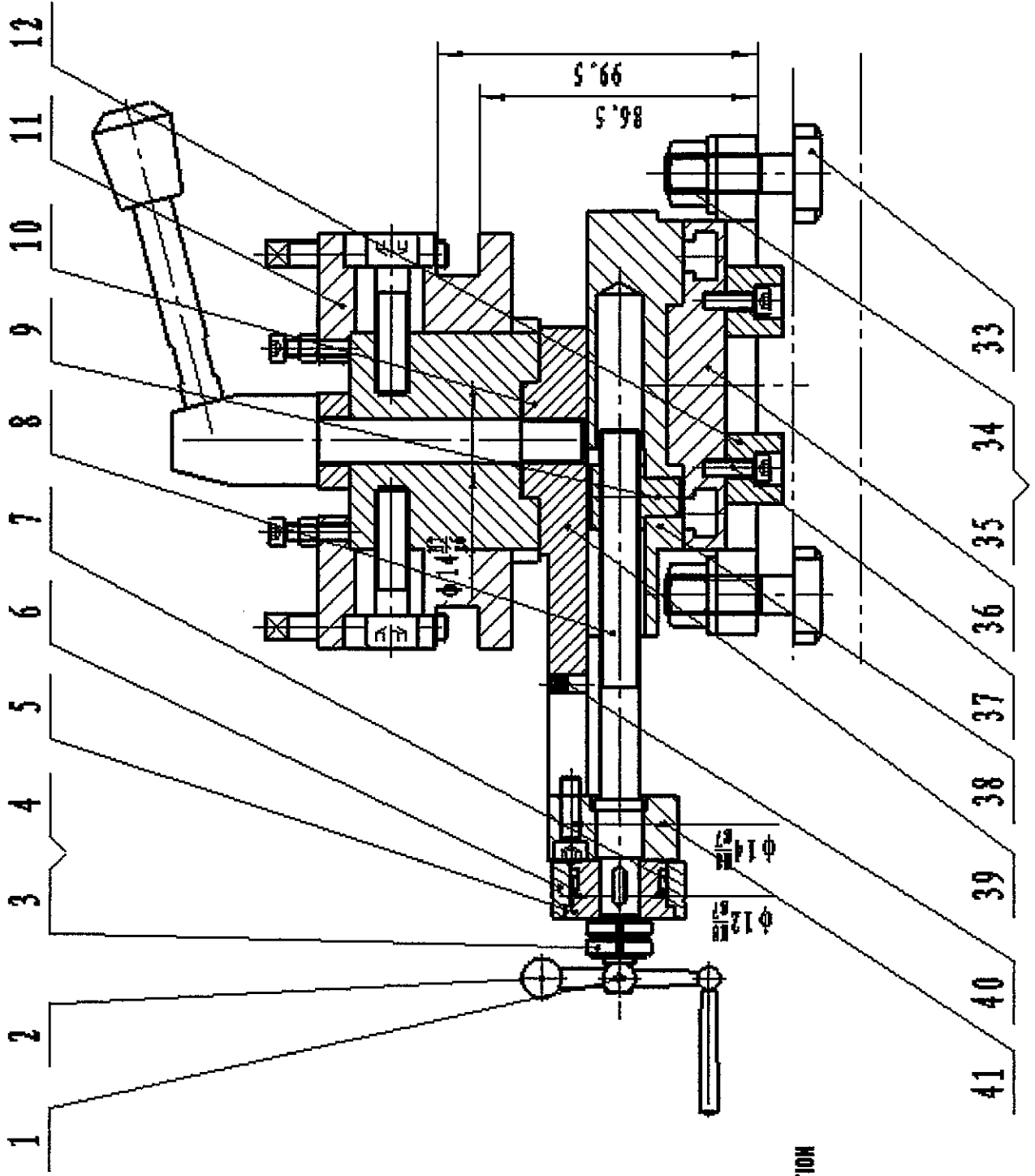
02- Tailstock Section

序号 serial number	代号 Part code	名称	Name of part	Specification	数量 Quantity
1	GB73-1985	开槽平端紧定螺钉	Lock screw	M8X45	2
2	GB/T6175-2000	六角螺母	Hexagon nut	M8	2
3		手柄套	Handle cap	M8x25	1
4	04-37	锁紧手柄	Lock handle		1
5	02-01	导轨调隙螺钉	Track adjusting screw		1
6	02-02	导轨调隙板	Track adjusting plate		1
7	01-16	床身	Chassis		1
8	GB/T70.1-2000	内六角螺钉	Inner hexagon screw	M10x90	2
9	02-03	连接座	Connection seat		1
10	02-04	尾座导轨	Track for tailstock		1
11	02-05	尾座支架	Support for tailstock		1
12	02-06	锁紧套	Lock sleeve		1
13	02-07	垫圈	Washer		1
14	GB/T5782-2000	六角螺栓	Hexagon screw	M8x40	4
15	GB/T5782-2000	平垫圈	Flat washer	8	7
16	02-08	锁紧螺钉	Lock screw		1
17		手柄套	Handle cap	M10x32	1
18	02-09	跟刀螺杆	Tracing screw bar		1
19	GB/T70.1-2000	内六角螺钉	Inner hexagon screw	M8x30	3
20	02-10	导向螺钉	Guide screw		3
21	02-11	摩擦铜帽	Friction brass cap		3
22	GB/T78-2000	内六角圆柱端定位螺钉	Inner hexagon lock screw	M6x12	3
23	02-12	螺母套	Nut sleeve		3
24	02-13	调整螺钉	Adjustment screw		3
25	02-14	主轴导向钉	guide screw for Main shaft		1
26		手柄杆	Handle bar	M10x80(12)	1
27	02-15	T形螺杆	T type screw bar		1

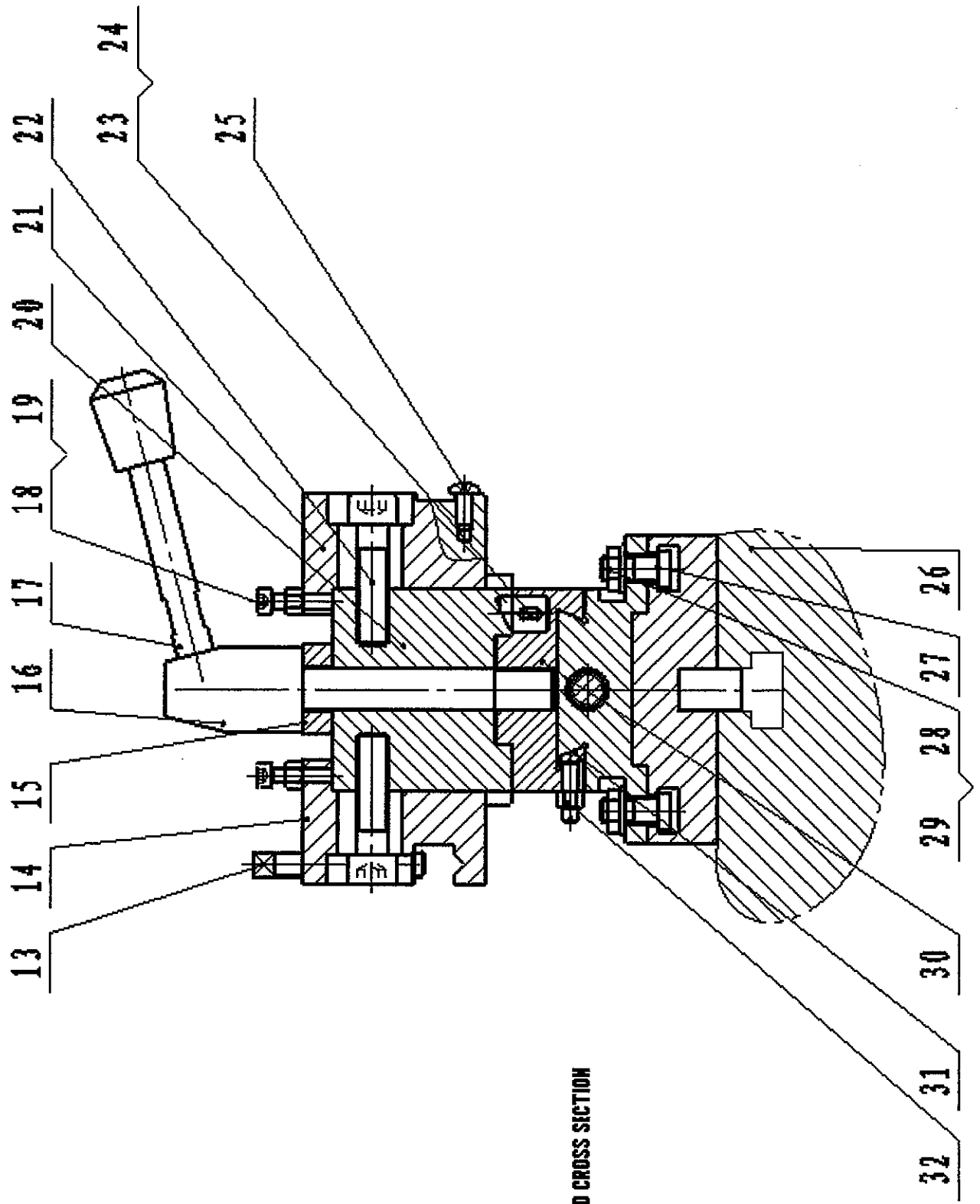
28	02-16	尾座轴套	Shaft sleeve for tailstock		1
29	02-17	尾座主轴	Main shaft for tailstock		1
30	02-18	T形螺母	T type nut		1
31	GB71-1985	开槽锥端紧定螺钉	Lock screw	M3X10	2
32	GB1155-89	压配式压注油杯	Pressure oil filler	6	2
33	02-19	定位套	Position sleeve		1
34	02-20	蝶形螺钉	Screw		1
35	GB/T1096-1979	平键	Flat key	4x10	1
36	GB/T6175-2000	六角螺母	Hexagon nut	M10	1
37	GB/T5782-2000	平垫圈	Flat washer	10	1
38	02-21	刻度盘	Dial		1
39	GB/T78-2000	内六角锥端紧定螺钉	Inner hexagon lock screw	M6x16	1
40		转动手柄	Rotating handle	M8x63	1
41	02-22	手轮	Handle wheel		1
42	GB/T78-2000	内六角锥端紧定螺钉	Inner hexagon lock screw	M6x12	1
43	02-23	跟刀螺钉头	Tracing screw bar		1



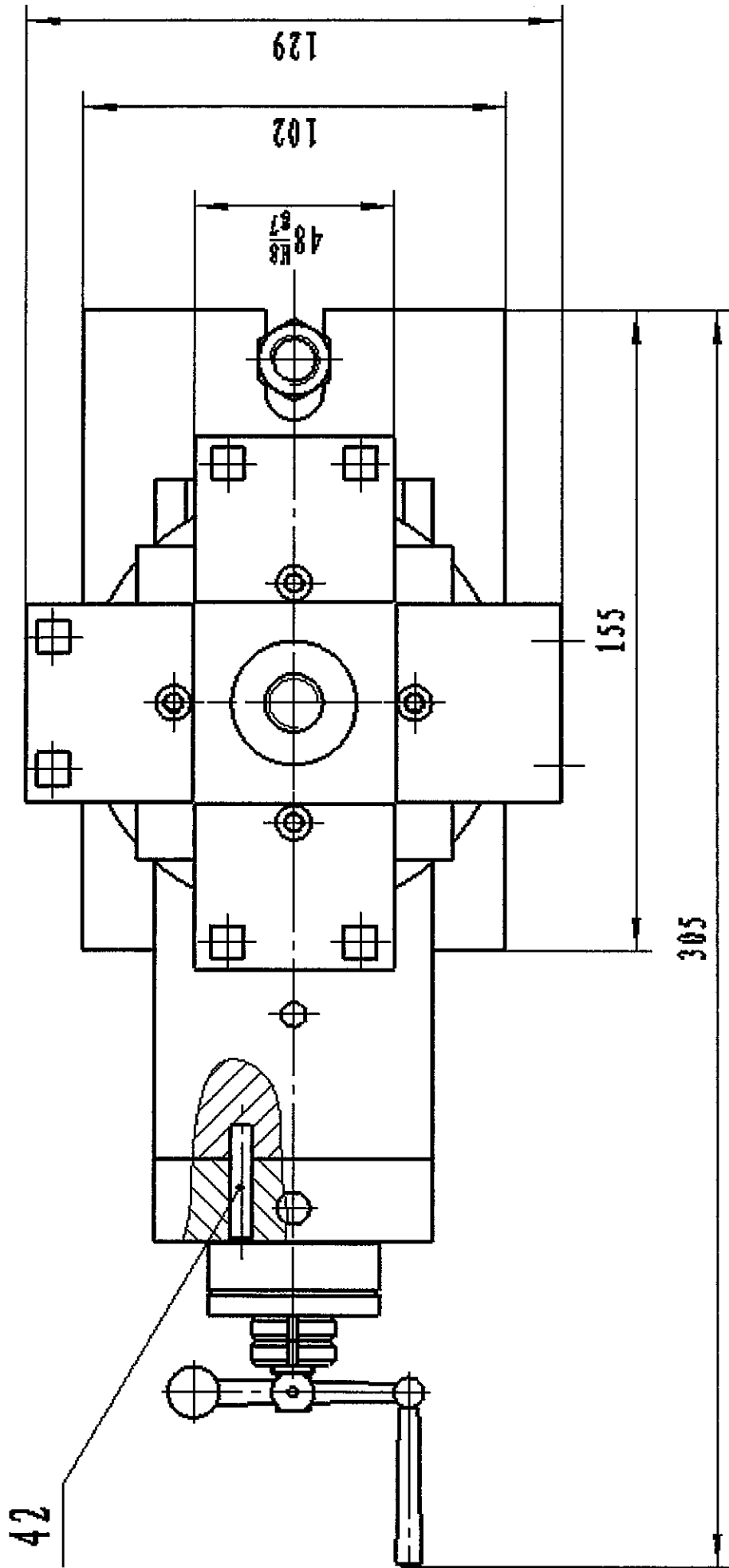
TOOLPOST ASSEMBLY



TOOLPOST CROSS SECTION



TOOLPOST END CROSS SECTION



TOOLPOST TOP VIEW

06-刀架部分

06-Knife support section

序号 serial number	代号 Part code	名称	Name of part	Specification	数量 Quantity	
1	78.	GB/T117-2000	圆锥销	Round pin	Φ3x16	1
2	79.	GB4141.9-84	单重手柄	Handle	8	1 套
3	80.	GB810-88	小圆螺母	Round nut	M10	2
4	81.	GB858-88	圆螺母止动垫圈	Lock washer	10	1
5	82.	06-01	摩擦套	Position sleeve		1
6	83.	06-02	刻度盘	Dial		1
7	84.	06-03	弹簧片	Spring piece		1
8	85.	06-04	螺杆	Screw		1
9	86.	06-05	螺母	Nut		1
10	87.	GB/T70.1-2000	内六角平端紧定螺钉	Lock screw	M4x12	2
11	88.	06-06	装刀座	Knife holder		2
12	89.	06-07	定位块	Positioning block		2
13	90.	06-08	紧刀螺钉	Screw tight knife		6
14	91.	06-09	圆刀杆装刀座	Knife holder of circle arbor		1
15	92.	06-10	厚垫圈	Thick washer		1
16	93.	06-11	锁紧螺钉	Lock screw		1
17	94.	GB4141.15	手柄杆	Handle	M10x80(12)	1 套
18	95.		手柄套	Handle cap	M10x32	
19	96.	GB/T70.1-2000	内六角螺钉	Inner hexagon screw	M5x20	4
20	97.	GB/T6175-2000	六角螺母	Hexagon nut	M5	7
21	98.	06-12	刀架	Knife support		1
22	99.	06-13	切刀装刀座	Knife holder of diffusion knife		1
23	100.	GB/T70.1-2000	内六角螺钉	Inner hexagon screw	M10x40	4
24	101.	06-14	压簧	Compression spring		1
25	102.	GB	钢球	Steel ball	8	1

26	105.	GB818-85	十字槽盘头螺钉	Cross-head screw	M5x10	4
27	104.	03-06	工作台	Table		
28	105.	06-15	回转座螺钉	Rotary Screw Block		2
29	106.	GB95-2002	平垫圈	Flat washer	8	2
30	107.	GB6174-86	六角薄螺母	Hexagon nut	M8	2
31	108.	06-16	刀架螺母	Knife Nut		1
32	109.	06-17	导轨调隙板	Rail gap adjustment plate		1
33	110.	GB73-85	开槽平端紧定螺钉	Flat-head screw	M5x20	3
34	111.	06-18	T形螺钉	T type screw		2
35	112.	GB/T6175-2000	六角螺母	Hexagon nut	M12	2
36	113.	GB95-2002	平垫圈	Flat washer	12	2
37	114.	06-19	底座	Base		1
38	115.	GB/T70.1-2000	内六角螺钉	Inner hexagon screw	M5x16	2
39	116.	06-20	回转座	Block rotation		1
40	117.	06-21	刀架拖板	Pallet knife		1
41	118.	GB	压配式注油杯	Pressure oil filler	8	1
42	119.	06-22	连接座	Connection Block		1
43	120.	GB119-86	B型圆柱销钉	B-type cylindrical pin	Φ5x28	2